OpenQM

2.6-6

Reference Manual

OpenQM

Reference Manual

Ladybridge Systems Limited

OpenQM

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Part 1

Introduction to the QM Database

1 Introduction to the QM Database

OpenQM is a database management system that allows you to develop and run applications for your business or personal use. It includes a wide range of advanced tools and features for complex applications whilst still allowing relatively painless construction of simpler applications.

OpenQM is a member of a family of database products known as **multivalue databases**, a term that relates to how the system stores your data. If you have experience of products such as Access or Oracle, you may find the architecture of OpenQM to be alien to what you have learnt in the past. It's not wrong; it's just a different way to work. Experience over many years shows that application development for a multivalue database is often many times quicker than for other methodologies, resulting in lower development costs and simpler maintenance.

OpenQM is the only multivalue database product that is available both as a fully supported closed source commercial product and in open source form for developers who wish to modify the product under the terms of the General Public Licence. In common with all GPL software, the open source version comes with no warranty and no support. This documentation describes the commercial product though most of what is here should apply equally to the open source.

The name OpenQM is often abbreviated to QM and it is this shorter name (which is the operating system command used to enter the product) that is used in most places within this documentation.

QM has a high degree of compatibility with other multivalue databases systems such as UniVerse, PI/open, Prime Information, Unidata, D3, Reality and many more.

Facilities are provided to create data files, enter, modify and retrieve data, produce reports and, where the data processing operation required cannot be achieved using the supplied tools, to construct powerful programs with the minimum of effort.

The major components of QM are:

The command processor	This includes a comprehensive command set to create, modify, copy and delete files and data stored in them as well as many commands to control processing.
The query processor	This provides facilities to produce reports from stored data using an English-like command syntax. The query processor also provides tools to select data which meets particular criteria and to perform operations on this data.
QMBasic	For those occasions where QM does not provide the desired functions, QMBasic is a very easy to use programming language with powerful screen manipulation and data handling functions.
QMClient API	The QMClient API is a set of functions that can be used from Visual Basic applications to access the QM database. This allows development of applications with a Windows "look and feel". There are variants of this API library for use with other languages, including access from inside QMBasic to allow programs to call subroutines or execute commands on other servers.

Specific topics:

User management	User management and system security issues.
Printing	A summary of QM's printing system.

Document Conventions

The QM documentation uses a simple set of conventions in descriptions of command lines or language elements. For example

DELETE.FILE {**DATA** | **DICT**} *file.name* {**FORCE**}

Items in bold type (**DELETE.FILE** for example) are keywords that must be entered as they appear in the description except that in most instances they may be in either upper or lower case.

Items in italics (*file.name*) represent places in commands or language statements where some variable data is required. In this case it is the name of a file.

Items enclosed in curly brackets (e.g. {**FORCE**}) are optional parts of a command or statement. The curly brackets are not part of the data and should not be typed. The descriptions will explain when the item should be used and what effect it has.

Lists of alternative keywords are shown separated by vertical bars (e.g. {**DATA** | **DICT**}).

Items that may be repeated are followed by ellipsis (...). The text explains the rules governing related items.

The mark characters are represented by IM, FM, VM, SM, TM and VM.

1.1 What is a Multivalue Database?

There are many different databases available but they all fall into a small number of basic types. One of these is the **relational database** such as Oracle or Access. A relational database holds data in the form of **tables** in just the same way that we could store information as tables written on paper.

Consider an order processing system. We need to hold information about the orders that each customer has placed. Keeping things very simple, at a minimum we might need a table such as that shown below.

Order no	Date	Customer	Product	Quantity
1001	12 Jan 05	1728	107	4
1002	12 Jan 05	3194	318	2
1003	13 Jan 05	7532	220	1
1004	13 Jan 05	1263	318	2

In this simple table, each row represents an order and each column holds data associated with that order.

Relational databases are built following a set of rules known as the **Laws of Normalisation** [E. Codd : "*A Relational Model of Data for Large Shared Data Banks*", Communications of the ACM, June 1970]. The process of transforming data to fit the rules of a relational database is called **normalisation** and the steps in this process are referred to as first normal form, second normal form, and so on.

The First Law of Normalisation states that we may not have repeating data. In practical terms this means that we cannot add extra columns to the right of the table to allow a customer to order more than one item at the same time.

Order no	Date	Customer	Product	Quantity	Product	Quantity
1001	12 Jan 05	1728	107	4		
1002	12 Jan 05	3194	318	2	452	3
1003	13 Jan 05	7532	220	1		
1004	13 Jan 05	1263	318	2		

Clearly this restriction is not acceptable in the real world.

There are many reasons why the Laws of Normalisation do not allow this, mostly based on the way in which the data might be stored by the computer system. If we are to observe the First Law of Normalisation, we must reconstruct our data in some way that removes the additional columns. One way would be to split an order that has multiple item across several rows of our table.

Order no	Date	Customer	Product	Quantity	Lines
1001-1	12 Jan 05	1728	107	4	1
1002-1	12 Jan 05	3194	318	2	2
1002-2	12 Jan 05	3194	452	3	2
1003-1	13 Jan 05	7532	220	1	1
1004-1	13 Jan 05	1263	318	2	1

Although we can now store as many items in an order as we wish, things have become more complicated. Firstly, the details of a single order are now split across multiple rows of our table. Secondly, we have been forced to add an extra column so that we can know how many lines there are in the order. Also, we have duplicated some information, a step which actually breaks another of the Laws of Normalisation. To avoid this last complication, a typical implementation of this sort of data in a fully normalised system (e.g. Oracle or Access) would break the order into two separate tables, one containing the basic information about the order and the other containing the details of the items ordered.

Order no	Date	Customer	Lines
1001	12 Jan 05	1728	1
1002	12 Jan 05	3194	2
1003	13 Jan 05	7532	1
1004	13 Jan 05	1263	1

Detail Ref	Product	Quantity
1001-1	107	4
1002-1	318	2
1002-2	452	3
1003-1	220	1
1004-1	318	2

Things are becoming complex and this is supposed to be a trivial application!

Multivalue database products avoid this complication by removing the need to adhere to the First Law of Normalisation. We allow a single cell of our table to hold more than one value (hence "multivalue").

Order no	Date	Customer	Product	Quantity
1001	12 Jan 05	1728	107	4
1002	12 Jan 05	3194	318 452	2 3
1003	13 Jan 05	7532	220	1
1004	13 Jan 05	1263	318	2

If you have spent many years working with fully normalised databases, you are probably shaking your head and saying that we cannot do this. Yes, we can do it; it's just a different way to hold our data.

Think about the advantages: The entire order is all held as a single record; there is no redundant duplication of data; we do not need an item counter.

The end result of this is that our multivalue view of the world is typically much faster than its fully normalised counterpart though there will always be situations where this model is not ideal. In such cases, you can freely revert to using the fully normalised approach. Notice that fully normalised

data can be stored in a multivalue database. The opposite tends not to be true.

The time has come to introduce some terminology. A typical application will have many tables, perhaps hundreds or even thousands though the multivalue model usually results in far fewer tables than in other data models. Each table is stored as a **file**. The rows of our table are known as **records** and the columns as **fields** (some users refer to these as **attributes**). The data stored in a field may be made up of multiple **values**.

Note how in our multivalued implementation of the above example, the values in the product and quantity columns are related together. For any particular order, the first product number belongs with the first quantity, the second product number belongs with the second quantity and so on. A typical realistic table may have several separate sets of fields that are linked in this way. The relationship between the values in different fields (e.g. product and quantity above) is referred to as an **association**.

By adopting this data model instead of using additional columns, the data model imposes no limit to the number of items that may be included in an order.

This extended form of the relational database model is at the heart of the QM database. You may also see it referenced as post-relational, nested table or NF2 (non-first normal form). They all mean the same thing.

In a multivalue database, the tables can gain a fourth dimension (**subvalues**). Continuing with the above example, perhaps we need to record the serial number of each item that we sell. Thus each value line in the table depicted above would have subvalues containing the serial numbers for each item supplied.

The History of Multivalue Databases

The original multivalue database is usually attributed to Dick Pick (hence the frequently used term "Pick databases") back in 1968 though their origins can be tracked back further. The current D3 database from Raining Data is a direct descendant of the original Pick product but there have been many other players along the way, some large, some small. Some of these are significant to the way in which QM works.

The Reality database, originally implemented on McDonnell Douglas systems but now owned by Northgate Information Solutions, closely follows the Pick style of operation. The long defunct Prime Information database from Prime Computer retained the same data model and general principles but made some fairly significant changes to the command and programming languages.

In the mid-1980's the various companies with multivalue products hit a problem. The world was standardising on the Unix operating system but these products did not run on Unix. As a result of this, McDonnell Douglas developed an "open systems" version of Reality (Reality X) and Prime Computer developed the PI/open database. At the same time, two start up companies appeared each with their own Unix based multivalue implementation, VMark (UniVerse) and Unidata (Unidata). These companies set out to capture users from the existing products as well as taking on new users. The history is long and complex but to bring it up to date in one step, UniVerse and Unidata are now both owned by IBM. Technically, IBM also own Prime Information and PI/open but both products have been retired.

The UniVerse and Unidata products (usually referred to collectively as U2) follow the Information style of implementation by default but have features that allow them to look more like the Pick style if required.

QM was originally developed in 1993 for use as an embedded database but not released as a product in its own right until 2001. Like the U2 products, it is an Information style database but has options to make it more like Pick for those who need it.

1.2 Installation

If you are going to try things out as you read this manual, the first thing we need to discuss is how to install your own version of QM. This section relates only to the commercial QM product. If you are planning to use the open source version of QM and build your own system, none of what follows in this section applies to you. Instead, you must download and build the system from its source code.

In this section, you will find details on how to install QM on

- Windows
- A USB memory stick under Windows
- Linux and FreeBSD
- Mac OS X
- A PDA

Although QM can be supplied on CD, users normally download the software from the OpenQM website, www.openqm.com which ensures that you have the latest version of this rapidly developing product.

If you purchase a commercial QM licence, you are free to download and install new versions as often as you wish during the free upgrade period (at least one year but this period can be extended). After this period expires, there will be a charge for upgrades. The software comes with free support for the first 60 days beyond which time further support is available on a chargeable basis.

On most platforms, you can also use QM in its single user "Personal Version" mode. This is exactly the same as the commercial product but is restricted for use in non-commercial activities, typically as a learning environment, and has a low limit on the size of database file that it will support. The personal version comes with no support beyond any help necessary to get it installed.

You will probably not want to install every revision that is released. The web site includes a "*What's new in recent releases*" page that can be used to help decide when an upgrade is desirable.

To download the software, follow the link to the download page and select the appropriate version for your platform. Right click on the *Download* link and select *Save as* to copy the install file to your system. If you need to move the file from the system on which it is downloaded to a different system for installation, be sure to use a binary mode copy tool.

The installation process is exactly the same for a new installation and for an upgrade. The following sections describe the process for each platform.

Installation on Windows

The self-extracting install file has a name of the form qm_2-6-6.exe, where the numeric components identify the release. Execute this file. The first screen confirms that you are about to install QM. Click on the *Next* button to continue.

The install process now displays the software licence. Tick the box to say that you accept the terms of this licence and click on the *Next* button.

QM can be installed in any convenient location. The default is C:\QMSYS but this can be changed. An upgrade installation will offer the directory used for the previous installation as the default.

Having selected the installation directory, you will be asked to specify the program group folder name in the Start menu. This defaults to QM and is probably best left unchanged.

The final step before installation commences is to select the components to be installed. The components offered are:

QM Database	The QM database itself.
QM Help	This document as a Windows help file.
QMTerm	A simple terminal emulator.
QM Online Documentation	Adobe Acrobat style pdf documentation.
QMAdmin	A Windows based system administration tool.
QMClient	The Visual Basic API for Windows developers.

After the main installation has been performed, the install process displays a screen in which the authorisation data can be entered as discussed below.

If this is an upgrade installation, you will be asked if the VOC file should be updated in all accounts. Although this is probably a good idea, users will be asked about upgrading when they enter QM if it is left until later.

The installation process then runs the QM Configuration Editor to allow changes to be made to configuration parameters.

Finally, the installer offers to show the readme file.

The installation process does not add QM to the Windows PATH environment variable. Depending on how you plan to operate your system it may be worth adding the bin subdirectory of the QMSYS account to the PATH variable.

The self-extracting archive file of the standard install includes the user documentation as a set of pdf files and a compiled HTML help file for use on the QM server or on other Windows clients. Individual pdf manuals and a zip file containing a browser based help package are also available on the download page.

Installation on a USB memory stick under Windows

This mode of installation allows you to carry a complete Windows based QM system on a USB memory stick and use it on any compatible PC without installing any software on the PC itself.

The first step is to prepare the memory stick for use with QM. The stick must comply with the USB 2 standards - older USB 1 sticks cannot be used. Download the USBCONFIG tool from the OpenQM website onto the PC that you will use to perform the installation. Run this program, following the on screen instructions. This tool creates a file named memstick on the USB memory stick containing the unique id codes for that stick. The content of this file is only used during licence application, however, you should not amend this file as this may cause QM to fail at a later upgrade.

To install QM, run the standard Windows installation program as described above, ensuring that the "USB memory device" check box is ticked and the pathname of the target device is correctly entered on the destination directory screen. The QMSYS directory must be E:\QMSYS where E is the appropriate drive letter for your USB stick. The remainder of the installation process is as

above.

To use QM from a USB memory device:

1. Open a Command Prompt window
2. Make the account directory on the USB device the current directory
3. Type "\qmsys\bin\qm" to enter QM

Because the USB installation is all about not needing to install anything on the host PC, it is not possible to run the QMSvc network service. A USB installation of QM includes the QMSrvr network management program (as used on Windows 98) to allow telnet and QMClient connections. To start this, open a Command Prompt window and execute the \qmsys\bin\qmsrvr program from the USB device. Network connections run as the user currently logged in on the Windows system.

Installation on Linux or FreeBSD

The self-extracting install file has a name of the form qm_2-6-6 for Linux or qmf_2-6-6 for FreeBSD, where the numeric components identify the release. Execute this file.

The installer confirms that you are about to install QM. Note that any existing installation of QM must have been shut down before installation of a new version.

The compressed install file is unpacked and the software licence is displayed. You must confirm that you agree with this licence to continue.

QM can be installed in any convenient location. The default is /usr/qmsys but this can be changed. An upgrade installation will offer the directory used for the previous installation as the default.

After the main installation has been performed, the install process displays a screen in which the authorisation data can be entered as discussed below.

If this is an upgrade installation, you will be asked if the VOC file should be updated in all accounts. Although this is probably a good idea, users will be asked about upgrading when they enter QM if it is left until later.

Finally, you will be asked whether the operating system network service should be restarted. This is necessary after a new installation before QM can be accessed from network connections. It should not normally be needed after an upgrade installation.

The installation process does not add QM to the operating system PATH environment variable. Depending on how you plan to operate your system it may be worth adding the bin subdirectory of the QMSYS account to the PATH variable.

The self-extracting archive file of the standard install does not include the user documentation. This must be downloaded separately from the web site as individual pdf manuals, a zip file of all the manuals, a compiled HTML help file for use on Windows clients or a zip file containing a browser based help package for use on all platforms.

Installation on a Mac

At this release, the Mac install is performed using a variant of the Linux install process. A graphical installer similar to those used by other Mac software will be introduced in a future

release.

The self-extracting install file has a name of the form qmm_2-6-6, where the numeric components identify the release.

Open a terminal window and gain administrative rights (consult your operating system documentation if this concept is new to you). Execute the downloaded file.

The installer confirms that you are about to install QM. Note that any existing installation of QM must have been shut down before installation of a new version.

The compressed install file is unpacked and the software licence is displayed. You must confirm that you agree with this licence to continue.

QM can be installed in any convenient location. The default is /usr/qmsys but Mac users may prefer to use /var/qmsys. An upgrade installation will offer the directory used for the previous installation as the default.

After the main installation has been performed, the install process displays a screen in which the authorisation data can be entered as discussed below.

If this is an upgrade installation, you will be asked if the VOC file should be updated in all accounts. Although this is probably a good idea, users will be asked about upgrading when they enter QM if it is left until later.

The installation process does not add QM to the operating system PATH environment variable. Depending on how you plan to operate your system it may be worth adding the bin subdirectory of the QMSYS account to the PATH variable.

The self-extracting archive file of the standard install does not include the user documentation. This must be downloaded separately from the web site as individual pdf manuals, a zip file of all the manuals, a compiled HTML help file for use on Windows clients or a zip file containing a browser based help package for use on all platforms.

Installation on a PDA

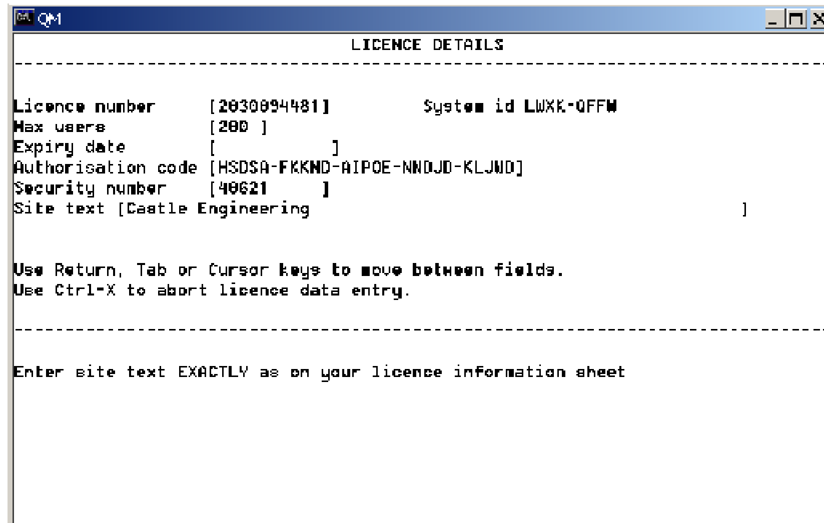
There are two alternative install files available; qmpda_2-6-6.exe for Windows Mobile 5.0 and qmpce_2-6-6.exe for the older Windows CE. The 2-6-6 component of the name identifies the release.

The install file should be executed on a Windows PC to which the PDA is connected via ActiveSync. QM must be installed under the Program Files directory which is the default offered by the installer. If this is an upgrade, you will be asked whether to overwrite or remove existing files. Choose the overwrite option. After the installer has copied the new version to the PDA, complete installation by clicking on the Launch button. This will display a modified version of the licence screen shown below.

The Personal Version of QM is not available on a PDA.

Licence Authorisation

QM will request licence authorisation data entry as part of the installation process described above. A new licence can also be applied at any time by use of the UPDATE.LICENCE command in the QMSYS account or from the command prompt by executing QM with the -L option (case insensitive).



You need to enter the details in the boxes surrounded by square brackets as given on your licence paperwork.

Licence number — The unique 10 digit number identifying this licence. If you are using the Personal Version, enter the word Personal and leave all further boxes empty.

Max users — The maximum number of concurrent processes including Windows GUI processes such as QMAdmin and QMClient.

Expiry date — The last date on which this licence is valid.

Authorisation code — A case insensitive sequence required to validate your licence details.

Security number — A number required to further validate your licence details.

Site text — This must be entered exactly as on your licence form.

The system id is used to tie a licence to a specific machine. The normal licensing procedure starts with a short term licence that will install on any system. During the life of this licence, you should supply the system id to your dealer who will then send you the final permanent licence.

If you subsequently move the QM software to a new system, you will need to arrange with your dealer to receive a new licence. There will normally be no charge for this so long as you undertake to remove the old installation.

When installing a new release of QM over an existing version, the previous licence details are displayed as the defaults. To preserve these either press the return key in each field in turn or use ctrl-X to exit from the screen.

When updating the licence on a system that uses data encryption, the install process will ask for entry of the master key if the licence number or system id code has changed.

Setting Configuration Parameters

After a new installation, you may need to set the value of some configuration parameters. In particular, the values of NUMFILES (the maximum number of files that can be open at one time) and NUMLOCKS (the maximum number of concurrent record locks) need to be appropriate to your use of the system.

Compatibility with Other Environments

The various multivalue database products implement some features differently. This results in syntactic or semantic differences in some commands or programming statements. If you are migrating an application to QM from another multivalue product, there are facilities to give closer compatibility without needing to make extensive modifications to the application.

The **OPTION** command can be used to enable features that are mostly concerned with the command environment. This command is typically embedded in the LOGIN paragraph that runs automatically when a user enters the system.

The QMBasic **$MODE** directive enables features that affect programming language syntax or semantics. Although developers could put this directive into every program, it is usually simpler to create a record named $BASIC.OPTIONS in the program file to apply mode settings (and other features) to every program in that file. Alternatively, this record can be put in the VOC file from where it will affect all programs in files that do not have their own $BASIC.OPTIONS record. For more details of this record, see the **BASIC** command.

It is recommended that after migration to QM, developers should spend some time reading the documentation to discover features of QM that were not in the previous environment so that they can take advantage of these.

1.3 Startup and Shutdown of QM

QM maintains some persistent data in shared memory that is accessed by all QM users. This includes the locking tables, user tables, configuration data and other information that must be visible to all QM user processes.

This section does not apply to the PDA version of QM.

Windows Systems

On a Windows system, the shared memory is created when the first user enters QM and is discarded when the last QM user logs out. It will be reloaded automatically when the next user enters QM.

The QMSvc OPTIONS configuration parameter can be used to specify that the shared memory is to be loaded when QMSvc starts and is to remain in place until it shuts down. Use of this mode will result in a small performance improvement on entry to QM. Also, user numbers will not reset when the last user logs out. The STARTUP configuration parameter described below is only available on Windows platforms when persistent memory mode is selected.

QMSvc can be started and stopped from the QM Network Control program group item or by use of qmsvc -start and qmsvc -stop (assuming that the bin subdirectory of the QMSYS account is in the program search path). Shutting down the QMSvc service will automatically logout all QM users that have come in via a network connection.

Other Platforms

On other platforms, the QM shared memory must be explicitly loaded before users can enter QM. It may be manually discarded if required.

The installation process will add system startup and shutdown scripts to start QM when the system is booted and to take it down gracefully when the system is shutdown. QM may be started, stopped or restarted at any time by typing:

```
qm -start
qm -stop
qm -restart
```

Executing a Coldstart Script

Sometimes it is useful to execute a paragraph or other command script when QM starts. This can be achieved using the STARTUP configuration parameter to specify the command to be executed. This command will be run in the QMSYS account and would typically be the name of a VOC paragraph. The command is limited to 80 characters and may not include double quotes.

On Windows, the command is run when QMSvc starts and is only available if QMSvc is running with the persistent memory option selected. The command runs as the SYSTEM user.

On other platforms, the command is run when the qm -start command is used. The command runs as the user starting QM, normally root.

1.4 Deinstallation

Should it be necessary to uninstall the QM database, the following steps are required:

Windows

Execute the QM Uninstaller from the QM program group.

PDA

Use the File Manager to delete QMSYS from the Program Files directory.

Other Platforms

1. Login with superuser rights and type "`qm -stop`".
2. Run the uninstall program in the qmsys/bin directory.

1.5 Accounts

An **account** is a place to work, typically corresponding to an application. Physically, an account is represented by an operating system directory in which files private to that application are stored. As well as one or more user accounts representing different applications or versions of a single application, there is always a system account named QMSYS which contains all of the components of the QM database product itself. You should not use this account for your own applications as parts of it are overwritten when a new version is installed. You may also want to restrict access to some files in this account for improved system security.

A new account may be created from any other account by use of the **CREATE.ACCOUNT** command. Alternatively, use the relevant operating system command to make a new directory in a suitable position and invoke QM in that directory. You will be prompted to confirm that you wish to make this directory into a new account.

Whichever method you use, QM will create a **VOC** file in this directory and it is then ready for use. Other system files may be created subsequently by some commands.

QM maintains a register of account names and their corresponding operating system pathnames in a file named ACCOUNTS in the QMSYS account. This file is visible from all accounts on the system but, because ACCOUNTS is the sort of name that might well be used as an application file, the alternative name QM.ACCOUNTS is used. Account names are mapped to uppercase in QM. They must start with a letter, may not contain spaces and are limited to 32 characters.

The standard files present in an account are shown below.

VOC	The vocabulary, a file that controls all aspects of command processing within QM.
BP	Application programs are written using the QMBasic programming language. The BP file (Basic Programs) is the default place to keep application programs. This file must be created when first needed and is usually a directory file. The compiler output is placed in a file of the same name as the source file but with a suffix of .OUT added (e.g. BP.OUT). The output file is created automatically when first required and must be a directory file.
$ACC	This is the account directory viewed as a QM directory file.
$COMO	QM provides a facility to record output that is displayed at the user's screen in a file. This file is known as a como (command output) file for compatibility with other systems. The $COMO file is automatically created as a directory file when the **COMO ON** command is first used. The command also specifies the record name to be used to store the output. This file also contains the log files generated by background (phantom) processes.
$FORMS	This VOC entry points to a file in the QMSYS account that is shared by all accounts as a repository for Pick style form queue definitions created using the **SET.QUEUE** command and used by the **SP.ASSIGN** command.
$HOLD	This is a directory file used to receive output sent to a print unit by a

program or standard command that has been set into mode 3 (output to hold file).

$SAVEDLISTS	This is a directory file used to store saved select lists. See the **SAVE.LIST** and **GET.LIST** commands for more information.
$SCREENS	This is a dynamic file used to hold screen definitions that are to be shared between accounts. See the description of the **SCRB** screen builder for more information.

The $COMO, $HOLD and $SAVEDLISTS files tend to collect redundant data as time goes by and may be cleared using the **CLEAN.ACCOUNT** command or some other process appropriate to your application.

Other files not directly visible from QM are:

cat	A subdirectory under the account holding programs added to the private catalogue using the **CATALOGUE** verb. Users should not modify this file except by use of the associated QM commands. The private catalogue can be moved by creating an X-type VOC entry named $PRIVATE.CATALOGUE in which field 2 contains the pathname of the alternative private catalogue directory. This only takes effect when QM is re-entered or on use of the **LOGTO** command. This feature is particularly useful where two or more accounts are to share a common private catalogue.
stacks	A subdirectory under the account used to store saved command stacks when a user exits from QM. On Windows systems, users of QMConsole sessions do not use this file. Instead, the command history is stored in a VOC record named $COMMAND.STACK.

The following files are in the QMSYS account only:

ACCOUNTS	The register of account names described above. This file is visible from all accounts as QM.ACCOUNTS. Field 1 contains the pathname of the account. Field 2 can be used to store a brief description of the account.
bin	A subdirectory, not visible from within QM, containing all the operating system level executable programs that form part of QM.
ERRMSG	A file of standard Pick style message texts provided for compatibility with other multivalue products and used by the QMBasic **STOP**, **ABORT** and **ERRMSG** statements for programs compiled with Pick style message processing.
gcat	Not directly visible from inside QM, this is the global catalogue directory. This file should only be accessed using the standard catalogue processing commands.
NEWVOC	The template vocabulary file from which new accounts are created. This file should not be updated by users as it will be overwritten on upgrading to a new release.
$IPC	This file, not visible from inside QM, is used to support inter-process communication and should not be touched by users. (Not present on a PDA)

$MAP	This file, visible from all accounts, is the default destination for a map of the system catalogue produced with the **MAP** command.
SYSCOM	The SYSCOM file holds standard definitions for use in QMBasic programs. It also contains QMClient.bas, a set of definitions for use in Visual Basic programs that use the QMClient API.
temp	Windows only. This subdirectory holds temporary files that are used to pass control information from the QMSvc service to the QM processes that it starts. All users must have full access to this directory.
terminfo	A subdirectory containing definitions of control data for terminal devices. (Not present on a PDA)
terminfo.src	The master source from which the terminfo definitions are built. (Not present on a PDA)

Accounts that are no longer needed can be deleted using the **DELETE.ACCOUNT** command.

1.6 Entering QM

The QM database can be accessed in a number of ways. The simplest is use of a **console session**. This is entry into QM directly from the system on which it is installed. Other methods allow direct connection over a network or via a serial port and are discussed later in this section.

PDA users should enter QM by using the QM shortcut in the Programs folder. Some commands may be difficult to use with the default screen size settings. The remainder of this section is not applicable to PDA systems.

On Windows systems, once QM has been successfully installed, the program group chosen during the install (usually QM) will contain an item titled "QM Console". Clicking on this item will open a console window. You will see a copyright line and a site specific licence line. You will then be asked to enter the name of the account you wish to work in.

On other platforms, login to the operating system and then type qm at the command prompt (this assumes that the operating system PATH environment variable has been set appropriately). This technique can also be used from a Command Prompt window on a Windows system. In all cases, if your current directory when you entered QM was not already a QM account, you will be asked if you wish to make it into one.

Entering QM Directly via a Network

TCP/IP network technology assigns each computer on the network a unique address, usually written as four numbers separated by dots (e.g. 193.118.13.14). When a connection is made to a network address, the caller also specifies a "port number" which identifies the service to which they wish to connect. If networking is new to you, it may help to consider the concept of network addresses and port numbers as being similar to telephone numbers and extensions.

With its default configuration, QM listens for users entering via a network connection on TCP/IP port 4242. This can be changed to an alternative port or disabled completely by amending the QM configuration parameters. Windows users who do not have any other telnet software running on their system may wish to change this to port 23, the default telnet port.

You can connect to QM using most terminal emulators. A licence for the AccuTerm emulator from AccuSoft Enterprises is bundled with a commercial QM licence. This emulator includes several features specifically for QM. Although the licence is bundled, you will need to download the latest version of the emulator software from the AccuSoft website.

On Windows 98/ME, the installation process installs a server program, QMSrvr, in the bin subdirectory of the account. This must be started manually though this can be automated via the Startup folder. Due to a published defect in Windows, the server cannot detect a system shutdown and must be closed manually.

On later versions of Windows, the QM installation process installs a Windows service (QMSvc) to manage the network. There should be no need to change anything as it will start and stop automatically as required.

On all Windows environments, there is a QM Network Control program in the QM program group that can be used to start and stop the appropriate network server.

On other platforms, the install process will make the necessary changes to the operating system files that control the network. There should be no need for any manual user intervention unless you decide to modify the default settings.

Port Mapping

Some software originating in other multivalue environments relies on being able to connect via multiple telnet ports, each leading to creation of a process with a fixed user number related to the port number. QM supports this capability via a feature known as port mapping. For more details, see the PORTMAP configuration parameter.

Port mapping is not available on Windows 98/ME.

Entering QM Directly via a Serial Port

On Windows NT and later, the QMSvc service can monitor one or more serial ports for incoming QM connections. This allows entry from directly connected terminals of via dial-up lines. See the SERIAL configuration parameter of QMSvc for more details.

It is also possible to login a serial port from another QM process using the **LOGIN.PORT** command. This will skip the user authentication described below as the new process runs with the user name and access rights of the user who established the connection. This style of login can be useful when connecting to automated data collection devices. The LOGIN paragraph would typically be used to enter the application.

Logging In to QM

Users entering QM directly from a network connection or via a serial port must provide a valid user name and password for authentication purposes.

On Windows NT and upwards, the user name must also be known to the operating system. Many users of Windows XP choose to operate their systems with login at the server screen disabled, however, Windows enforces use of a valid user name on network connections, including "loop back" to the host system from a terminal emulator running on the same machine. User names can be set up using the User Administration area of the Windows Control Panel. The QM process will run as the specified user and with that user's access rights.

When using domain style logins, the format is *username@domain*.

Earlier versions of Windows (98/ME) did not provide a suitable user authentication system so QM provides its own. This can be disabled using the **SECURITY** command if required, leaving the system open for network users to connect with no authentication.

On other platforms, the user name must be known to the underlying operating system. The resultant QM process will run as this user and with the access rights of that user. Use the appropriate operating system administration tools to create and maintain user names.

Suppressing the Copyright and Licence Lines

The -quiet option to the QM executable suppresses display of the copyright and licence details. This is particularly useful in situations such as scripts using QM as part of a CGI web interface. The **LOGIN.PORT** command mentioned above, implies use of the -quiet option so that no data is sent to the port until the application starts execution.

1.7 The Login Process

There are two stages to login; user authentication and process initialisation. The first applies only to network connections

User Authentication

On Windows NT and later, users connecting to QM via a network must enter a valid Windows username and password. The new process runs as that user and with the associated access permissions.

QM implements a further layer of security on top of the Windows authentication by maintaining a register of usernames allowed to use QM. A username may be added to this register using the **CREATE.USER** or **ADMIN.USER** commands. The register entry determines:

1. whether the user is allowed to use QM at all. This check can be suppressed using the **SECURITY** command.
2. whether the user is to be granted administrator rights within QM.
3. the name of the account that the user should start in. If no account is specified, a prompt is displayed for the account name.

If security has been turned off and the username does not appear in the user register, the user runs without administrator rights and an account name prompt is displayed.

On Windows 98/ME, the above mechanism is extended such that QM performs the username and password validation using its own internal user register as these platforms do not provide an adequate user authentication system. The newly created process runs with the Windows user name and access permissions of the user that started the QMServer process.

On other platforms, users connecting to QM via a network usually open telnet sessions as normal users and then enter QM, perhaps automatically via their profile script. It is, however, possible to connect directly to QM in which case the security mechanisms described above for Windows NT and later apply.

Process Initialisation

When a user successfully enters an interactive QM session, the following steps occur:

1. For users entering QM directly from a network connection, QM attempts to determine the terminal type by use of telnet negotiation commands. If the emulator in use does not support these, QM looks for an environment variable named TERM and, if this is found, uses it to set the default terminal type. If this also fails, vt100 is used by default.

   For PDA users, the terminal type is set to pda.

   For QMConsole users on Windows, the terminal type is set to qmterm.

   For users entering QM from an operating command prompt on other platforms, QM looks

for an environment variable named TERM and, if this is found, uses it to set the default terminal type. If this fails, vt100 is used by default.

In all cases except for PDA users, the terminal type can be changed later from within QM using the **TERM** command. When using AccuTerm, it is strongly recommended that the terminal types with the -at suffix (e.g. vt220-at) are used as these enable AccuTerm specific features such as the screen switching required for the full screen mode of the QMBasic debugger.

2. On all platforms except the PDA, QM then looks for environment variables named LINES and COLUMNS and, if found and valid, uses these to set the initial size of the terminal window. When using a QMConsole session on Windows, the displayed window will be adjusted to be this size. On other connections, it is the user's responsibility to ensure that the terminal emulator screen dimensions match those expected by QM.

3. The system looks in the QMSYS account VOC file to find a paragraph named MASTER.LOGIN and, if this exists, executes it. This paragraph can be used for system wide initialisation such as setting European date format or standard printer associations.

4. The system checks in the user's account VOC file to find an executable (menu, paragraph, sentence, verb) item named LOGIN and, if this exists, executes it. The LOGIN item is typically used to perform account specific initialisation and the enter the application. Note that this happens for all QM processes, including phantoms and QMClient sessions. To exit from the LOGIN paragraph for a phantom process, insert a line
   ```
   IF @TTY = 'phantom' THEN STOP
   ```
   at the relevant point in the paragraph. For a QMClient session, test for 'vbsrvr'. See @TTY for more details.

5. The break key is enabled. By running the MASTER.LOGIN and LOGIN paragraphs with the break key disabled, the user cannot quit out of any security checking done in these paragraphs. If a LOGIN paragraph is used to start the application, it may be necessary to enable the break key at this stage by including a **BREAK ON** command.

Step 4 above is also executed when the **LOGTO** command is used to move to a new account.

User specific process initialisation can be performed by testing the content of the @LOGNAME variable in the MASTER.LOGIN or LOGIN paragraphs. For example,

```
IF @LOGNAME = 'ADMINISTRATOR' THEN ADMIN.STARTUP
```

or even executing a user name dependant paragraph by a command of the form

```
START.<<@LOGNAME>>
```

1.8 Command Scripts

The QM VOC file normally contains one or more items that represent scripts of commands to be executed automatically at certain events. Although these are usually paragraphs, all except for the MASTER.LOGIN item may actually be any executable type of VOC record (verbs, menus, Procs, etc). None of these items need exist. They provide the means to perform a fixed sequence of commands at the events described below.

LOGIN

The LOGIN paragraph is executed on entry to QM and also when the **LOGTO** command is used to switch to a new account. The break key is inhibited until execution of this paragraph has been completed. This paragraph is executed for terminal users, phantom processes and QMClient connections. The @TTY variable can be tested to determine the user type. The LOGIN paragraph is typically used to set QM option flags perform security checks, set up printers, set terminal characteristics and enter the application.

Example

```
PA
DATE.FORMAT ON
IF @TTY = 'phantom' THEN STOP
PTERM CASE NOINVERT
BELL OFF
OPTION NO.USER.ABORTS
BREAK ON
RUN BP MAIN
```

ON.LOGTO

The ON.LOGTO paragraph is executed on use of the **LOGTO** command before switching to the new account. This paragraph might be used, for example, to clear down application specific data such as named common blocks.

Example

```
PA
DELETE.COMMON ALL
```

ON.EXIT

The ON.EXIT paragraph is executed on leaving QM by use of the **QUIT** command. The break key is inhibited during execution of this paragraph. An abort occurring in this paragraph will terminate the QM session immediately.

Example

```
PA
SELECT TEMP WITH UNO = <<@USERNO>>
IF @SELECTED THEN DELETE TEMP NO.QUERY
```

ON.ABORT

The ON.ABORT paragraph is executed when QM aborts a program due to an internally detected error, a QMBasic program executes an **ABORT** statement or when the Abort response is chosen after use of the break key. The @ABORT.CODE and @ABORT.MESSAGE variables may be useful in determining the cause of the error. An abort occurring whilst executing the ON.ABORT paragraph will cause a message to be displayed. The paragraph is not re-entered. Aborts occurring in commands started using the QMBasic **EXECUTE** statement with the TRAPPING ABORTS option do not execute the ON.ABORT paragraph.

The primary role of the ON.ABORT paragraph is to prevent the user reaching a command prompt if the application fails. It may be useful to include logging of the cause of the abort.

Example

```
PA
RUN BP LOG.ABORT
QUIT
```

MASTER.LOGIN (QMSYS account)

This item, if present, must be a paragraph and is executed on initial entry to QM in any account before the LOGIN paragraph but not when the **LOGTO** command is used to switch to a new account. This paragraph is executed with the break key inhibited for terminal users and phantom processes. It is not executed for QMClient connections.

Example

```
PA
DATE.FORMAT ON
OPTION NO.USER.ABORTS
OPTION DUMP.ON.ERROR
```

Part

The Command Environment

2 The Command Environment

Although applications commonly use the graphical interface capabilities of QM, developers normally work from the character mode interface command prompt using a terminal emulator or directly from the system console. Commands can also originate from within application programs.

Commands entered at the terminal or generated from within a QM application are processed by the command processor. This uses the vocabulary file (VOC) to determine the meaning of each word or symbol within the command.

The terminal command prompt is the colon character. Whenever this is displayed at the start of a line, QM is ready to accept a new command. The command prompt changes to a double colon if the default select list is active. This serves as a warning that the select list may impact execution of the next command. The prompt characters may be modified using the **PTERM** command.

The first word of a command entered at the command prompt must identify an executable item within the VOC. This will be the name of a verb, sentence, paragraph, menu or Proc. It is also possible to run a program from the system catalogue by typing its name as a command. Other valid actions at the command prompt are:

Command stack operations, prefixed by a dot character

Command editor keystrokes

Save the command without execution by appending a question mark

A command usually commences with a **verb** which may also require one or more **arguments** to determine exactly what the verb is to do.

The command processor performs the VOC look-up for a verb in three stages; firstly by looking for a record with the name of the verb exactly as entered. If this fails, it then tries again with the name mapped to uppercase. All system verbs have uppercase names and can therefore be entered in lowercase, uppercase or a mix. For compatibility with Pick databases, a third attempt is made with any hyphens in the uppercase version of the verb name replaced by dots. Thus a command such as **CREATE.FILE** can be entered as **create.file** or **CREATE-FILE**.

If the command is not found in the VOC, a final check is made in the private and global catalogues. If the name exists here, the catalogued program is executed. The names of catalogued programs executed in this way must commence with a letter or an asterisk.

Many commands perform the first two phases of this look-up for file names, keywords, etc, however, commands that might have a detrimental effect if used in error (**DELETE.FILE**, for example) either insist on the file name being entered exactly as it appears in the VOC or prompt for confirmation if the name is not an exact match.

Command lines commencing with an asterisk followed by at least one space are treated as comments and ignored except that inline prompts are still processed. Although comments are primarily of use within paragraphs, they can be entered directly at the keyboard when they will appear in any active como file.

Many QM commands return status values via the @SYSTEM.RETURN.CODE variable. In general, a positive or zero value indicates success. A negative value is an error code and the actual value is the negative of the codes listed in the ERR.H include record in SYSCOM.

2.1 The Command Stack

Commands entered at the terminal are stored in a **command stack** (to be technically correct, it a queue but historically users have called it a stack). They may subsequently be recalled for re-execution by a simple short form command. By default, the stack holds the last 99 commands but this value can be changed by use of the CMDSTACK configuration parameter. The list is indexed by number such that the most recent command is numbered as 1, the oldest as 99.

The stack can be manipulated by commands prefixed by a dot character entered at the command prompt. These allow commands on the stack to be edited and also provide facilities to save and restore sequences of commands to and from VOC paragraphs.

The stack manipulation commands are

.A*n text*	Append *text* to command stack entry *n*. There must be a space before *text*. Any additional spaces will be included in the appended data. If *n* is omitted, the top entry on the stack (position 1) is updated. The text is displayed after modification.
.C*n /old/new/***G**	Change string *old* to *new* in stack entry *n*. If *n* is omitted, it defaults to one. The delimiters around *old* and *new* may be any non-space character. The space before the first delimiter may be omitted if the delimiter is not a digit. The optional **G** causes a global replacement, that is, all occurrences of *old* are replaced by *new*. If **G** is not specified, only the first occurrence of *old* is changed. The text is displayed after modification.
.D*n*	Delete stack entry *n*. If *n* is omitted, the top stack entry is deleted.
.D *name*	Delete VOC entry *name* if it is a sentence or paragraph record. A confirmation prompt is issued prior to deletion.
.I*n text*	Insert *text* as stack entry *n*. If *n* is not specified, *text* is inserted at the top of the stack. There must be a space before *text*. Any additional spaces will form part of the inserted entry.
.L*n*	List the most recent *n* commands. The value of *n* defaults to 20.
.L *name*	List VOC entry *name*.
.R*n*	Recall stack entry *n* to the top of the stack without deleting the original copy. If *n* is omitted, the top entry is duplicated.
.R *name*	Read VOC entry *name* to the top of the stack if it is a sentence or paragraph. Field one of the VOC entry is discarded and any continuation lines are merged.
.S *name n m*	Save stack lines *m* to *n* as VOC entry *name*. The value of *m* and *n* may be entered in either order. If *m* is omitted it defaults to the same value as *n*. If *n* is also omitted, the top line of the stack is saved. The VOC entry will be a sentence if only a single line is saved, otherwise it will be a paragraph.
.Un	Convert stack entry *n* to upper case. *n* defaults to one if omitted.
.X*n*	Execute command *n*. If *n* is omitted, the last command is executed. The repeated command is copied to the top of the stack except when executing the current topmost command.

.X *file record*	Execute command stored in the named file and record. This record must have the same format as a VOC record.
.?	Display a help message regarding the stack manipulation commands.

For compatibility with other environments, a command can also be saved on the stack without execution by entering it at the command prompt with a question mark as the last character. The question mark is removed.

The command stack is saved between sessions if the VOC contains a record named **$COMMAND.STACK** with field 1 set to **X**. This record is inserted automatically when a new account is created but can be deleted if the stack is not to be saved. For console users on Windows systems, the command stack will be saved into this record on leaving QM and loaded from it on re-entry. For all other Windows users and on other platforms, presence of this record causes the command stack to be saved to, or restored from, a file named as the user's login name in the stacks subdirectory of the account in which QM was entered.

See also **The Command Editor**

2.2 The Command Editor

The command line editor allows editing of a command line. It is of use in correcting typing errors or repeating saved commands, possibly after modification.

The command line editor handles the following keystrokes:

Ctrl-A or **HOME**	Move cursor to start of command.
Ctrl-B or **Cursor Left**	Move cursor left one place.
Ctrl-D or **DELETE**	Delete character under cursor.
Ctrl-E or **END**	Move cursor to end of command.
Ctrl-F or **Cursor Right**	Move cursor right one place.
Ctrl-G	Exit from the command stack and return to a clear command line.
Ctrl-K	Delete all to the right of the cursor.
Ctrl-N or **Cursor Down**	Display "next" command from command stack.
Ctrl-O or **Insert**	Toggle insert/overlay mode.
Ctrl-P	Display "previous" command from command stack.
Ctrl-R	Search back up the command stack for a given string.
Ctrl-T	Interchange characters before cursor.
Ctrl-U	Convert command to uppercase.
Ctrl-Z or **Cursor Up**	Display "previous" command from command stack.
Backspace	Backspace one place.

Entering a command line containing only a question mark shows a summary of the command editor keys.

The command editor operation is controlled by option codes which may be entered in field 3 of the $RELEASE VOC entry. These are:

E	Position the cursor at the end of a recalled command rather than the start.
O	Start in overlay mode.
S	Show the stack commands when moving back through the stack.
X	Clear the recalled command if the first character typed is not a control code. This mode cannot be used with E.

See also **The Command Stack**

2.3 Interrupting Commands

It may be necessary to terminate a command because, perhaps, it is producing more output than expected or it is not functioning as required. The break key (usually ctrl-C) can be used to terminate processing and return to the command prompt.

To protect against accidental use of the break key, QM will display a prompt asking for confirmation that processing is to be terminated. Valid responses to this prompt are

- A Abort. Returns to the command prompt in exactly the same way as an abort generated by an **ABORT** statement in a QMBasic program or an **ABORT** command in a paragraph. The ON.ABORT paragraph is executed, if present. The @ABORT.CODE variable will be set to 1. The default select list (list 0) will be cleared if it was active.
- D Only offered when appropriate, this option enters the QMBasic debugger.
- G Go. Continues processing from where it was interrupted. If the terminal supports the necessary operations, QM will restore the display image to remove the prompt.
- P Creates a process dump file and continues execution.
- Q Quit. Returns from the current command to the paragraph, menu, program or command prompt that initiated the command. The ON.ABORT paragraph is not executed. The @ABORT.CODE variable will be set to 2. The default select list (list 0) is not cleared.
- S Stack. Displays the call stack showing the program name and location for each entry.
- W Where. Displays the current program name and location.
- X Exit. Aborts totally from QM without executing the ON.EXIT paragraph. This option should only be used if QM appears to be behaving incorrectly.
- ? Help. Displays a brief explanatory help text for each option.

2.4 Output Pagination

Output to the display is automatically paginated, where appropriate, by inserting a prompt at the end of each page of output. The options available at this prompt are

A	Abort. Returns to the command prompt in exactly the same way as an abort generated by an **ABORT** statement in a QMBasic program or an **ABORT** command in a paragraph. The ON.ABORT paragraph is executed, if present. The @ABORT.CODE variable will be set to 1. The default select list (list 0) will be cleared if it was active.
Q	Quit. Returns from the current command to the paragraph, menu, program or command prompt that initiated the command. The ON.ABORT paragraph is not executed. The @ABORT.CODE variable will be set to 2. The default select list (list 0) is not cleared.
S	Suppress pagination. Continues execution with no further pagination prompts.
Other	Any other key continues execution until a further pagination prompt is displayed.

The number of lines per page can be adjusted from its initial value by use of the **TERM** command.

Pagination can be disabled by application software or by use of the NO.PAGE option to some commands.

2.5 The VOC File

The VOC file is central to everything that QM does. This file is the vocabulary of words and symbols that may appear in commands and holds many other things as well. The initial VOC file is a copy of NEWVOC from the QMSYS directory. By modifying the VOC it is possible to change the names of commands to meet particular needs of an application or user. It would be possible, for example, to include French translations of all the command names. More often, changes are made simply to use wording that is more appropriate to the manner in which the product is used.

Records in the VOC are of differing types, the type of the record being determined by the first one or two characters of field 1 of the record. The remainder of field 1 after the identifying characters may contain any value and is typically used to comment the role of the VOC entry.

The **VOC** record types are

D Data item
Defines a field within a data file. D type entries may appear in the VOC but are more commonly found in dictionaries.

F File
Defines a file, relating its application level name for use within QM to its operating system pathname.

K Keyword
Many commands have keywords which affect the behaviour of the command or introduce optional clauses in the command syntax.

M Menu
A menu record defines a menu that can be displayed by executing the VOC entry.

PA Paragraph
A paragraph is a sequence of commands that can be executed by entering the name of the VOC entry.

PH Phrase
A phrase is a short form for a sequence of items to be substituted into query processor commands.

PQ PROC
A PROC is the predecessor of paragraphs. QM supports PQN style PROCs for use when migrating applications. It is recommended that new developments should use paragraphs or QMBasic programs instead.

Q Remote File
A remote file pointer refers to a file in another QM account, perhaps on a different server.

R Remote
An R type VOC entry points to a record in another file which is constructed in the same way as an executable (M, PA, R, S or V type) VOC entry.

S Sentence
A sentence is a single command.

V Verb
A verb is the portion of a command which identifies the part of QM which will process it.

X Other
X type records may be used to store miscellaneous information in the VOC.

Users may add handlers for other VOC record types that are to be usable as commands. This is done by creating a VOC record named $VOC.PARSER:

Field 1 X

Field 2 A multivalued list of VOC record type codes.

Field 3 A corresponding multivalued list of catalogued handler subroutine names.

The handler is a QMBasic subroutine taking two arguments; the verb name and the VOC record.

The VOC includes an F-type entry referencing itself so that commands that access the VOC do not have to treat it as a special case. Users must not modify this VOC entry as any change is likely to cause QM to malfunction because internal components reference the VOC by pathname.

The VOC also includes a Q-type entry named MD as a synonym for VOC for compatibility with other systems.

VOC D-type records - Data items

A D-type record defines a field stored in a data file.

Although D-type records may be stored in the VOC file, they are more usually found in dictionaries. A D-type entry in the VOC can be used to reference a field in any file whereas a D-type entry in a dictionary can only be used in queries against the associated file.

A D-type record has up to 8 fields:

1: D { descriptive text }

2: Field number. This is the position in the data record at which the field described by this dictionary entry can be found. A value of zero denotes the record id.

3: { Conversion code }

4: { Display name. This will be used as the default column heading by the query processor. }

5: Format specification

6: Single/multi-value flag. Set as S if the field is always single valued or M if it can be multi-valued.

7: { Association name. Where a multi-valued field has a value by value relationship with some other multi-valued field defined in the same dictionary, this name links the fields together.}

8: {Available for user use in any way. Not referenced by QM. }

Fields 9 onwards are reserved for internal use and users should not assume anything about their content.

Click here for a detailed description of dictionaries.

VOC F-type records - File definitions

Every file referenced by an application is accessed via an F-type VOC record. This record maps the QM name of the file to the pathnames of the data and dictionary components.

1: F { descriptive text }

2: The pathname(s) of the data portion of the file. In a multi-file, the pathname of each subfile appears as a separate value in this field

3: Dictionary pathname. This field is empty if the file has no dictionary.

4: Subfile names for a multifile. This field is empty for a simple file.

5: File inclusion flags for **ACCOUNT.SAVE** and **FILE.SAVE**.
There are three possible values:
D Include only the dictionary of this file in the save
E Exclude this file from the save
I Include this file in the save
Leaving the field empty causes **ACCOUNT.SAVE** and **FILE.SAVE** to fall back on alternative file selection methods.

Either pathname field may be blank to indicate that the file portion does not exist.

Three special pathname prefixes are allowed:

- @QMSYS will be replaced by the QMSYS account directory pathname, ensuring that references to items in the QMSYS account will still function if a new release is installed at a different location.
- @TMP will be replaced by the pathname in the TEMPDIR configuration parameter.
- @HOME will be replaced by the value of the HOME environment variable. Windows users may need to create this variable before using this feature.

Where two or more accounts share a file, the VOC files in each account could have F-type records mapping the QM name to the pathnames. This is not recommended. Instead, the account that owns the file should have an F-type record and all other accounts should have Q-type records to access the file indirectly.

The pathname of either or data or dictionary portion of a file may be specified as
VFS:*handler*:*detail*
to make use of the Virtual File System.

A summary of F-type VOC records may be displayed or printed using

LISTF	Show all F-type entries
LISTFL	Show only local files (in the account directory)
LISTFR	Show only remote files (not in the account directory)

VOC K-type records - Keywords

Keywords affect the behaviour of commands or introduce optional components in the command syntax. Keywords are defined by K-type VOC records.

1: K { descriptive text }

2: Keyword number

3: { alternative expansion }

Each keyword is assigned a number which appears in field 2 of a keyword VOC entry.

Keywords with internal number 0 in field 2 are ignored by the query processor and some other parts of QM. They are provided to allow construction of more natural English sentences. For example, the THAN keyword can be used with other elements such as GREATER and LESS to allow a query such as

```
LIST STOCK WITH PRICE GREATER THAN 100
```

instead of

```
LIST STOCK WITH PRICE GREATER 100
```

Users can freely add new keywords with internal number 0 as required.

In some cases, a keyword is also needed as a command name (e.g. **OFF** which is a synonym for **QUIT** but also a modifier in several other commands). A keyword can never be the first token in a command. If the command processor finds a K-type VOC item used as the first token in a command, it looks for an alternative VOC record structure starting at field 3.

Thus, as an example, the OFF VOC entry reads

```
1: K
2: 20
3: V
4: IN
5: 1
```

where fields 3 onwards contain an alternative V-type (verb) definition.

A summary of K-type VOC records may be displayed or printed using **LISTK**.

VOC M-type records - Menu definitions

A VOC menu record defines a menu of numbered options to be displayed to the user when the menu entry is executed. Because menu records may be very large, they are often stored in some other file with a VOC R-type record as a remote pointer to the actual menu definition.

A menu record has 11 fields:

1: M { descriptive text }

2: Menu title line to appear at the top of the screen

3: Item text. This field is multi-valued with one value for each menu entry. Blank entries are allowed to insert spacing in the menu. Each menu entry is numbered except as described under field 4 below.

The descriptions are normally displayed starting on the third line of the screen, left justified. If the menu has more items than will fit in a single column on the screen and the items are all sufficiently short, the menu will be displayed as two columns. Any menu items that will not fit on the screen are lost.

4: Action. This field is multi-valued with entries corresponding to the text in field 3. If the action is terminated by a semicolon, the menu processor issues a "Press return to continue" prompt when the command is completed. Blank entries cause the field 3 text to be treated as a sub-title and not numbered on the displayed menu.

5: Help text. A multi-valued set of one line help texts corresponding to each menu option in the previous fields.

6: Access key. An optional multi-valued set of access control keys corresponding to the menu items. The access key value is passed to the access control subroutine if this is used.

7: Hide inaccessible entries. This field may be single valued in which case it applies to all menu entries or it may have one value for each menu item. Each value present is a boolean (1 or 0 corresponding to true or false) flag indicating whether inaccessible menu entries should be hidden (not displayed) or shown as unavailable.

8: Access subroutine. This optional field contains the name of an access control subroutine. When the menu is displayed, this subroutine is called for all entries with an access key in field 6 to determine whether the option is to be offered. The subroutine takes three arguments; the returned true/false accessibility flag, the menu name and the access key from field 6.

9: Prompt text. If present, this text replaces the default option prompt.

10: Exit codes. An optional multi-valued list of codes which when entered at the option prompt will exit from the menu. If this field is blank, entering a null response to the menu prompt will exit from the menu. Because exit codes are processed before option numbers, it is possible to include an option that causes an exit by specifying the option number as an exit code.

11: Stop codes. An optional multi-valued list of codes which when entered at the option prompt will generate an abort event, terminating all active processing and returning to the command prompt. If this field is blank, it defaults to Q. Because stop codes are processed before option numbers, it is possible to include an option that causes a stop by specifying the option number as a stop code.

Menus may be constructed and maintained using the menu editor **MED**.

A summary of M-type VOC records may be displayed or printed using **LISTM**.

When used on a PDA, QM allows selection of menu options using a stylus tap. Clicking on or below the option line exits from the menu.

VOC PA-type records - Paragraphs

A **paragraph** is a sequence of stored commands or sentences which will be executed in turn by entering the paragraph name in response to the command prompt.

1: PA { descriptive text }
2: First sentence
3: Second sentence
4: etc...

Field 1 of the VOC paragraph record commences with **PA**, fields 2 onwards are the commands to execute. Any sentence within the paragraph may be broken into shorter parts by using the underscore character to indicate that the command continues on the next line.

The **C***n* and **I***n* control codes of inline prompts may be used to substitute additional text from the sentence that started the paragraph into the commands within the paragraph.

Paragraphs may contain a number of special commands and constructs that are not allowed in sentences. These are

DATA	Embedded data for an application
IF	Conditional execution
GO	Jumps to labels
LOOP	Repeated execution of a loop

Paragraphs may invoke other paragraphs. Beware of accidental recursive invocation of the same paragraph.

There are four reserved paragraph names for special functions. These are:

LOGIN	Executed on entry to QM and also when the **LOGTO** command is used to switch to a new account.
ON.LOGTO	Executed on use of the **LOGTO** command before switching to the new account.
ON.EXIT	Executed on leaving QM by use of the **QUIT** command.
ON.ABORT	Executed when QM aborts a program.

The QMSYS account may contain a paragraph with a further reserved name:

MASTER.LOGIN	Executed on initial entry to QM in any account before the LOGIN paragraph.

For more details of the above, see Command Scripts.

A summary of PA-type VOC records may be displayed or printed using **LISTPA**.

VOC PH-type records - Phrases

A phrase can be used in query processor sentences. When the sentence is executed, the phrase name is replaced by the phrase expansion. Typically, phrases are used to give names to groups of fields to be displayed or selection criteria.

1: PH { descriptive text }

2: Phrase expansion

Phrases may be included in the VOC but are more commonly found in dictionaries. A phrase in the VOC can be used in queries against any file whereas a phrase in a dictionary can only be used in queries against the associated file.

A summary of PH-type VOC records may be displayed or printed using **LISTPH**.

VOC PQ-type records - PROCs

PROCs are the predecessor of paragraphs. They are generally thought to be much harder to understand and maintain but are supported in QM for compatibility with other systems. New applications should use paragraphs or QMBasic programs in place of PROCs.

1: PQ{N} { descriptive text }

2+: PROC statements

PROCs come in two styles identified by the VOC record type; standard PROCs (PQ) and new style PROCs (PQN). QM supports the major features of PROCs but is not a full implementation of the various PROC environments found in other multivalue environments.

Because development if new PROCs is discouraged, only an overview of what elements of PROCs are supported by QM is given here. It is not intended as a detailed reference document or a learning aid.

Proc Buffers

A PROC works by manipulating data in a set of buffers, each stored internally as a field mark delimited dynamic array (PQN) or a space delimited string (PQ). These are:

The Primary Input Buffer (PIB)

The PIB initially holds the command that started the PROC and any command line options. A PROC can use the PIB to store other data during its operation.

The Secondary Input Buffer (SIB)

The SIB is typically used to store user input entered in response to the IN statement.

The Primary Output Buffer (POB)

The POB is used to construct a command to be executed. Execution of the assembled command is triggered by use of the P statement or by termination of the PROC.

The Secondary Output Buffer (SOB)

The SOB, often called the stack, is used to hold data to be processed by the command in the POB. It can also hold supplementary commands to be executed after the POB has been executed.

At any moment, one input and one output buffer is considered as being active. The SP and SS statements can be used to make the primary or secondary input buffer active respectively. Similarly the STOFF and STON statements can be used to select the primary or secondary output buffers as active.

The input buffer pointer is used to identify a position within the active input buffer.

When a PROC starts, the primary input and output buffers are active and the input buffer pointer points to the start of the PIB.

The File Buffers

There are ten file buffers, numbered from 0 to 9. File buffers 1 to 9 are the standard file buffers. File buffer 0 is the fast file buffer and can be accessed with a special buffer reference syntax.

Select List Buffers

The eleven numbered select lists can be accessed using the select list buffers.

Buffer References

Many statements can reference buffers using the tokens shown below:

Token	Buffer	Direct		Indirect	
%	Primary input buffer	%1	PIB field 1	%#2	PIB field referenced by #2
#	Active output buffer	#1	AOB field 1	#%1	AOB field referenced by %1
&	File buffer	&4.2	File 4, field 2	&%1.%2	File %1, field %2
&	Fast file buffer	&1	Field 1	&%2	Field referenced by %2
!	Select list	!5	List 5	!%1	List referenced by %1

An indirect reference uses the content of one buffer to index into another.

In a file buffer, field 0 references the record id associated with the buffer.

A-References

An A-reference is a reference to data in the active input buffer using the syntax of the A statement described in the following section. When used in this form, an A-reference does not move the input pointer or change the content of the buffers.

PROC Statement Summary

A Move a field from the active input buffer to the end of the active output buffer.

A{*c*}{*p*}{**,***m*}
Move up to *m* characters of field *p* to the output buffer, enclosing the text in character *c*.
c may be any character except a digit, left bracket or comma and defaults to a space.
Specifying *c* as a backslash suppresses the surround character. The surround character is ignored if the data is copied to the secondary output buffer.
If *p* is omitted, data is copied from the field addressed by the current position of the input pointer.
If *m* is omitted, data is copied until the end of the field is reached.

The input pointer is positioned following the last character moved.

A({*n*}{**,***m*})
Move up to *m* characters, starting at character *n*, to the output buffer.
If *n* is omitted, data is copied from the current position of the input pointer.
If *m* is omitted, data is copied until the end of the field is reached.
The input pointer is positioned following the last character moved.
Data copying normally terminates at the end of the field. Use **OPTION** PROC.A to enable compatibility with D3 where the copy continues past the end of the field.

B Move the input pointer back to the previous field.

If the input pointer is at the start of a field, it is moved back to the start of the previous field. Otherwise it is moved back to the start of the current field.

BO Move the output pointer back to the previous field

The output buffer pointer is move back to the previous field, truncating the data at its new position.

C Comment

C*text*
All text following the C is ignored.

D Display fields from the active input buffer

D{*ref*|*p*}{**,***m*}{+}
ref is a direct or indirect reference to a buffer containing the field number of the active input buffer that is to be displayed.
p is the field number of the active input buffer that is to be displayed. If p is zero, the entire input buffer is displayed.
m is the maximum number of characters to be displayed.
\+ suppresses the normal newline after display

DB Display all input and output buffers

The content of the primary and secondary input and output buffers is displayed.

DF Display file buffer

DF{*n*}
The content of the specified file buffer is displayed. If *n* is omitted or specified as zero, the fast file buffer is displayed.

DS Display select buffer

DS*n*
The content of the specified select buffer is displayed. If *n* is omitted, it defaults to zero.

F Moves the input buffer pointer forward

The input buffer pointer is moved forward to the start of the next field. If the pointer was in the last field, it is moved to the end of the buffer.

F; Perform stack based arithmetic

F;*element*{**;***element...*}
The **F;** statement performs integer arithmetic using a stack. The *element* list contains values to be added to the stack and operators to be performed against the stack values.

ref	A direct or indirect reference to a buffer element to be placed on the stack.
n	A numeric constant to be placed on the stack. The value may be preceded by **C**.
+	Adds the top two stack items, replacing them by the result.
-	Subtracts the top stack item from the next item, replacing them by the result.
*	Multiplies the top two stack items, replacing them by the result.
/	Divides the second item on the stack by the first item, replacing them by the truncated integer result.
R	Divides the second item on the stack by the first item, replacing them by the remainder value.
{	Interchanges the top two items on the stack.
_	Interchanges the top two items on the stack.
?P	Moves the top item from the stack into the primary input buffer at the input pointer position.
?*ref*	Moves the top item from the stack into the specified register location.

F-CLEAR Clear a file buffer

F-C{**LEAR**} *n*
The file buffer for file *n* is cleared.

F-DELETE Delete a record from an open file

F-D{**ELETE**} *n*
The record identified by the file and id associated with file buffer *n* is deleted. An error will be reported if there is no open file associated with the file buffer.

F-FREE Release a record lock in an open file

F-F{**REE**} {*n* {*id*|*ref*}}
The record identified by the file and id associated with file buffer *n* is deleted. The record id may be specified using a buffer reference. If no id is specified or it is a null string, all locks in that file are released. An error will be reported if there is no open file associated with the file buffer.
If no file number or id are specified, all locks associated with files opened by the PROC are released.

F-OPEN Open a file

F-O{**PEN**} *n* {**DICT**} {*filename*|*ref*}
Opens the file specified by *filename* or by the buffer addressed by *ref*, associating it with file buffer *n*. The **DICT** qualifier specifies that the dictionary portion of the file is to be opened.
If the file cannot be opened, the PROC continues at the next statement, otherwise this statement is skipped.
All files are closed on return to the command processor.

F-READ Read a record from an open file

F-R{**EAD**} *n* {*id*|*ref*}
The record with id specified by *id* or by the direct or indirect *ref* is read into file buffer *n*. If the record cannot be found, the PROC continues at the next statement, otherwise this statement is skipped. In either case, the record id will be stored as field zero of the file buffer.

F-UREAD Read a record from an open file with an update lock

F-U{**READ**} *n* {*id*|*ref*}
The record with id specified by *id* or by the direct or indirect *ref* is read into file buffer *n*, locking it for update. If the record cannot be found, , the PROC continues at the next statement, otherwise this statement is skipped. In either case, the record id will be stored as field zero of the file buffer and the process will own the lock.

F-WRITE Write a record to an open file

F-W{**RITE**} *n*
The record stored in file buffer *n* is written using the id stored in field zero of the file buffer.

FB Read a record into the fast file buffer

FB{**U**}({**DICT**} *filename*|*ref1* *id*|*ref2*)
The file identified by *filename* or *ref1* is opened to the fast file buffer and the record identified by *id* or *ref2* is read into the buffer. The **U** option specifies that an update lock is required.
If the file cannot be opened or the record cannot be found, the PROC continues at the next statement, otherwise this statement is skipped. Where the action fails because the file was opened but the record could not be found, the id will be stored in field zero of the file buffer and the process will own the update lock if the **U** option was specified.

GO Jump to a label or a mark (Synonyms **G** and **GOTO**)

GO *label*|*A-ref*|*ref*|**F**|**B**
The PROC continues execution at the given position.
label specifies a numeric label attached to the destination.
A-ref is an A-reference used to determine the destination label.
ref is a direct or indirect buffer reference to a location containing the label.
F jumps forward to the next **M** statement in the PROC.

B jumps to the location of the last **M** statement executed within the PROC.

GOSUB Enter a labelled subroutine

GOSUB *label*
Label specifies a numeric label at the start of the subroutine.
Execution continues at the given location. The subroutine may return to the statement following the **GOSUB** by use of **RSUB**.

H Add text to the active output buffer

H{*text*|*ref*}
The literal *text* or the content of the buffer location identified by the direct or indirect *ref* is added to the active output buffer. Multiple spaces are compressed to a single space. All spaces within the string are then replaced by field marks.

IF Conditional execution

IF {**N**} *condition statement*
N specifies that a numeric comparison is to be performed where only the leading numeric part of the data to be tested is used.
The *condition* may take several alternative forms referencing an *item* which may be:

- *A-ref* Data obtained using an A-reference
- *ref* A direct or indirect buffer reference
- **E** The value of @SYSTEM.RETURN.CODE
- **S***n* Tests whether select list is active. *n* defaults to 0 if omitted.

The *conditions* are:

item — Tests that *item* is not blank. Used with **E**, this tests whether the value is negative.

#item — Tests that item is blank. Used with **E**, this tests whether the value is not negative.

item op text|ref — Compares *item* with unquoted literal *text* or a value obtained from a direct or indirect buffer reference. The operator *op* may be

- = Equality
- # Inequality
- > Greater than
- < Less than
-] Greater than or equal to
- [Less than or equal to

If *text* or *ref* is enclosed in round brackets and the operator is = or #, it is treated as a pattern match.

If the data identified by *text* or *ref* is multivalued and the operator is = or #, the operator tests whether *item* appears in the multivalued data. There are two extended syntaxes available with this style of test:

IF *item* = AVMBVMC GO 10VM20VM30

and

IF *item* = AVMBVMC GOSUB 10VMGO 20VMXDone

The first form, applicable to GO only, jumps to one of a list of labels dependant on the value of the *item*. The second form takes a

multivalued list of statements to be executed dependant on the value of *item*.

IH Insert test in the active input buffer

I{**B**}**H***text*|*ref*|\| \}
Copies the unquoted literal *text* or the data addressed by the direct or indirect buffer *ref* to the active input buffer at the position given by the input buffer pointer. If this is positioned at the start of a field, the entire field is replaced. If it is positioned part way though the field, the new data is appended to the portion before the input pointer position.
The \ token with no preceding space, clears the field addressed by the input buffer pointer. If the pointer is positioned part way through a field, characters before the pointer position are retained.
The \ token with a preceding space, inserts an empty field.
Leading and trailing spaces are removed and multiple embedded are compressed to single spaces. If the **B** option is not present, the spaces are then converted to field marks.
The input buffer pointer is not moved by this operation.

IN Input data from the terminal to the secondary input buffer

I{**B**}**N**{*c*}
The secondary input buffer is activated and the user input overwrites any existing content. All leading and trailing spaces in the input data are removed and multiple embedded spaces are compressed to a single space. If the **B** option is not present, all remaining spaces are then replaced by field marks. The optional prompt character *c* specifies an alternative to the default of a question mark and remains in effect for subsequent input until another prompt character is set.

IP Input data from the terminal to any buffer

I{**B**}**P**{**P**}{*c*}*ref*
User input overwrites the location specified by the direct or indirect *ref*. If *ref* is omitted, the field addressed by the input buffer pointer in the primary input buffer is overwritten. All leading and trailing spaces in the input data are removed and multiple embedded spaces are compressed to a single space. If the **B** option is not present, all remaining spaces are then replaced by field marks. The optional prompt character *c* specifies an alternative to the default of a question mark and remains in effect for subsequent input until another prompt character is set. The prompt character must be present if *ref* is used.

In a PQ style Proc, entering a blank response retains the existing content of the input buffer. A PQN style Proc would clear the buffer.

IS Input data from the terminal to the secondary input buffer

This is a synonym for **IN** described above.

L Send output to a printer

L{'*text*'|*ref*|(*col*)**,**...}{+}
Outputs the items specified in the comma separated list. These may be quoted literal *text* or the data addressed by the direct or indirect buffer *ref*. Use of *ref* may be followed by an input conversion code enclosed in semicolons or an output conversion code enclosed in colons.
The (*col*) element can be used to move to a specific column number where the leftmost column is column one.
The + element suppresses the normal newline at the end of the output.
The list may span multiple lines by breaking it after a comma.

LC Close printer

The printer is closed and the output is passed to the underlying print management system for printing.

LE Page eject

Starts a new page

LHDR Set page header

LHDR{'*text*'|*ref*|(*col*)|**P**|**T**|**Z**|*n*|**,**...}
Sets the page header using the items specified in the comma separated list. These may be quoted literal *text* or the data addressed by the direct or indirect buffer *ref*. Use of *ref* may be followed by an input conversion code enclosed in semicolons or an output conversion code enclosed in colons.
The (*col*) element can be used to move to a specific column number where the leftmost column is column one.
The **P** element inserts the page number.
The **T** element inserts the date and time.
The **Z** element restarts page numbering.
The *n* element specifies a number of newlines.
The list may span multiple lines by breaking it after a comma.

LN Redirect printer output to the terminal

Specifies that output from the **L** statement is to be directed to the terminal. This is mainly useful for debugging purposes.

M Mark

The **M** statement marks a location in a PROC for use by the **GO F** and **GO B** operations.

MV Move data from one location to another

MV *destination source*
destination is a direct or indirect reference to the buffer location to which data is to be copied.

source is a list of one or more items to be copied. Each item may be direct or indirect buffer reference or a quoted literal string.
A comma separating two items inserts the items as separate fields. Use of two or more consecutive commas with no source item between them skips fields in the destination.
An asterisk between two items concatenates them.
An asterisk after a file buffer reference as the last item in the *source* list copies all remaining fields from the file buffer.
An asterisk followed by a number after a file buffer reference in the *source* list copies the given number of fields from the file buffer.
An underscore as the last item in the list truncates the destination by removing all fields after the last one copied.

MVA Move data from one location to another as a sorted multivalued field

MVA *destination source*
destination is a direct or indirect reference to the buffer location to which data is to be copied.
source is a direct or indirect buffer reference or an unquoted literal string.
The source data is inserted as a new value in the multivalued destination using a left aligned ascending sort order to determine its position. The item will not be inserted if it would duplicate an existing entry in the list.

MVD Delete an entry from a multivalued field

MVD *destination item*
destination is a direct or indirect reference to the buffer location from which the data is to be deleted.
item is a direct or indirect buffer reference or an unquoted literal string.
The multivalued destination is searched for the first occurrence of *item*, removing this entry from the list.

O Output text to the terminal

O*text*{+}
The unquoted literal *text* is displayed on the user's terminal. The optional + token suppresses the normal newline after output.

P Process the command in the primary output buffer

P{**P**}{**H**}{**X**}{**W**}{**L***n*}
The command in the primary output buffer is passed to the command processor for execution.
Any data in the secondary output buffer is queued up as data for use by the executed command.
If there is any unprocessed data remaining after the command has been executed, the first field of this data is passed to the command processor for execution, using the remaining fields as data. This cycle continues until all the data has been processed.
The **P** option displays the content of the output buffer before execution of the command.
The **H** option suppresses terminal output by the executed command.
The **X** option terminates the PROC after the command has been executed.
The **W** option displays the command and prompts the user to confirm whether it should be executed. Valid replies are Y to execute the command, N to terminate the PROC without executing the command and S to skip the command but continue execution of the PROC.

The **L***n* option sets process task lock *n* for the duration of the command.
After the command has been executed, the output buffers are cleared and the primary output buffer is activated.
There is an implied **P** command at the end of a PROC.

Q Quit

Q*text*
The PROC and all other underlying programs, paragraphs, menus, etc are terminated, displaying the optional unquoted *text* on the user's terminal. The user is returned to the command prompt, executing any ON.ABORT VOC entry on the way.

RI Reset input buffers

RI{*f*|(*col*)
Used with no options, this statement clears both input buffers, resets the pointer to the start of the primary input buffer and makes this the active buffer.
The *f* option specifies that the primary input buffer is to be cleared from field *f* onwards, leaving the input buffer pointer positioned at the end of the remaining data.
The (*col*) option specifies that the primary input buffer is to be cleared from the given character position, leaving the input buffer pointer positioned at the end of the remaining data.

RO Reset output buffers

Both output buffers are cleared and the primary output buffer is activated.

RSUB Return from a GOSUB

RSUB{*n*}
Without the *n* option, the PROC continues execution at the statement following the last GOSUB executed.
n specifies that execution is to continue starting *n* lines following the GOSUB.
The RSUB statement is ignored if the PROC is not in a subroutine.

RTN Return to a calling PROC

RTN{*n*}
The PROC returns to the PROC from which it was called, continuing execution *n* lines after the [] statement that called the current PROC. If *n* is omitted, it defaults to 1.

S Set the input buffer pointer

S*f*|*ref*|(*col*)
Moves the input buffer pointer of the active input buffer at the specified position.
f specifies that the pointer is to be positioned at field *f*.
ref is a direct or indirect buffer reference used to obtain the field number.
The (*col*) option sets the pointer to the given character position.

SP Active the primary input buffer

The primary input buffer is activated.

SS Active the secondary input buffer

The secondary input buffer is activated.

STOFF Active the primary output buffer

The primary output buffer is activated. This statement can also be written as **STOF** or **ST OFF**.

STON Active the secondary output buffer

The secondary output buffer is activated. This statement can also be written as **ST ON**.

T Terminal output

T*element*{**,***element*...}
Outputs each element of a comma separated list to the terminal. The elements may be:

text	Quoted literal text
ref	A direct or indirect buffer reference identifying the data to be displayed. This may be followed by an input conversion code enclosed in semicolons or an output conversion code enclosed in colons.
(*col*)	Position the cursor to the specified column of the current line. The value of *col* may be given as a number or as a direct or indirect buffer reference.
(*col***,***row*)	Position the cursor to the specified row and column. The value of *row* and *col* may be given as a number or as a direct or indirect buffer reference.
B	Sounds the terminal "bell".
C	Clears the screen.
D	Pauses for one second.
I*n*	Displays character *n* where *n* may be given as a number or a buffer reference.
L	Terminates a **T**...**L** loop.
S*n*	Emits *n* spaces where *n* may be given as a number or a buffer reference.
T	Starts a **T**...**L** loop where the elements enclosed in the loop will be executed three times.
U	Moves the cursor up by one line.
X*n*	Displays character *n* where *n* may be given as a number or a buffer reference to a two digit hexadecimal value.
+	Suppresses the normal newline after display.

The (*col*) and (*col***,***row*) elements can also be used to access the terminal control codes that use negative *col* values.
The list of elements for display can span multiple lines by breaking it after a comma.

TR Enable or disable tracing

TR {**ON**|**OFF**}
The **ON** option causes the PROC processor to display each statement before it is executed.
The **OFF** option terminates trace mode.
The space before the mode keyword can be omitted. If no mode is specified, tracing is enabled.

U Call a QMBasic program

U*name*
The catalogued program identified by *name* is called. This program should take no arguments and can access the PROC buffers using @-variables.

X Exit from the PROC

X*text*
Displays the optional unquoted *text* and terminates the PROC, returning to the calling PROC, program, menu, etc.

+ Add an integer value to a numeric field

+*n*
The specified numeric value is added to the field of the active input buffer identified by the input buffer pointer. Non-numeric data is treated as zero.

- Subtract an integer value from a numeric field

-*n*
The specified numeric value is subtracted from the field of the active input buffer identified by the input buffer pointer. Non-numeric data is treated as zero.

( ) Transfer control to another PROC

({**DICT**} *filename* {*id*}**)** {*label*}
The PROC identified by the given *filename* and *id* is executed, starting at *label*, or the first statement if no *label* is specified. If *id* is omitted, the record id is obtained from the field of the active input buffer addressed by the input buffer pointer.
The buffers and pointers are not changed by this statement.
Control does not return to the current PROC when the called PROC terminates.

[ ] Transfer control to another PROC

[{**DICT**} *filename* {*id*}**]** {*label*}
The PROC identified by the given *filename* and *id* is executed, starting at *label*, or the first statement if no *label* is specified. If *id* is omitted, the record id is obtained from the field of the active input buffer addressed by the input buffer pointer.
The buffers and pointers are not changed by this statement.
Control returns to the current PROC when the called PROC executes a RTN or X statement.

VOC Q-type records - Remote file pointers

A Q-type VOC record points to a file defined in the VOC of another account.

1: Q { descriptive text }

2: Account name or pathname. Leave blank for the same account.

3: VOC record name in target account

4: Server name for files accessed using QMNet

Field 2 contains either the account name or the pathname of the account directory. If field 2 is blank, the target record is assumed to be in the same VOC file.

Field 3 holds name of a VOC record in the target account. This VOC item must be either an F-type (file) or a further Q-type record. A chain of Q pointers is extremely inefficient and is restricted to a maximum of ten steps.

If the remote file is on a different QM server, this is specified by putting the server name in field 4 of the VOC entry. The network address and user authentication information is defined using the **SET.SERVER** command.

The **SET.FILE** command provides an easy way to create Q-pointers.

A summary of Q-type VOC records may be displayed or printed using **LISTQ**.

VOC R-type records - Remote pointers

An R type VOC entry points to a record in another file which is constructed in the same way as an executable (M, PA, R, S or V type) VOC entry.

1: R { descriptive text }

2: File name

3: Record name

4: {Security subroutine name}

R-type VOC entries are used to:

- Move large paragraphs and menus out of the VOC as large records degrade the performance of the hashing process.
- Reference a common version of a VOC item to be used from multiple accounts.
- Add security checks prior to command execution.

The file name in field 2 must correspond to an F-type or Q-type entry in the same VOC.

The record name in field 3 is the record in the target file that holds the item to be executed.

An R-type VOC record can optionally hold the name of a catalogued security subroutine in field 4. This subroutine can be used to determine whether the user is to be allowed to execute the command pointed to by the R-type record. If the validation fails or the subroutine cannot be found in the catalogue a message is displayed:

```
This command is restricted (verb)
```

A summary of R-type VOC records may be displayed or printed using **LISTR**.

VOC S-type records - Sentences

Where a particular command is executed frequently, it may be useful to store it as a **sentence**.

1: S { descriptive text }

2: Sentence text

A sentence is a command containing a verb and, optionally, its arguments. Sentence names may be entered in response to the command prompt in the same way as a verb. Any arguments following the sentence name on the command line entered at the keyboard will be appended to the sentence retrieved from the VOC.

Field 1 of a VOC sentence record must commence with a letter **S**. Field 2 holds the text of the sentence. This text replaces the sentence name in the current command and parsing continues with the first word of the substituted sentence.

Where a sentence is very long it may be broken into multiple lines within the VOC record by terminating all but the final line with an underscore character. When the sentence is executed, the lines are merged, replacing the underscore with a single space.

Any additional text following the sentence name in a command that starts the sentence will be appended to the sentence expansion retrieved from the VOC. For example, the **EDIT.LIST** command is actually a sentence stored as

```
1:  S
2:  ED $SAVEDLISTS
```

Typing

```
EDIT.LIST MYLIST
```

actually executes the command

```
ED $SAVEDLISTS MYLIST
```

This automatic appending of additional text in the command makes stored sentences very useful as the start of commands but prevents effective use of some inline prompt control codes in the sentence expansion.

A summary of S-type VOC records may be displayed or printed using **LISTS**.

VOC V-type records - Verbs

A **V** type record defines a command name and determines the QM component that will be used to process the command.

1: V { descriptive text }

2: Dispatch code

3: Processor

4: { Qualifying information }

5: { Security subroutine }

The dispatch code identifies the type of processor referenced by field 3. It may be:

CA A catalogued verb. Field 3 holds the catalogue name of the function to be executed. For system supplied verbs, field 4 may also be significant and should not be altered.

CS A locally catalogued function program. This format allows a QMBasic program to CALL a function that is in the compiler output file rather than in the catalogue.

IN An internal verb. Field 3 holds an identifying number which determines the action of the verb.

OS An operating system command. QM will execute an operating system command made up from the contents of field 3 of the VOC record (which may be null) followed by the remainder of the current sentence after the verb.

Users may add their own V-type records for catalogued programs (usually by use of the **CATALOGUE** verb) or make copies of standard records to provide synonyms for other verbs.

A V-type VOC record can optionally hold the name of a catalogued security subroutine in field 5. This subroutine can be used to determine whether the user is to be allowed to execute the command. If the validation fails or the subroutine cannot be found in the catalogue a message is displayed:

```
This command is restricted (verb)
```

A summary of V-type VOC records may be displayed or printed using **LISTV**.

VOC X-type records - Miscellaneous storage

X-type VOC items are miscellaneous data storage records which may be used in any way the application designer wishes.

1: X { descriptive text }

2: user data

Fields 2 onwards are available for data storage. Users may freely create X type records for their own purposes but should avoid names containing $ signs as these may clash with system defined records.

Security subroutines

An R-type or V-type VOC entry can optionally include the name of a catalogued security subroutine in field 4 (R-type) or field 5 (V-type). This subroutine can be used to determine whether the user is to be allowed to execute the command.

The security subroutine is written using QMBasic. A simple subroutine that prompts for a password is shown below.

```
SUBROUTINE SECURITY(OK, VERB, REMOTE.FILE, REMOTE.ID)
   PROMPT ''
   DISPLAY 'Enter security password: ' :
   FOR I = 1 TO 3
      ECHO OFF
      INPUT PASSWORD
      ECHO ON
      IF PASSWORD = 'FSKJJ' THEN RETURN (@TRUE)
   NEXT I

   RETURN (@FALSE)
END
```

The arguments to this subroutine are:

OK	Used to return the result of the validation. This should be set to true (1) if the command is to be allowed, false (0) if it is to be rejected.
VERB	The name of the R-type VOC entry being processed.
REMOTE.FILE	The name of the file containing the remote item to be executed. This is a null string for a security subroutine referenced from a V-type VOC record.
REMOTE.ID	The record of the remote item to be executed. This is a null string for a security subroutine referenced from a V-type VOC record.

If the validation fails or the subroutine cannot be found in the catalogue a message is displayed:

```
This command is restricted (verb)
```

2.6 Inline Prompts

Inline prompts provide a means to prompt for data needed by a sentence or paragraph when it is executed. The DATA command does not affect inline prompting which always takes its response from the keyboard. There are also variants on inline prompts that retrieve data from other sources, providing a generalised way to substitute variable items into a command.

An inline prompt has the general form

<<{*control*,} *text* {, *check*}>>

where

control determines the way in which the prompt is displayed and how it is actioned on subsequent execution of the same statement or another with the same *text*. Control codes are generally case sensitive.

text is the prompt text to be displayed. An equals sign is automatically added to the end of the prompt text.

check is used to check whether the response to the prompt is valid. If omitted, no checking is performed.

The *control* option has two parts; the *display control* and the *response control*. Both parts are optional.

The *display control* may contain any of the following items. Multiple items may be concatenated, separated by commas, and are performed in the order in which they appear.

@(*col*, *row*) specifies the display position for the prompt text. The QMBasic @() function variants with a negative value for the first (or only) argument are also supported.

@(BELL) sounds the audible warning. The **BELL OFF** command will suppress this action.

@(CLR) Clears the display.

@(TOF) Positions to the top left of the display.

The *response control* consists of one of the items listed below. If omitted, the prompt is actioned only for the first occurrence of a prompt with the given *text*. Subsequent execution of the same inline prompt or another with the same *text* will not cause a prompt to be displayed but will use the response to the previous prompt. All prompt responses are discarded on return to the command prompt. The **CLEAR.PROMPTS** command can be used to discard all inline prompt responses from within a paragraph.

A Always prompt. This is usually needed on the first occurrence of each prompt in a loop so that each iteration of the loop prompts again.

C*n* Used in paragraphs to take the *n*'th token of the sentence that started the paragraph as the response to the prompt. No prompt text will appear unless the implicit response fails to meet the *check* conditions. The **C** control code has several extended forms:

C*m*-*n* Returns tokens *m* to *n*.

C*n*+ Returns tokens *n* onwards.

C# Returns the number of tokens in the command line.

All formats of the **C** control code may include a default value. For example,

<<C4:SALES>>

The default value will be applied if the prompt would otherwise return a null string.

F(*file***,** *key* {**,***field* {**,** *value* {**,** *subvalue*}}}**)** Use record *key* of the data portion of the named *file* as the response to the prompt. The optional *field*, *value* and *subvalue* allow extraction of a particular part of the record.

I*n* Used in paragraphs to take the *n*'th token of the sentence that started the paragraph as the response to the prompt. If this is a null string or the implicit response fails to meet the *check* conditions, an input prompt appears.

L*n* Extracts the next item from select list *n*. If *n* is omitted, it defaults to zero. When the select list is exhausted, a null string is returned.

R Prompt repeatedly for input, concatenating data with an intervening space until a blank line is entered.

R(*string***)** Prompt repeatedly for input, concatenating the responses with *string* between responses until a blank line is entered. The *string* may not include field mark characters. An abort will occur if a field mark is specified as part of *string*.

S*n* Take the *n*'th token of the sentence entered at the command prompt as the response to the prompt. If this is a null string or the implicit response fails to meet the *check* conditions, an input prompt appears.

SUBR(*name***)** Execute catalogued QMBasic function *name*, returning the result of this function as the value of the inline prompt.

SUBR(*name***,** *arg1***,** *arg2***)** Execute catalogued QMBasic function *name*, passing in the given arguments and returning the result of this function as the value of the inline prompt. Up to 254 arguments may be specified. These may be enclosed in quotes if necessary to avoid any syntactic ambiguity.

SYSTEM(*n***)** Returns the value of the QMBasic **SYSTEM(*n*)** function.

U Converts the data entered in the response to the prompt to uppercase. Note that this control has no effect on data from other sources such as the command line, a file or a select list.

@*var* The name of an @-variable, including user defined names (see the **SET** command), may be used to retrieve the value of the given variable. A default value may be applied by use of a prompt of the form:

<<@*name*:*value*>>

The default value will be applied if the prompt would otherwise return a null string.

$*var* The name of an operating system environment variable may be used to retrieve the value of the given variable. . A default value may be applied by use of a prompt of the form:

<<$*name*:*value*>>

The default value will be applied if the prompt would otherwise return a null string.

The **C***n* and **I***n* control codes are only useful in paragraphs. A command that references a paragraph (PA-type VOC entry) may include additional text that can be accessed using these control codes. In a command that references a stored sentence (S-type VOC entry), any additional text following the sentence name is added to the end of the sentence expansion, making effective use of these control codes impossible. There is no reason why a paragraph cannot contain only a single sentence if these control codes are to be used.

The <<@*var*>> construct allows @variables to be inserted into any command, simplifying paragraph structure. For example:

```
SAVE.LIST LIST.<<@USERNO>>
```

could be used to save a select list with a name that includes the user number to ensure uniqueness for the duration of the user's QM session.

The *check* code performs simple data validation and is either a pattern match template or an input conversion code. Multiple patterns can be specified separated by the word **OR** with a single space either side. For example,

```
3N'-'4N OR 4N'-'3N
```

would accept numbers of the form 123-4567 or 1234-567.

Input conversion codes must be enclosed in brackets. Any of the codes that can be used with the **ICONV()** function may be used. The check is considered successful if no conversion error occurs. The value returned by the prompt is the actual text entered, not the result of the conversion.

Entry of QUIT at the keyboard in response to an inline prompt will abort and return to the command prompt. The **@ABORT.CODE** variable will be set to 2 as for QUIT entered at other prompts.

Inline prompts are expanded as the first stage of processing a command. This has two important effects:

An inline prompt in a comment line will be evaluated. This slightly strange effect can be useful as a means to perform all prompts at the start of the paragraph rather than as they are needed, perhaps much later.

An **IF** command in a paragraph where the conditioned statement includes an inline prompt will display the prompt before determining whether the condition is true.

A single command may contain multiple inline prompts. These will be evaluated left to right. Nested inline prompts will be evaluated from the inside outwards.

The response to an inline prompt may not include the left or right double angle bracket symbols (<< and >>) or field marks. Entering a response containing one of these will cause the prompt to be repeated.

When used as an item to test in an IF command, the prompt will usually need to be enclosed in quotes so that a response that contains spaces or reserved keywords does not cause the command parsing to fail. For example

```
IF <<Customer number>> = "" THEN STOP
```

should be written as

```
IF "<<Customer number>>" = "" THEN STOP
```

Examples

```
PA
SELECT ORDERS SAVING UNIQUE CUST.NO_
  WITH DATE AFTER <<Start date>>
LIST CUSTOMERS NAME_
  HEADING "Clients ordering after <<Start date>>"
```

The above paragraph uses two identical inline prompts. The first asks the user to enter a start date for a SELECT operation. The second prompt will not repeat the request as the answer is already known. Note that the prompt text can contain spaces and that the inline prompt substitution occurs even though it is part of a quoted string.

```
PA
* <<Target file>>
RUN OVN.PROCESS
OVN.RPT <<Target file>>
```

In this example, the inline prompt is in a comment. Although the prompt will be issued at the start of the paragraph, the result is not used until the final command. If the OVN.PROCESS program takes a considerable length of time to execute, this technique allows the prompt to be answered early, without having to wait for the program to complete.

```
PA
* <<I2,Target file>>
RUN OVN.PROCESS
OVN.RPT <<Target file>>
```

By adding the I2 control option to the previous example, the paragraph will take the target file name from the second word on the command line if present, prompting if it is not given.

```
PA
LOOP
   IF <<A,Customer>> = "" THEN STOP
   LIST ORDERS WITH CUST.NO = <<Customer>>
REPEAT
```

This paragraph uses a loop in which the user is prompted to enter a customer number. If this is a null string, the paragraph terminates. Otherwise it lists the ORDERS file records for this customer. Note the use of the A option on the first prompt in the loop so that it is repeated on each cycle of the loop. Without this, the paragraph would list the orders for the same customer continuously until stopped by user action.

```
SAVE.STACK <<@LOGNAME>>
DISPLAY Domain is <<$USERDOMAIN>>
```

These two commands show use of the inline prompt mechanism to insert the value of system variables into commands. The first uses an internal QM @variable to retrieve the user's login name, the second accesses the operating system USERDOMAIN environment variable.

```
DISPLAY Licence number <<SYSTEM(31)>>
```

This example uses the inline prompt mechanism to access the QM licence number via the QMBasic SYSTEM() function.

See also:
CLEAR.PROMPTS

2.7 Pattern Matching

Pattern matching is a way to test whether data has a particular structure. It can be used for data validation and as a means to extract the part of a data item that matches against a specified element of the pattern. The pattern matching operations are the query processor **LIKE** and **UNLIKE** keywords, the QMBasic **MATCHES** operator and **MATCHFIELD()** function, and the **M** search of **ED**. All of these compare a character string with a pattern template.

Pattern matching breaks the character set into three classes of character, each represented by a character type code:

A Alphabetic, upper and lowercase A - Z
N Numeric, digits 0 - 9
X Any character, including alphanumerics

There are also three ways to specify how many characters are present:

4 Exactly 4 characters
2-7 Between 2 and 7 characters
0 Any number of characters, including none

The *template* consists of one or more concatenated items formed from pairs of lengths and character type:

0X	Zero or more characters of any type
*n*X	Exactly *n* characters of any type
*n-m*X	Between *n* and *m* characters of any type
0A	Zero or more alphabetic characters
*n*A	Exactly *n* alphabetic characters
*n-m*A	Between *n* and *m* alphabetic characters
0N	Zero or more numeric characters
*n*N	Exactly *n* numeric characters
*n-m*N	Between *n* and *m* numeric characters
"*string*"	A literal string which must match exactly. Either single or double quotation marks may be used.

The values *n* and *m* are integers with any number of digits. *m* must be greater than or equal to *n*.

The 0X code is a wildcard that matches against anything. It has a commonly used synonym:

...	Zero or more characters of any type

The 0A, *n*A, 0N, *n*N and "*string*" patterns may be preceded by a tilde (~) to invert the match condition. For example, ~4N matches four non-numeric characters such as ABCD (not a string which is not four numeric characters such as 12C4).

A null string matches patterns ..., 0A, 0X, 0N, their inverses (~0A, etc) and "".

The 0X and *n-m*X patterns match against as few characters as necessary before control passes to

the next pattern. For example, the string ABC123DEF matched against the pattern 0X2N0X matches the pattern components as ABC, 12 and 3DEF.

The 0N, *n-m*N, 0A, and *n-m*A patterns match against as many characters as possible. For example, the string ABC123DEF matched against the pattern 0X2-3N0X matches the pattern components as ABC, 123 and DEF.

The *template* string may contain alternative patterns separated by value marks. The source data will match the overall pattern if any of the pattern values match.

Examples

"A123BCD" would match successfully against patterns of
    1A3N3A
    1A1-3N3A
    'A'1-3N3A
    0A0N0A
    1A...3A
    1A~3A3A
    and many more

It is often acceptable to omit the quotes around literal components. The above example would also match
    A1-3N3A
There is no confusion between the leading A as a literal or as a character type as it is not preceded by a length value. It is, however, recommended that the quotes should be included. Omitting the quotes in a pattern used in the **MATCHFIELD()** function may affect the function's behaviour as each character of the literal will be counted as a separate component of the pattern.

A program might need to test whether data entered by a user is a non-negative integer (whole number) value. The QMBasic NUM() function can be used to test for numeric data but this would allow fractional or negative values. Testing against a pattern of "1-4N" would allow only integer values in the range 0 to 9999. To remove the upper limit, a pattern of 1N0N tests for one digit followed by any number of further digits, including none.

2.8 Printing

QM applications do not drive printing devices directly. Instead they reference numbered print units with no knowledge of where the output will actually go. This leads to a very flexible printing system where the output can be sent to a printer, a file or the user's screen. QM uses the underlying Print Manager on Windows or the operating system spooler on other platforms to perform output to printer devices.

Windows Mobile and Windows CE used on PDA devices have no built-in printer support. Third party software packages are required to print on these platforms. QM retains support for mode 3 print units as described below.

Each QM session has its own pool of print units, numbered from 0 to 255. In most cases, if a print unit is not specified in a command, printer 0, the default printer, is used. Application developers are free to use these print units in any way that meets their needs. They might correspond to different printers, different paper types on the one printer, selection of portrait or landscape mode, etc. Although it is unlikely, all 256 print units can be used simultaneously.

Within QMBasic programs printer 0 is treated as a special case. If the program has not used the **PRINTER ON** statement (or the **LPTR** qualifier to the **RUN** command), output to printer 0 is actually sent to the user's screen rather than the printer. This allows an application to use either the screen or the default printer simply by choosing whether to execute the **PRINTER ON** statement rather than having to implement two alternative paths for every place that performs output.

QMBasic programs can also reference print unit -1 as a synonym for the user's screen.

Pick Style Form Queues

As an aid to migration from other systems, QM provides limited support for Pick style form queues by use of the **SP.ASSIGN** command. Internally, QM needs to relate form queue numbers to the equivalent **SETPTR** options and this is managed by a mapping file, $FORMS, using the **SET.QUEUE** command.

For more information, see the **SP.ASSIGN** and **SET.QUEUE** command descriptions.

Setting Print Unit Characteristics

Unless otherwise defined, print unit 0 is directed to the system's default printer and all other print units are directed to the $HOLD file. Almost all applications will need to modify this default behaviour by using the **SETPTR** command. This may be executed from the MASTER.LOGIN paragraph in the QMSYS account (to affect all users), from the LOGIN paragraph of a specific account (to affect only users of that account), or from within the application.

The **SETPTR** command defines the shape of the printed page (width, depth, margins), the destination and various options relating to the treatment of the output.

A print unit can operate in several modes:

Mode 1 directs the output to the underlying operating system print processor, usually to send it to a physical printer.

Mode 3 formats the data ready for printing but directs it to a record in the $HOLD file from

where it may subsequently be viewed on the screen with a suitable editor or sent on to a printer when required. The hold file is most commonly used to defer printing until a process has completed, to gather diagnostic output, or for testing.

Mode 4 directs the output the the stdout (standard output) file unit.

Mode 5 buffers the data in the $HOLD file and then sends it to the terminal when the printer is closed, prefixing it with the control code to enable the terminal auxiliary port and disabling this port on completion of the print. This feature relies on the mc5 (aux on) and mc4 (aux off) terminfo items being set correctly.

Mode 6 combines the actions of modes 1 and 3, creating a file and also printing the data.

A print job commences when the first line of output is sent to the printer and normally terminates when the program closes the print unit either explicitly or implicitly by returning to the command processor. It is possible to merge output from several successive print programs into one job by use of the **PRINTER** command. The **KEEP.OPEN** option used before output commences followed by the **CLOSE** option after the final program completes treats the entire sequence as a single print job.

Printing on Windows

Windows defines two alternative printing interfaces. The graphical device interface (GDI) allows a Windows application to construct complex text and graphics images whereas the non-GDI mode (known in QM as raw mode) is a much simpler interface that permits only simple text output. QM uses the raw mode by default though, for compatibility with older releases, the GDI configuration parameter can be used to make GDI the default though QM does not provide any functions to generate GDI graphics.

Some options of the **SETPTR** command are applicable only to one or other of the two modes. Also, some options may not be supported by all Windows print drivers. In most cases, inapplicable options are simply ignored.

Printing on Other Platforms

QM normally uses the underlying lp command to print data on these platforms though this can be modified by use of the **SPOOLER** configuration parameter or the SPOOLER option of the **SETPTR** command. **SETPTR** options that are not applicable are ignored.

Printing to a File

The **SETPTR** command can be used to direct output to a record in the $HOLD file or to any specific pathname on the server system. Hold file entries have a default name of P*n* where *n* is the print unit number but this can be modified in **SETPTR** to use a different name and/or to add a rolling sequence number to the name.

Print Prefix Files

The PREFIX option of the **SETPTR** command can be used to specify the pathname of a file containing printer initialisation commands. The content of this file is sent to the printer before the first output from the application. A typical use of a prefix file might be to select a paper tray.

PCL Printer Support

The printing system of QM includes features for greater control of PCL printers. These include font selection, basic graphics and enhanced report formats. The PCL features are enabled by including the PCL option in the **SETPTR** command when defining the printer characteristics.

By default, a PCL printer will print in Courier font at 10 characters per inch and 6 lines per inch. The **SETPTR** command includes options to specify alternative values for the character and line spacing. The paper size defaults to A4 but can also be amended using **SETPTR**. The LANDSCAPE option will rotate the page through 90 degrees.

The query processor also has special support for PCL printers in report generation commands (e.g. **LIST**). Page headings, footings and breakpoint values are printed in bold face. The **BOXED** option draws a box around the page and separates the heading and footing from the text with horizontal lines.

Graphical Overlays

The OVERLAY option of the **SETPTR** command can be used to specify the name of a catalogued subroutine that will be called at the start of each page of output and can be used to emit printer specific control codes to draw a graphical overlay on the page. The **OVERLAY** option of the query processor reporting commands performs the same action but applies only to the report in which it is used.

In either usage, the catalogued subroutine takes a single argument which is the print unit number. Any control strings output by this subroutine should be emitted using the **PRINT** statement, normally with the trailing carriage return/line feed suppressed. For PCL printers, it is recommended that the standard QMBasic PCL control string functions should be used.

Example

```
subroutine overlay(pu)
$catalog overlay
$include pcl.h

   s = pcl.save.csr()                 ;* Save cursor position
   s := pcl.box(0,0,2320,3300,2,10) ;* Draw box
   s := pcl.restore.csr()             ;* Restore cursor position
   s := pcl.left.margin(1)            ;* Left margin column 1
   print on pu s :
   return
end
```

The above subroutine draws a box around an A4 sized page on a PCL printer. Note how it saves the cursor position to ensure that subsequent application output appears at the correct place.

Because the subroutine is called before any other output to the page, it is possible for the subroutine to make other changes to the page settings. Note in the above example how the left margin is indented to bring the application output away from the left edge of the box.

Commands Relating to Printing

CLEAN.ACCOUNT	Clears $HOLD and other system temporary files.
PRINTER	Various printer control operations
SETPTR	Display or set print unit characteristics
SPOOL	Sends record(s) to the printer

Query Processor Keywords Relating to Printing

FOOTING	Set page footing
HEADING	Set page heading
LPTR	Direct output to a printer (applies to many commands)

QMBasic Statements and Functions Relating to Printing

FOOTING	Set page footing
HEADING	Set page heading
GETPU()	Retrieve print unit characteristics
PAGE	Force a new page
PRINT	Emit data to a print unit
PRINTER CLOSE	Close a print unit
PRINTER OFF	Direct print unit 0 to the screen
PRINTER ON	Direct print unit 0 to the printer
PRINTER RESET	Resets the default print unit
PRINTER DISPLAY	Direct printer output to the screen
PRINTER FILE	Direct printer output to a file
PRINTER NAME	Direct printer output to a named printer
SETPU	Set print unit characteristics

2.9 User Management and System Security

This section applies to Windows users only.

Because QM runs on all multi-tasking Windows environments, some of which do not feature particularly good security systems, QM supports two methods of user authentication.

On Windows 98/ME, QM supplies its own user name and password checking for network users. This can be disabled if required so that no user name or password is requested on connecting to the system.

On later versions of Windows, QM uses the Windows security system. This cannot be disabled and a valid user name and password must be supplied for all network connections. Many of the user name management commands described here are still relevant as they handle the QM aspects of user control.

User name management is handled by four commands, available from all accounts but restricted to users with administrator rights. QMConsole users and users logging in with user names that are defined as administrators at the operating system level always have administrator rights. Other users can be registered as QM administrators using the commands described below.

The user name management commands are:

ADMIN.USER	User name administration tool
CREATE.USER	Creates a new user name
DELETE.USER	Deletes a user name
LIST.USERS	Lists all defined user names

In addition, Windows 98/ME users can change their passwords using the **PASSWORD** command. This command can be used by users with administrator rights to change other users' passwords.

By default on Windows 98/ME, all network connections to a QM system require a username and password to be supplied. This security system can be disabled by the System Administrator if a simpler but less secure system is desired. This is achieved using the **SECURITY** command in the QMSYS account:

SECURITY ON	to enable security checks
SECURITY OFF	to disable security checks
SECURITY	to display the current setting

This command can only be executed from a QMConsole session. If security checking is enabled, the **SECURITY** command can only be used by a user with administrator rights. If disabled, all QMConsole users have access to this command.

Part 3

The QM File System

3 The QM File System

File Types

The files used by QM are of two types; directory files and dynamic files. Directory files do not give high performance but allow data to be viewed from outside of the QM environment. They are therefore frequently used for data interchange with other software. Dynamic files offer very high performance and are typically used for the bulk of the data stored by an application.

Facilities are provided to create data files, enter, modify and retrieve data, produce reports and, where the data processing operation required cannot be achieved using the standard commands, to construct powerful programs with the minimum of effort.

Most files consist of two parts; a data part holding the actual data and a dictionary part holding a description of the structure of data records. Files do not have to have both parts. Files with no dictionary portion are fairly common. Dictionaries with no data part usually exist only to provide a single dictionary common to the data portion of many files.

For compatibility with other multivalue database products, QM also supports multifiles. These are a collection of data files that share a common dictionary where the component files are referenced by a two part name consisting of a file name and a subfile name separated by a comma. See the **CREATE.FILE** command for further details.

Files contain data stored as records which are the basic unit of file access. Records are identified by unique keys which may be any sequence of up to 63 characters. This limit can be increased by the system administrator.

Special Filename Syntaxes

Normally, QM commands that reference files use a file name that corresponds to an F or Q-type VOC entry which, in turn, references the actual operating system file to be accessed. There are three special extended syntaxes for filenames that allow access to files without needing a VOC entry. Use of these is controlled by the FILERULE configuration option. Users should consider any impact of the security of their system before enabling these.

The three extended syntaxes are:

Implicit Q-pointer	*account:file*
Implicit QMNet pointer	*server:account:file*
Pathname	PATH:*pathname*

Note that in the final form, depending on context, Windows users may need to use forward slash characters (/) as directory delimiters because the backslash (\) is reserved as a string quote. Alternatively, the entire "PATH:*pathname*" construct can be quoted.

These special syntaxes cannot be used with a multifile component name.

For details of file processing from QMBasic programs, see File Processing.

3.1 Creating and Deleting Files

As a general rule, files that may be accessed from the operating system level must be directory files and all other files should be dynamic files. Dynamic files give best performance but records cannot be accessed from outside of QM.

QMBasic source programs are normally stored in directory files. Dictionaries are automatically created as dynamic files regardless of the type of the associated data file as a directory file dictionary could cause severe performance degradation in query processor commands.

Files are created using the **CREATE.FILE** command which normally creates both a data and dictionary portion for the file. Either may be created individually by use of the **DATA** or **DICT** keywords. Dictionary portions are not required for files used to hold QMBasic source programs or include records.

The **CREATE.FILE** command creates the file and also writes an F-type record to the VOC. If the file is to be accessed from more than one account, this F-type record may be duplicated in the other accounts, changing the pathnames in fields 2 and 3 to include the drive and directory components as necessary. A better method is to use Q-type VOC entries for remote file pointers.

The data portion of a file is created at the specified or default minimum modulus size and with no records. The dictionary portion has a single record, **@ID**, added to it to represent the record key.

Files may be deleted using the **DELETE.FILE** command. The **DATA** or **DICT** keywords allow deletion of just the appropriate portion of the file.

Where the file's pathname in the VOC includes drive or directory components, the **DELETE.FILE** command assumes the file to be in some other account and prompts for confirmation that it should be deleted. If the file is to be retained but the reference to it from the current account is to be deleted, use the **DELETE** command to delete the VOC record.

Rules and Restrictions

The QM file system uses the underlying operating system file structures to store its data. This imposes some rules on how the operating system level files should be managed.

On Windows XP systems, use of mapped drives can assign different physical locations to the same drive letter for different users. This will cause serious problems to QM as it is impossible to identify a file uniquely. In particular, the locking system is likely to become unreliable.

All QM users should use the same mappings. For users entering QM via a network connection, including connections looped back to the same machine, the DOS SUBST command may need to be used to create the drive mapping. This can be included in the LOGIN or MASTER.LOGIN paragraphs in the form

```
SH SUBST X: C:\ABC
```

where X: is the mapped drive letter and C:\ABC is the target directory to which X: is to be mapped.

Similarly, use of chroot on non-Windows systems destroys the uniqueness of file names. Although

this may work in some cases, it can lead to ambiguities that will cause QM to fail in unpredictable ways. Use of this command is at the user's own risk.

Systems other than Windows allow a file to be renamed or deleted while it is in use. This action is likely to cause QM to fail and should not be used.

3.2 Directory Files

A **directory file** is represented by an operating system directory and the records within it by operating system files. The record key is the name of the operating system file holding the data for the record except where this would be an invalid name in which case QM performs automatic name mapping as described below.

Directory files do not give high performance because the process of searching a directory for a file is, with many operating systems, essentially a linear scan. Locating a record to be read would, therefore, require on average that half of the entries in the directory are examined. Writing a new record would require the entire directory to be processed to verify that the file does not already exist.

Directory files are mainly used for data that is to be processed from outside of QM or for very large records (hundreds of kilobytes) where the operating system file structures may give better performance than the hashed file system. Typical uses include storage of QMBasic programs, COMO (command output) files, and saved select lists.

When a record is written to a directory file, any field mark characters are converted to the operating system dependent representation of a newline. Thus, each field becomes a line of text which allows the data to be processed by external software that does not understand the concept of field marks. Conversely, when data is read from a directory file, the newlines are translated to field marks. Where the data contains value marks or subvalue marks, these are not translated as it is assumed that whatever software will process this data must understand multivalued data.

One common use of directory files is to store scanned documents, digital photographs, etc. In this case, the data is not text divided into fields using the field mark character but is simple binary data that may contain any sequence of bytes. The data will nearly always contain bytes that appear to be field marks and other bytes that are the ASCII linefeed character. On writing the data to disk, the field marks will be converted to newlines. On reading the record back again, all of the newlines get converted to field marks such that the record does not match the original data written. This is clearly unacceptable. Application developers using director files to store binary data must suppress the translation of field marks by use of the QMBasic **MARK.MAPPING** statement.

Where a record id contains characters that are not valid in operating system file names, QM automatically replaces them with an alternative representation. This is totally invisible from inside QM but other software that accesses directory file records must allow for these translations. Rather than have a different set of translations for each platform, QM adopts a single set based on the most restrictive platform (Windows) so that data may be moved between environments without modification of record names. The translations performed are:

*	%A	"	%Q
\	%B	/	%S
,	%C	+	%V
=	%E	:	%X
>	%G	;	%Y
<	%L	?	%Z
%	%P		

Depending on the operating system in use, record ids in directory files may be case insensitive.

Note also that the Windows file system does not allow file names that clash with Windows device names such as COM.

When writing a record to a directory file, QM normally opens the operating system file that will represent this record and writes to it, overwriting any existing data. There is a possibility of data loss when updating an existing record if the system fails during this write (e.g. a power outage) or if there is insufficient disk space. To prevent this, the SAFEDIR configuration parameter can be set to adopt a "safe update" technique where the data is written to a temporary file, the original is deleted and the temporary item is renamed to replace the original. This removes nearly all possibility of losing the record but degrades performance of the write.

Records in directory files may be read, written or deleted by applications in exactly the same way as records in hashed files. The QMBasic programming language provides some additional operations for directory file access. A record may be opened using the **OPENSEQ** statement and then processed on a line by line basis (**READSEQ**, **WRITESEQ**, etc) or as a simple binary item (**READBLK**, **WRITEBLK**, etc). In addition, programming statements are provided to simplify processing of comma separated variable format data (**READCSV**, **WRITECSV**).

3.3 Dynamic Files

A **dynamic file** is represented by an operating system directory, the records within it stored in a fast access file format in the directory. Users should not place any other files in the directory or make any modifications to the files placed there by QM. Dynamic files are so called because of the dynamic reconfiguration of the file which takes place automatically to compensate for changes in the file's size and record distribution.

Record keys may have between 1 and 63 characters but these may not include mark characters or the ASCII null character. This length limit can be increased to a maximum of 255 by changing the value of the MAXIDLEN configuration parameter but this can lead to compatibility problems when transferring data to other systems and significantly increases the size of QM's internal locking tables.

A dynamic file has two parts; a **primary subfile** which is examined first when looking for data and an **overflow subfile** which contains data which does not fit into its correct location in the primary subfile. Users do not need to understand the mechanisms that are involved in accessing dynamic files though the following information will help in determining settings for the parameters which control file configuration and hence performance. In most cases these can be left at their default values.

Data within a dynamic file is stored in record **groups**. The number of groups in the files is known as the **modulus**. The group in which a record is located is determined mathematically by using the **hashing algorithm** associated with the file.

A group consists of a fixed sized area in the primary subfile and, if the data assigned to the group does not all fit into this area, as many additional overflow subfile blocks as are needed will be created. A dynamic file performs best when the data is distributed evenly across each group and no group extends into the overflow area. In reality, this is almost impossible to achieve whilst still keeping each group reasonably full. A well tuned dynamic file typically has less than 20 percent of its data in overflow.

The **group size** parameter determines the size of the primary subfile groups as a multiple of 1024 bytes. This parameter may have a value in the range 1 to 8 and defaults to 1 though this default can be changed using the GRPSIZE configuration parameter. It should be set to a multiple of the disk block size if this value is known. As a general rule, use values of 1, 2, 4 or 8.

Where a file contains very large records, performance can be improved by placing these in disk blocks of their own with just the record key and a reference to their location stored in the primary subfile. Such records are known as **large records** and the size above which data is handled in this way is configurable. The default value of 80% of the group size is good for most purposes. Because a large record has only its key stored in the primary subfile, a **SELECT** operation will be faster if the group is mainly large records but reading the record's data will require at least two disk accesses. Also, since large records are held in their own disk block(s) rather than sharing with other records, surplus space at the end of the final block is wasted resulting in higher disk space usage. If the file will be used frequently in **SELECT** operations where selection is based only on the record id, a lower large record size may be beneficial. If data records are frequently read from the file, a higher large record size may help. In general it is best only to change the large record size if performance problems are seen.

The number of groups in a dynamic file changes with time. QM uses two parameters to determine when the number of groups should change. At any time, the file's **load value** is the total size of the data records (excluding large records) as a percentage of the primary subfile size. This value

changes as records are added, modified or deleted. It may have a value in excess of 100%, indicating that there is very high usage of overflow space. The **split load** value (default 80%) determines the load percentage at which an additional group will be added to the file by splitting the records in one group into two. The **merge load** value (default 50%) determines the point at which two groups are merged back into one. A split may result in the load falling below the merge load or, conversely, a merge may result in a new load value above the split load. In neither case will the file be immediately reconfigured back again.

The split and merge loads determine the way in which the file's modulus and hence actual load vary. A low load results in reduced overflow at the expense of increased disk space. Conversely, a high load increases overflow but reduces disk usage. High overflow in turn results in poor performance as more disk blocks must be read to find a record. The split load value determines the load at which a group will be split into two, the merge load determines the load at which groups will be merged. The difference between the two values needs to be reasonably large to avoid continual splitting and merging of groups.

The **minimum modulus** value determines the size below which the file will not merge groups. The default setting of this parameter is one, resulting in full dynamic reconfiguration. If the file is subject to frequent addition or deletion of large numbers of records so that its modulus varies widely, it may be worth setting the minimum modulus to a typical average size or higher, however, a file with a higher modulus than is necessary is relatively slow in **SELECT** operations that must read the entire file. The minimum modulus parameter can also be used to pre-allocate primary subfile disk space when creating a new file, minimising fragmentation.

Record ids in dynamic files are normally case sensitive. Case insensitive ids can be selected when the file is created or a file can be converted at a later date using the **CONFIGURE.FILE** command.

The total size of a dynamic file is limited to 2Gb for file versions 0 and 1, and 2147483647 groups (up to 16384Gb) for version 2 upwards.

Disabling File Resizing

Although dynamic files are very reliable, the split/merge mechanism that maintains optimum file performance introduces the possibility of file corruption in the event of a power failure or other situation that causes outstanding write operations not to be completed. QM offers a mode of operation that forms a hybrid between the dynamic file system and the static files found in many other database products.

The NO.RESIZE option of the **CONFIGURE.FILE** command can be used to disable splits and merges, locking the file at its configuration when the command is issued. As new data is added, the file will extend into overflow, reducing performance. Conversely, if large volumes of data are deleted, the groups will become less tightly packed, again resulting in reduced performance. Files can be created with this mode set by use of the NO.RESIZE option to the **CREATE.FILE** command.

The file can be reconfigured using the IMMEDIATE mode of the **CONFIGURE.FILE** command. This performs the outstanding splits or merges, bringing the file back to the configuration that it would have had if resizing had not been disabled. For typical file update patterns and reasonably frequent use, this should be considerably faster than the equivalent resizing of a static file system.

One scenario for use of this mechanism would be to operate the file(s) with resizing disabled during normal day time activity, perform backups at the start of an overnight downtime period and then

use **CONFIGURE.FILE** to reconfigure the files ready for the next day. In the unlikely event of a system failure during the reconfiguration process, the backup provides an up to date copy of the data. This resizing operation is fully interruptable and can be performed while the file is in use.

3.4 QMNet Network File Access

QMNet uses the QMClient interface to provide an extension to the QM file system allowing network access to files on another QM system. Unlike use of NFS or mapped network drives, QMNet provides locking of remote records, ensuring that data integrity can be maintained on distributed data.

Two steps are necessary to use QMNet. Firstly, the server must be defined, mapping the server name to a network address, user name and password. Secondly, the remote file must be defined using a Q-type VOC record.

Defining the Server

The remote server is defined using the **SET.SERVER** command. This can only be executed by users with administrative rights in the QMSYS account.

The command is

SET.SERVER *name address user.name password*

where

name	is the name to be given to the server. This must consist of letters, numbers, periods and hyphens only and will be mapped to uppercase internally.
address	is the IP address or server name of the remote server. If the remote server uses a non-standard port number for QMClient access, the port number should be included, separated from the IP address by a colon (e.g. 193.118.13.48:4229).
user.name	is the login name to be used on the remote system.
password	is the password for the specified user.

The remote server must have remote access enabled by setting the NETFILES configuration parameter to 2.

Defining the Remote File

Each remote file is defined by an extended form of the Q-type VOC entry where field 4 contains the name of the server.

Once the file has been defined, it may be accessed by programs in the same way as a local file. The following restrictions apply to access from QMBasic programs:

- The **OPENSEQ** statement and related sequential file access operations are not supported.
- Access to remote files inside transactions will be non-transactional.
- The **FILEINFO()** function will return the file type as FL$TYPE.NET (6). Some modes of **FILEINFO()** are not supported.
- A maximum of 10 servers may be accessed at one time by any one QM process. There is

no practical limit to the number of files that may be open on each server.

Listing Server Definitions

A list of all defined QMNet servers can be displayed using the **LIST.SERVERS** command. This can only be executed by users with administrative rights in the QMSYS account.

The command is

LIST.SERVERS

Deleting a Server Definition

The definition for a remote server may be deleted using the **DELETE.SERVER** command. This can only be executed by users with administrative rights in the QMSYS account.

The command is

DELETE.SERVER *name*

where

name is the name of the server.

3.5 The Virtual File System

The Virtual File System (VFS) allows application designers to provide access to data that appears to an application as a file but may actually be something quite different. Possible uses of the VFS include:

- Providing access to data in other database environments.
- Accessing data transparently over a network where QMNet is not appropriate.
- Implementing an alternative encryption layer on top of standard QM files.

The VFS Handler Class Module

A VFS handler is a globally catalogued QMBasic class module that intercepts all attempts to access the file. It processes requests, storing or retrieving data as appropriate.

A template class module named VFS.CLS is provided in the BP file of the QMSYS account. This includes a brief description of each of its component functions and subroutines.

Creating a Virtual File System

There are two steps; creating the VFS handler and creating the VOC entries.

Like all files, a VFS file is identified by an F-type VOC item. It is possible for only some parts of a file to be VFS items. Thus a file might have a VFS data part but a normal dictionary part. The components of a multifile can be a mix of VFS and normal items.

A VFS item is identified by the pathname in the F-type VOC entry being specified as "`VFS:`*`handler`*" where *handler* is the name of the globally catalogued VFS handler class module. There is an optional third component to this syntax which will be passed to the handler on opening the VFS item. The full syntax of the VOC item is thus

```
VFS:handler:string
```

This third component could be used, for example, when a single *handler* class module is used to access many files. The *string* might be the pathname or other reference to the actual file to be opened by the handler.

Partial Select Lists

The QM file system optimises select list generation by arranging that the QMBasic **SELECT** statement (not the query processor equivalent) used against a hashed file actually performs the select group by group as the **READNEXT** statement is used to walk through the list. Anything that requires the list to be completed (e.g. using **SELECTINFO()** to determine the number of items in the list) will cause the remainder of the list to constructed immediately.

A VFS handler can work in much the same way. The V$SELECT function can return the entire list or just the initial part of the list. When a program processing this list reaches the end of the list returned by V$SELECT, the V$CONTINUE.SELECT function is called to return the next part of the list. The V$COMPLETE.SELECT function will be called if the remainder of the list should be returned as a single item and the V$END.SELECT subroutine is called to terminate generation of a partial list.

VFS handlers that do not use partial list construction can omit the V$CONTINUE.SELECT, V$COMPLETE.SELECT and V$END.SELECT entry points.

Alternate Key Indices

The Virtual File System does not support alternate key indices at this release. The **INDICES()**, **SELECTINDEX**, **SELECTLEFT**, **SELECTRIGHT**, **SETLEFT** and **SETRIGHT** operations are not valid with a VFS item.

3.6 Database Records and Mark Characters

A database record may have any number of fields (table columns). The entire record and the constituent fields are of variable length, there being no restriction applied by QM. A record may exist in the database with no data or with many megabytes of data.

The record stored on disk or manipulated in memory may be divided into fields by **field mark** characters. A field may be divided into values by use of **value mark** characters and values may be further divided by use of **subvalue mark** characters.

Two additional mark characters are defined. The **text mark** is typically used to mark points in text data where newlines should be inserted. This mark character is often inserted by programs manipulating data in memory rather than being stored in the database. The **item mark** is defined mainly for compatibility with other database systems. Its only reserved use within QM is to separate items in the DATA queue.

The internal representation of the mark characters uses the last five characters of the ASCII character set:

Item mark	char(255)
Field mark	char(254)
Value mark	char(253)
Subvalue mark	char(252)
Text mark	char(251)

The memory representation of a record containing mark characters for use in QMBasic programs is known as a **dynamic array** and there are many specialised program operations for working on this data.

Fields, values within a field and subvalues within a value are numbered from one upwards. By convention the record key is sometimes referred to as field zero though it is not part of the dynamic array and references to field zero are only recognised by QM in certain contexts.

Database records are often entered, modified or retrieved by the **ED**, **SED** and **MODIFY** commands.

In directory files, the internal field mark character is replaced by the ASCII newline character when a record is written to disk so that fields appear as lines if the record is viewed, edited or printed from outside QM. Conversely, ASCII newlines are converted to field marks on reading a record. Mechanisms are provided in QMBasic (see the **MARK.MAPPING** statement) to turn off this translation when handling binary data.

3.7 Dictionaries

Every data file normally has an associated dictionary which describes the structure of the data records in the file. The dictionary is normally only used by the query processor and a few other commands. Application developers may find it useful to construct data structure definitions from the dictionary for use in programs using the **GENERATE** command.

It is possible to create a file that has no dictionary or for multiple files to share a common dictionary.

A dictionary contains the following types of record, identified by the leading characters of field 1.

A Pick style data definitions. An A-type record describes data that is held in a field of the record or calculated from that data.

C Calculated values. Similar in concept to an I-type, a C-type is a program that returns a calculated value via the @ANS variable. C-types are provided for compatibility with other environments and I-types should be used by preference.

D Direct data types. A D-type record describes data that is held in a field of the record.

I Indirect data types. An I-type record describes data that can be evaluated from data in fields of the record, perhaps with reference to other records or other files. It is essentially a small program that returns a value.

L Links to other files. Used only in query processor commands.

PH Phrases for use in query processor commands.

S Pick style data definitions. An S-type record describes data that is held in a field of the record or calculated from that data. S-type records are identical to A-type records in QM.

X Other miscellaneous data.

The names given to A, D, I and S-type dictionary records are the names used in queries to reference the field. Every field to be used in query processor sentences must have a corresponding dictionary record. There may be multiple dictionary references to a single field thus allowing synonyms for query processor commands, perhaps with different default display characteristics.

Dictionary A and S-type records

A and S-type dictionary items are an alternative to the preferred D and I-type items that describe data stored in database files. QM provides a limited subset of the full A and S-type functionality found in other multivalue database environments. There is no difference between A and S-type records within QM.

An A or S-type record has up to 11 fields:

1: Type (A or S) plus optional description

2: Location of this field (field number)

3: { Display name to be used by **LIST** or **SORT** when displaying this field. The text can commence with 'R' (including the quotes) to right justify the heading, 'X' to suppress the normal dot filler characters, or 'RX' to apply both modifications. }

4: { Association }

5: Not used

6: Not used

7: { Conversion code for entry and display of this field }

8: Correlative code.

9: Display justification

10: Display width

11: Available for user use. Not referenced by QM.

12+Reserved for internal use

Field 2 of an A or S-type record holds the field number of the data record to which this dictionary entry relates. This must be a positive integer value. A value of zero may be used to refer to the record id. For compatibility with other multivalue database products a value of 9998 or 9999 will be recognised by the query processor as references to the item number within the query and the length of the record respectively. Both of these special cases are better implemented using I-type records. Where field 8 contains an A or F correlative, the value in field 2 is not used.

Field 4 defines the relationship between associated multivalued fields. Within an association, one field is considered to be the controlling item and the remainder are considered as dependant. The controlling field has **C;***p***;***q***;***r* in field 4 where *p*, *q*, *r* (etc) are the field numbers of the associated items. The dependant fields all have **D;***n* in field 4 where n is the field number of the controlling field. Internally, Internally, QM converts Pick style association definitions into an association name __*n*.

Field 7 contains an optional conversion code to be applied immediately before the data is displayed in a query processor report. QM does not support use of A or F-correlative expressions in this field.

Field 8 contains an optional expression to be evaluated to calculate the value of the item. This may be an A or F correlative or a conversion code to be applied to the field identified in field 2 of the dictionary record. Conversion codes appearing in field 8 are applied immediately to the data extracted from the record and hence affect sorting and selection.

Field 9 contains the justification code L, R, T or U that determines the alignment of data in a query

processor report.

Field 10 contains the field width to be used in a query processor report.

Important note: In Pick systems, correlatives are processed in an interpretive manner. QM compiles A and S-type dictionary items in a similar way to I-types. This results in better performance but, if one dictionary item uses the value of another, it will be necessary to compile both if changes are made. The **COMPILE.DICT** command with no record ids will compile all A, C, I and S-type items in the specified dictionary.

QM does not support the LPV (load previous value) data item found on Pick systems as it is dependant on the exact sequence in which the query processor evaluates expressions. The query optimiser of QM may cause this to behave in an unexpected manner. It is always possible to restructure dictionary items that used LPV to work without it.

Correlatives

A correlative is an expression in an A or S-type dictionary item that derives a value from data in a database record. Although similar in concept to the preferred I-type dictionary items, correlatives are less powerful and more difficult to maintain. They are provided in QM to aid migration of applications from other multivalue environments. New developments should use I-type items instead and it is recommended that correlatives should be converted to I-types as part of the migration process.

There are two styles of correlative:

- A-correlatives are algebraic expressions and are relatively easy to understand.
- F-correlatives are written in reverse Polish notation which makes them difficult for less experienced developers to understand.

On other multivalue databases, correlatives are processed interpretively and A-correlatives are translated into their equivalent F-correlative format at the start of a query for improved performance. On QM, correlatives are compiled in much the same way as I-type expressions so the potential minor performance advantage of writing an F-correlative directly is lost. The query processor will compile correlatives automatically when they are first used. The **COMPILE.DICT** (**CD**) command can be used to force a compilation.

A-Correlatives

An A-correlative is an algebraic expression that applies operators to fields, constants and other data to produce a result. It is similar in concept to an I-type expression but very limited and often difficult to maintain.

The expression is prefixed by A and an optional semicolon.

Data items

n A field number. This field is extracted from the current record

N(*name***)** A field name. This name is looked up in the dictionary when the correlative is compiled and run time code generated to extract the field from the current record.

"*string***"** A constant. All constants, including numeric values, must be enclosed in single quotes, double quotes or backslashes.

Any of the above three data item types may be followed by **R** to indicate that the **REUSE()** function is to be applied to the data.

D The internal date. This is the actual date at the point when the function is executed, not a reference to the @DATE variable (which does not change during a command).

T The internal time. This is the actual time at the point when the function is executed, not a reference to the @TIME variable (which does not change during a command).

@NB The breakpoint level.

@ND The detail line counter.

@NI The item counter.

@NS The subvalue counter.

@NV The value counter.

Functions and Operators

+ Adds operands

- Subtracts operands

* Multiplies operands

/ Divides operands. Note that this is an integer division.

= Relational equality test.

or <> Relational inequality test.

> Relational greater than test.

< Relational less than test.

>= Relational greater than or equal to test.

<= Relational less than or equal to test.

p[*q*,*r*] Returns a substring of *p* starting at character *q*, *r* characters long.

R(*p*,*q*) Returns the remainder from dividing *p* by *q*.

S(*p*) Returns the sum of all the values in multivalued item *p*.

IF *p* **THEN** *q* **ELSE** *r*
Returns *q* if *p* is true, *r* if *p* is false.

(*conv*) Applies the given conversion code to the expression value. Note that *conv* is not quoted.

AND Logical AND

OR Logical OR.

Examples

```
A;3*2
```
Multiplies the content of field 3 by the content of field 2.

```
A;(N(PRICE)+N(TAX))(MD2)
```
Adds the PRICE and TAX fields. The result is then converted using an MD2 conversion code.

```
A;N(PRICE)*"1175"/"1000"
```
Adds 17.5% tax to the single valued PRICE field. Note the need to perform the calculation in two steps because correlatives use integer arithmetic.

```
A;N(PRICE)*"1175"R/"1000"R
```
Adds 17.5% tax to each value in the multivalued PRICE field. Note the use of the R qualifier on both constants in this expression.

```
A;DESCRIPTION["1","20"]
```
Extracts the first 20 characters of the DESCRIPTION field.

```
A;IF N(QTY)<"10" THEN "Re-order" ELSE ""
```
Returns "Re-order" if the QTY field is less than 10, otherwise returns a null string.

F-Correlatives

On systems that process correlatives interpretively, A-correlatives are converted to the more efficient F-correlative format at the start of a query that uses them. F-correlatives use "reverse Polish" notation which, whilst actually very simple, is difficult for inexperienced developers to maintain.

QM compiles both A and F-correlatives to its own internal instruction set and, therefore, the potential advantage of writing these more complex expressions on other systems is irrelevant.

Reverse Polish notation defines data and operations to be performed on it as a series of steps that manipulate an internal stack. Each step is separated by a semicolon. As an example, consider a simple A-correlative expression such as

A;1*"11"/"10"

that adds 10% to the value in field 1. As an F-correlative expression this becomes

F;1;"11";*;"10";/

where the steps are

1	Push the value of field 1 onto the stack
"11"	Push the constant "11" onto the stack
*	Multiply the top two items on the stack, replacing them with the result
"10"	Push the constant "10" onto the stack
/	Divide the top two items on the stack, replacing them with the result

Data items

n A field number. This field is extracted from the current record

"*string*" A constant. All constants of this style, including numeric values, must be enclosed in single quotes, double quotes or backslashes.

C*number* An integer constant.

Any of the above three data item types may be followed by **R** to indicate that the **REUSE()** function is to be applied to the data. The field number form can be followed by a conversion code in brackets. If used with **R**, the sequence is *n***R**(*conv*).

D The internal date. This is the actual date at the point when the function is executed, not a reference to the @DATE variable (which does not change during a command).

T The internal time. This is the actual time at the point when the function is executed, not a reference to the @TIME variable (which does not change during a command).

@NB The breakpoint level.

@ND The detail line counter.

@NI The item counter.

@NS The subvalue counter.

@NV The value counter.

Functions and Operators

+ Adds the top two items on the stack, replacing then with the result

- Subtracts the top item on the stack from the next item, replacing them with the result.

* Multiplies the top two items on the stack, replacing then with the result

- Divides the second item on the stack by the top item, replacing them with the result. Note that this is an integer division.

: Concatenates the top stack item on to the end of the second stack item, replacing then with the result

= Replaces the top two items on the stack by 1 if they are equal, 0 if they are unequal.

\# Replaces the top two items on the stack by 1 if they are unequal, 0 if they are equal.

> Replaces the top two items on the stack by 1 if the top item is greater than the second item, otherwise 0.

< Replaces the top two items on the stack by 1 if the top item is less than the second item, otherwise 0.

] Replaces the top two items on the stack by 1 if the top item is greater than or equal to the second item, otherwise 0.

[Replaces the top two items on the stack by 1 if the top item is less than or equal to the second item, otherwise 0.

[ ] Replaces the top three stack items with a substring of third stack item, starting at the character position given by the second stack item, with a length determined by the top stack item.

P Duplicates the top stack item.

R Replaces the top two stack items with the remainder from dividing the second item by the top item.

S Replaces the top stack item by the sum of all the values in multivalued item at the top of the stack.

_ Exchanges the top two items on the stack.

^ Deletes the top item from the stack.

(*conv*) Replaces the top item on the stack with the result of applying the given conversion code to the current top stack item. Note that *conv* is not quoted.

& Replaces the top two items of the stack with the result of a logical AND between their values.

! Replaces the top two items of the stack with the result of a logical OR between their values.

Examples

`F;3;2;*`
Multiplies the content of field 3 by the content of field 2.

`F;3;7;+;(MD2)`
Adds the field 3 and field 7. The result is then converted using an MD2 conversion code.

`F;3;"1175";*;"1000";/`
Adds 17.5% tax to the price in field 3. Note the need to perform the calculation in two steps because correlatives use integer arithmetic.

`F;3;"1175"R;*;"1000"R;/`
Adds 17.5% tax to each value in the multivalued price in field 3. Note the use of the R qualifier on both constants in this expression.

`F;1;"1";"20";[]`
Extracts the first 20 characters of field 1.

Dictionary C-type records

A C-type record defines a calculated value and has up to 8 fields:

1: C { descriptive text }

2: QMBasic program, multivalued.

3: { Conversion code }

4: { Display name. This will be used as the default column heading by the query processor. A special value of a backslash character can be used to specify that no heading is to be displayed. The text can commence with 'R' (including the quotes) to right justify the heading, 'X' to suppress the normal dot filler characters, or 'RX' to apply both modifications.}

5: Format specification

6: Single/multi-value flag. Set as S if the field is always single valued or M if it can be multi-valued.

7: { Association name. Where a multi-valued field has a value by value relationship with some other multi-valued field defined in the same dictionary, this name links the fields together. See Associations for more details. }

8: {Available for user use in any way. Not referenced by QM.}

Fields 9 onwards are reserved for internal use and users should not assume anything about their content.

A C-type dictionary item is a QMBasic program written with each line of the program as a separate value in field 2. The **EV** (edit values) command of **ED** may help in editing this field. The Dive function of **SED** provides similar functionality.

The program must return a result via the @ANS variable. This variable is initially zero on entry to QM, is automatically updated to contain the result of I-type expressions and should be updated by C-types. Although it is possible to use @ANS to pass a value from evaluation of one C or I-type item to the next, this is not recommended as the sequence of execution may be indeterminate.

The program can reference data defined by other items in the same dictionary using the **{***name***}** construct where *name* is a C-type, D-type or I-type item.

C-type programs may not use the following QMBasic components:

$CATALOGUE
$DEBUG
$QMCALL
CLASS
DEBUG
FUNCTION
PROGRAM
SUBROUTINE

Dictionary D-type records

A D-type record defines a field stored in a data file and has up to 8 fields:

1: D { descriptive text }

2: Field number. This is the position in the data record at which the field described by this dictionary entry can be found. A value of zero denotes the record id.

For compatibility with other multivalue database products a value of 9998 or 9999 will be recognised by the query processor as references to the item number within the query and the length of the record respectively. Both of these special cases are better implemented using I-type records.

3: { Conversion code }

4: { Display name. This will be used as the default column heading by the query processor. A special value of a backslash character can be used to specify that no heading is to be displayed. The text can commence with 'R' (including the quotes) to right justify the heading, 'X' to suppress the normal dot filler characters, or 'RX' to apply both modifications.}

5: Format specification

6: Single/multi-value flag. Set as S if the field is always single valued or M if it can be multi-valued.

7: { Association name. Where a multi-valued field has a value by value relationship with some other multi-valued field defined in the same dictionary, this name links the fields together. See Associations for more details. }

8: {Available for user use in any way. Not referenced by QM.}

Fields 9 onwards are reserved for internal use and users should not assume anything about their content.

Dictionary I-type records

An I-type record defines calculated data and has up to 8 fields:

1: I { descriptive text }

2: Expression

3: { Conversion code }

4: { Display name. This will be used as the default column heading by the query processor. A special value of a backslash character can be used to specify that no heading is to be displayed. The text can commence with 'R' (including the quotes) to right justify the heading, 'X' to suppress the normal dot filler characters, or 'RX' to apply both modifications.}

5: Format specification

6: Single/multi-value flag. Set as S if the field is always single valued or M if it can be multi-valued.

7: { Association name. Where a multi-valued field has a value by value relationship with some other multi-valued field defined in the same dictionary, this name links the fields together. See Associations for more details.}

8: {Available for user use in any way. Not referenced by QM. }

Fields 9 onwards are reserved for internal use and users should not assume anything about their content.

To simplify editing of compound I-type expressions, the "edit values" mode of both the **ED** and **SED** editors can be used to break the expression such that each element appears on a separate line.

Dictionary L-type records

An L-type record represents a link to another file. It can be used in query processor commands to reference fields in a dependent file without the need to create an I-type **TRANS()** expression for each field.

1: L { descriptive text }

2: Id expression

3: File name

The expression in field 2 is constructed in exactly the same was as an I-type expression and derives the record id of the record(s) in the linked file from data in the original file.

Example

If a library application has two files, BOOKS and TITLES where the record id of BOOKS is formed from the id of the corresponding TITLES record and the copy number separated by a hyphen, the following link placed in the dictionary of the BOOKS file could be used to access the associated TITLES record:

```
1:   L
2:   @ID['-', 1, 1]
3:   TITLES
```

Queries based on the BOOKS file could then reference data from the TITLES file using field names made up from the name of the link record, a % character and the name of the TITLES field to be accessed. For example, if the above line was named TTL, a query such as

```
LIST BOOKS TTL%TITLE TTL%AUTHOR
```

could be used to print a list of book titles and their authors.

Dictionary PH-type records

A phrase can be used in query processor sentences. When the sentence is executed, the phrase name is replaced by the phrase expansion. Typically, phrases are used to give names to groups of fields to be displayed or selection criteria.

1: PH { descriptive text }

2: Phrase expansion

Phrases may also be included in the VOC but are more commonly found in dictionaries. A phrase in the VOC can be used in queries against any file whereas a phrase in a dictionary can only be used in queries against the associated file.

There are a number of reserved phrase names as listed below.

@ID A D-type record defining the record id.

@ A phrase record defining the default list of items to be displayed by **LIST** and **SORT** in the absence of any other field names.

@LPTR A phrase record defining the default list of items to be displayed by **LIST** and **SORT** in the absence of any other field names when output is directed to a printer. If this record is not present, the query processor uses the @ record instead.

@MODIFY A phrase record defining the default list of items to be processed by the **MODIFY** command.

@SHOW A phrase record defining the default list of items to be displayed by **SHOW** in the absence of any other field names.

Dictionary X-type records

X-type dictionary items are miscellaneous data storage records which may be used in any way the application designer wishes.

1: X { descriptive text }

2: user data

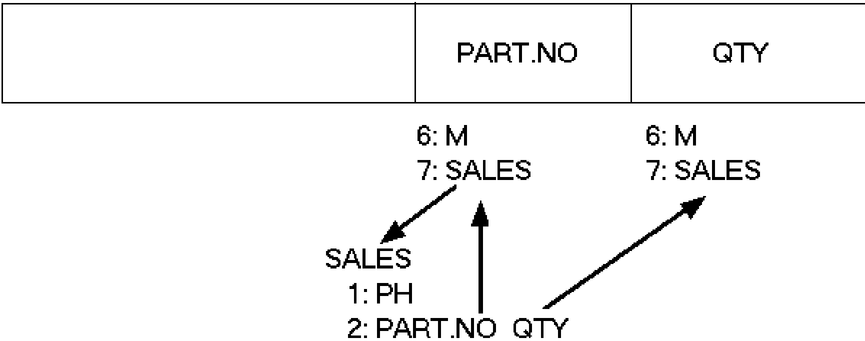
Fields 2 onwards are available for data storage. Users may freely create X-type records for their own purposes but should avoid names containing $ signs or starting with the @ character as these may clash with system defined records.

Associations

An association is a set of two or more multi-valued fields that are related such that the values are inter-dependent. For example, an order processing database might contain a file listing the items in each order. This would require a multi-valued list of products and a corresponding multi-valued list of quantities. A realistic data file may contain several associated sets of fields.

The query processor needs to know about this relationship. An association is defined by giving it a name which appears in field 7 of the dictionary entry of each field in the association. There is also a phrase record with this name which contains a space separated list of the fields that make up the association.

Thus, starting from any one element of the association, its dictionary entry can be used to find the phrase record which, in turn, allows the query processor to find all the members of the association.



I-type expressions

The difference between a D-type and an I-type dictionary item is perhaps best illustrated by a simple example. A file might contain information about employees including their date of birth. If we want to list all employees with their date of birth we could do this by a query of the form

```
LIST EMP.FILE NAME DOB
```

If we want the employee's age, this data is not recorded and, of course, changes with time. However, by creating an I-type called AGE we could simply enter

```
LIST EMP.FILE NAME AGE
```

What is in this I-type? It is a simple program which calculates the employee's age using the DOB field and today's date.

Any I-type has an expression in field 2. This is constructed from the following components:

Field names (D or I-type)
Constants
@ variables
Operators
QMBasic functions
Special functions

The AGE I-type referred to above is actually more complex than it may at first seem. It might be written as

```
OCONV(DATE(), "D4Y") - OCONV(DOB, "D2Y"); IF
OCONV(@DATE,"DMD") > OCONV(DOB,"DMD") THEN @ + 1 ELSE @
```

An I-type must be compiled before it can be used and whenever the dictionary is changed in a manner that would affect fields used by the I-type. The **COMPILE.DICT** (synonym **CD**) command compiles one or more I-types in a dictionary. The **MODIFY** command also provides facilities to compile I-types when they are edited and the query processor commands all compile a previously uncompiled I-type when it is first used.

An I-type expression consists of one or more **elements** each of which is similar to a QMBasic expression.

Whereas a QMBasic program would refer to variable names, an I-type expression uses field names as defined in the file's dictionary. These names may be either D or I-type items.

Many of the @-variables used by QMBasic are also available in I-types. The following @-variables are specific to I-types though some can be used by QMBasic programs to set up the working environment for the I-type.

@FILE.NAME	The name of the file being processed by the command.
@ID	The record id of the current record.
@NB	Break level number.

@NI	Item counter.
@RECORD	The data of the record being processed by the command.

A **compound I-type** has multiple elements separated by semicolons. The value of the previous element may be referred to by the symbol @ and the value of a specific element as @*n* where *n* is the element number, starting at one. The overall value of the I-type is the value of the final expression.

To simplify editing of compound I-type expressions, the "edit values" mode of both the **ED** and **SED** editors can be used to break the expression such that each element appears on a separate line.

Most QMBasic functions are also available in I-type expressions. The following functions are either specific to I-type expressions or modified from their QMBasic form:

TOTAL()
TRANS()
SUBR()

3.8 Conversion Codes

Sometimes data is not stored in the database in the same way as we would wish to present it to a user. A **conversion code** determines how data is translated between its internal format and the user friendly external format.

Although there are many conversion codes, the most important are those that handle dates, times and scaled decimal values.

Conversion codes appear in field 3 of a C-type, D-type or I-type dictionary item or field 7 of an A or S-type item. They determine the way in which data is converted prior to output by the query processor or when input via **MODIFY** or **UPDATE.RECORD**. Conversion codes are also used in the QMBasic **ICONV()** and **OCONV()** functions and with the query processor **CONV** keyword.

The standard conversion codes are:

Base64	B64
Boolean	B
Concatenation	C
Dates	D
Group	G
Integer	IS, IL
Length	L
Radix	MB, MO, MX
Radix	MCDX, MCXD
Character	MC*x*
Masked Decimal	MD, ML, MR
Times	MT
Pattern matching	P
Range checking	R
Substitution	S
Text substring	T*m*,*n*
Translation	T*file*
User defined	U
Fields	<*f*,*v*,*s*>

Base 64 Conversion (B64)

The base64 conversion code translates data to or from a format widely used for transmission over the internet.

The full format of this conversion code is

B64

Used with **OCONV()** for output conversion, this operation converts data to base64 format. The data is returned as a continuous sequence of encoded characters. In common use, this data would then be divided into lines of manageable length, typically 72 characters. This can be achieved with the **FOLD()** function.

Used with **ICONV()** for input conversion, this operation converts base64 data back to its original form. Newlines and other filler characters are ignored.

Example

```
OPENPATH '$HOLD' TO FVAR ELSE STOP 'Cannot open file'
MARK.MAPPING FVAR, OFF
READ TEXT FROM FVAR, 'REPORT.PDF' ELSE STOP 'Cannot read data'
MARK.MAPPING FVAR, ON
B64 = OCONV(TEXT, 'B64')
WRITE FOLD(B64, 72) TO FVAR, 'REPORT.B64'
```

The above program opens the $HOLD file. It then suppresses the normal directory file translation of newlines to field marks because the item to be read contains binary data (a PDF document). Having read this record, mark translation is re-enabled. The B64 conversion is used to translate the PDF to its base64 encoded equivalent. Finally, the FOLD() function is used to wrap the encoded data into 72 character lines.

Boolean conversion (B)

The boolean conversion code converts between the internal representation of false (0) and true (1) and the external representation Y or N.

The full format of this conversion code is

B

Used with **OCONV()** for output conversion, this conversion code returns N for false (zero or a null string) or Y for true (all other values).

Used with **ICONV()** for input conversion, this conversion code returns false (0) for a null string or a string containing the single character N in upper or lower case. It returns true (1) for a string containing the single character Y in upper or lower case. Any other input value returns the original data and sets an error status of 1.

Concatenation conversion (C)

The concatenation conversion code concatenates data items, optionally inserting separators between them. It behaves identically for input conversion with **ICONV()** and output conversion with **OCONV()**.

The general form of a concatenation conversion code is

```
C{;} c expr c expr ...
```

where

c is the separator. This may be any single character except for a digit, a mark character, a quote or a backslash. A semicolon specifies that no separator is to be inserted. Where *c* is a space or semicolon and the next character is also a space or semicolon, this is treated as a further separator, allowing insertion of multiple spaces.

expr is the data to be inserted and may be:

a field number. This will be extracted from the current content of **@RECORD** or from @ID if zero.

a string enclosed in single quotes, double quotes or backslashes.

an asterisk to substitute the data supplied in the conversion function call.

Examples

If @RECORD contains F1FMF2FMF3 and @ID contain 21:

Operation	Result
`OCONV('abc', 'C;3;"xxx";1')`	`F3xxxF1`
`OCONV('abc', 'C;3;1')`	`F3F1`
`OCONV('abc', 'C;"aaa"1"bbb"')`	`aaaF1bbb`
`OCONV('abc', 'C;1    2')`	`F1    F2`
`OCONV('abc', 'C;1*2')`	`F1*F2`
`OCONV('abc', 'C;1**')`	`F1*abc`
`OCONV('abc', 'C;   3')`	`   F3`
`OCONV('abc', 'C;0=1')`	`21=F1`

Date conversion (D)

Inside QM, dates are stored as a number of days since 31 December 1967 (day zero). All dates after that point are represented by positive numbers. All dates before that point are represented by negative numbers. This form of date is used by all multivalue databases and means that they had no issue with the millennium (day 11689). The multivalue world had its own date crisis on 18 May 1995 (day 10000) when developers discovered that they had stored the date as four characters of a composite record id or were sorting dates as character strings rather than numbers such that 17 May 1985 (day 9999) came after 18 May 1995. This potential problem still applies to any application that handles historic dates but the advantages of working with a simple day number internally far outweigh any disadvantages.

The date conversion code converts a date from its internal day number to one of a number of external formats or vice versa.

The full format of this conversion code is

D {*y*} {*c*} {*fmt*} {[*f1*, *f2*, *f3*, *f4*, *f5*]}

where

y is a digit in the range 0 to 4 specifying the number of digits to appear in the year number. This defaults to 4.

c is the character to be used to separate the year, month and day components of the converted date. If omitted, a space is used.

fmt specifies the components to be present in the converted date. Multiple characters may be chosen from the following list subject to restrictions shown below. If *fmt* is omitted it defaults to MDY if American date mode is in use or DMY if European date mode is in use.

D Day of month.

DO Ordinal day of month (1st, 2nd, 3rd, etc)

E Toggles European date format (day, month, year). See also DATE.FORMAT.

J Julian date (days since the start of the year).

L Alphabetic month and day names are to appear with only the first character in uppercase instead of entirely in uppercase.

M Month in format determined by format modifiers. If no format modifiers are present, a two digit month number is used unless *c* is present in which case a three letter alphabetic month is used.

MA Month name.

Q Quarter number (1 to 4).

W Day of week number. Monday is day 1.

WA Weekday name.

WI ISO week number.

Y Year.

YI ISO year number. This is not always the same as the calendar year as a date may be in the last week of the previous ISO year or in the first week of the following ISO year.

[*f1,f2,f3,f4,f5*] These format modifiers affect the way in which the above formats are handled. Up to five modifiers may be specified and they are associated with the formats in the order in which they appear in *fmt*. Format modifiers are

n Use *n* characters.
A Display as alphabetic (applies to month component only).
A*n* Display as *n* alphabetic characters (applies to month component only).
Z Suppress leading zeros.
Z*n* Display as *n* digits with leading zeros replaced by spaces.
"*text*" Uses the supplied text as the separator after the associated component.

Output Conversion of Dates

The following examples show the result of output conversion of a value of 9649 with various conversion codes. Where affected by **DATE.FORMAT** setting, both forms are shown.

Code	Result	European date
'D'	01 JUN 1994	01 JUN 1994
'D2'	01 JUN 94	01 JUN 94
'D4'	01 JUN 1994	01 JUN 1994
'D/'	06/01/1994	01/06/1994
'D '	06 01 1994	01 06 1994
'D2/'	06/01/94	01/06/94
'D/E'	01/06/1994	06/01/94
'D2 E'	01 06 94	06 01 94
'D.YJ'	1994.152	
'D2:JY'	152:94	
'D YMD'	1994 06 01	
'D MY[A,2]'	JUN 94	
'D4DOMAYL'	1st June 1994	
'D DMY[,A3,2]'	01 JUN 94	
'D DMY[,A9,2]'	01 JUNE 94	
'D/MDY[Z,Z,2]'	6/1/94	
'D DMYL[,A,]'	01 June 1994	
'DDMYL[Z,A,2]'	1 June 94	
'DYMD[2,2,2]'	94 06 01	
'DW'	3	
'DWA'	WEDNESDAY	
'DWAL'	Wednesday	
'DMA'	JUNE	

'DMAL'	June
'DQ'	2
'D-YIWI'	1994-22

Input Conversion of Dates

Alphabetic month names may be supplied in the external format date. At least three letter must be present and conversion is not case sensitive. If more than three letters are present, the must correctly match the spelling of the month name. Where an alphabetic month name is used, the day and month fields of the external format date may be interchanged. Thus '1 Jun 94' and 'Jun 1 94' would both convert to 9649, the internal representation of 1 June 1994.

For dates entered as two digits, year number values in the range 30 to 99 are assumed to be 1930 to 1999 and 0 to 29 are assumed to be 2000 to 2029. This 100 year window can be moved using the **YEARBASE** configuration parameter.

Where not included, the day number or month number is assumed to be one and the year number to be the current year.

For compatibility with Information style multivalue products, a day number that exceeds the number of days in the month will roll forward into the next month and return a value of 3 from the **STATUS()** function. This feature can be suppressed by enabling the NO.DATE.WRAPPING option.

Calendar Differences

The process of converting an external format date to its internal day number and vice versa is not as easy as it sounds. As well as the slightly complex rules that determine which years are leap years and hence have 29 days in February, there is a problem of calendar differences. Most of the world now uses the same calendar for business purposes but this has not always been the case. There were two significant realignments, one in 1752 and an earlier one in 1583 in different parts of the world. Prior to these changes, the date in one country could be several days different from that elsewhere.

The QM date conversion operations assume the current calendar system and make no adjustment to handle these realignments. Some multivalue products implement one or other realignment. Whichever system is used, it will be incorrect in some contexts. Users who require specific handling of these changes or need to handle dates before 1 January 0001 will need to develop their own date conversion functions.

Group conversion (G)

The group conversion code treats the source data as being formed from a number of components separated by a delimiter character and extracts specified components. It works identically on input and output conversions.

G*cn* Returns the first *n* components of the source data delimited by character *c*.

G*scn* Skips *s* components and then returns the next *n* components of the source data delimited by character *c*.

Example

Consider a date stored in character form as 03/10/98. The G conversion code could be used to extract components of this date:

G/1 returns 03
G/2 returns 03/10
G1/1 returns 10

Integer conversion (IS, IL)

The integer conversion codes convert integer values between numeric form and hardware specific integer representation.

IS Short integer (16 bit value).

IL Long integer (32 bit value).

Used with the **ICONV()** function, the conversion code translates a QMBasic integer numeric value to the equivalent hardware specific representation of that integer. Used with the **OCONV()** function, the conversion code translates a hardware specific representation of an integer value to its equivalent QMBasic numeric form.

By default, these conversions adopt the byte ordering of the machine on which the program is being executed. Adding an optional L to the end of the conversion code (ISL, ILL) causes conversion to assume a low byte first format for the hardware representation of the value. Similarly, adding an optional H to the end of the conversion code (ISH, ILH) causes conversion to assume a high byte first format for the hardware representation of the value.

These codes should not be used to encode numeric values to be stored in database files as the hardware specific representation may include bytes that will be interpreted as mark characters. These conversions are intended for use in, for example, applications that need to generate hardware specific data for transmission over communications networks.

Length conversion (L)

The length conversion code performs string length constraint checks. It works identically on input and output conversions and has three forms:

L	Returns the length of the string being converted.
L*n*	Returns the original string if its length is less than or equal to *n*. Otherwise it returns a null string.
L*n***,***m*	Returns the original string if its length is greater than or equal to *n* and less than or equal to *m*. Otherwise it returns a null string.

Examples

Conversion	**Data**	**Result**
L	1234	4
L3	A	A
L3	AB	AB
L3	ABC	ABC
L3	ABCD	
L2,3	A	
L2,3	AB	AB
L2,3	ABC	ABC
L2,3	ABCD	

Character conversion (MCx)

The character conversion codes perform various character based conversions.

MCA	Delete all non-alphabetic characters
MC/A	Delete all alphabetic characters
MCAN	Delete all non-alphanumeric characters
MC/AN	Delete all alphanumeric characters
MCL	Convert to lower case
MCN	Delete all non-numeric characters
MC/N	Delete all numeric characters
MCP	Replace non-printing characters by dots
MCT	Capital initial all words (see below)
MCU	Convert to uppercase

These conversion codes behave identically for both input and output conversion.

The MCT conversion code is implemented differently across various multivalue products. The default behaviour of QM is to match D3 and other Pick style products where the first letter after a non-alphabetic character is converted to uppercase, all others to lowercase. Use of the SPACE.MCT mode of the **OPTION** command enables the behaviour found in Information style products such as UniVerse whereby letters immediately following a space are converted to uppercase, all others to lowercase. In both modes, the first character of the string is converted to uppercase.

Examples

Data	**Code**	**Result**
267PS-A17	MCA	PSA
267PS-A17	MC/A	267-17
267PS-A17	MCAN	267PSA17
267PS-A17	MC/AN	-
267PS-A17	MCN	26717
267PS-A17	MC/N	PS-A
Red pencil	MCL	red pencil
Red pencil	MCU	RED PENCIL
Red pencil	MCT	Red Pencil
123FM456	MCP	123.456

Masked decimal conversion (MD, ML, MR)

The masked decimal conversion codes convert a number between its internal and external forms. The formats available provide scaling, currency symbol insertion, thousands separation and a variety of methods for handling negative numbers.

Scaling provides a means by which items such as currency values which are usually written as pounds and pence (or dollars and cents) can be handled internally as integer numbers of pence (or cents) for faster and precise calculation. Scaling is performed by specifying the position of an assumed decimal point.

Input conversion allows for some degree of flexibility in the exact format used. For example, any of the negative value representations may be used regardless of the method actually defined in the conversion code.

The three masked decimal conversion codes are

MD Convert without regard to justification

ML Left justify the converted result

MR Right justify the converted result

The full format of this conversion code is

ML *n* {*f*} {**,**} {*$*} {*s*} {[*intl*]} {**P**} {**Z**} {**T**} {*x*{*c*}} {*fx*}

where

n is a digit in the range 0 to 9 specifying the number of digits to appear to the right of the decimal point. Rounding occurs on output conversion in the fractional part and, if the result is an integer, the decimal point does not appear.

f is a digit in the range 0 to 9 specifying the position of the implied decimal point in the data to be converted. For example, if the value supplied to an output conversion is 12345 and *f* is 2, the result is 123.45. Conversely, if the value supplied to an input conversion is 123.45 and *f* is 2, the result is 12345. If omitted, *f* defaults to the same value as *n*.

, specifies that the national language convention thousands separator is to be inserted between every third digit to the left of the decimal point. The default delimiter is a comma but this may be changed by use of the **NLS** command or the **SETNLS** QMBasic statement.

$ specifies that the national currency symbol should be used as a prefix to the converted data on output conversion and may be present on input conversion. The default currency symbol is a dollar sign but this may be changed by use of the **NLS** command or the **SETNLS** QMBasic statement.

s specifies the handling of the numeric sign of the value.

\+ places a + or - sign to the right of the converted data.

\- places a - sign to the right of negative values or a space to the right of positive values.

(encloses negative values in round brackets. A positive value has a space placed to its right.

< encloses negative values in angle brackets. A positive value has a space placed to its right.

C places the letters cr to the right of negative values or two spaces to the right of positive values. Use the **CRDB.UPCASE** keyword of the **OPTION** command to change this to CR.

D places the letters db to the right of negative values or two spaces to the right of positive values. Use the **CRDB.UPCASE** keyword of the **OPTION** command to change this to DB.

Input conversion accepts any of these representations of a negative value regardless of the actual conversion code used.

[*intl*] specifies alternative international handling of currency symbols and separators. *intl* consists of up to four comma separated items which specify the prefix, thousands separator, decimal separator and suffix to be applied to the converted value. These components should be quoted if there is any potential confusion.

Z specifies that a zero value should be represented by a null string on output conversion. This option is ignored on input conversion.

T specifies that trailing decimal places should be truncated rather than rounded. This option is ignored on input conversion.

x{*c*} specifies that the result of an output conversion is to be a field of *x* characters, left or right justified as specified by use of ML or MR. If the converted data is longer than *x* characters it will be truncated to fit. If it is less than *x* characters it is padded using character *c* or spaces if *c* is not specified. The value of *x* may be one or two digits.

On input conversion, the value of *x* is ignored and all occurrences of character *c*, or spaces if *c* is not specified, within the data are ignored.

fx is an alternative style of padding specification. It cannot be used with *x*{*c*}.
f specifies the padding character to be used; * for asterisk, # for space, % for zero.
x specifies the field width.

The *fx* element may be a complete mask as used in format specifications (e.g. #3-#4).

Masked Decimal Output Conversion

The following table sets out a variety of combinations of masked decimal output conversion features.

Value	Conversion	Result
0	MD0	'0'
0	MD0Z	''

Sign handling		
12345678	MD0	'12345678'
-12345678	MD0	'-12345678'
12345678	MD0+	'12345678+'
-12345678	MD0+	'12345678-'
12345678	MD0-	'12345678 '
-12345678	MD0-	'12345678-'
12345678	MD0<	' 12345678 '
-12345678	MD0<	'<12345678>'
12345678	MD0(	' 12345678 '
-12345678	MD0(	'(12345678)'
12345678	MD0C	'12345678 '
-12345678	MD0C	'12345678CR'
12345678	MD0D	'12345678 '
-12345678	MD0D	'12345678DB'

Scale factors		
12345678	MD22	'123456.78'
1234567.89	MD22	'12345.68'
-12345678	MD22	'-123456.78'
12345678	MD02	'123457'
12345678	MD02T	'123456'

Thousands separators and currency symbols		
1234567	MD0,	'1,234,567'
12345678	MD2,$	'$123,456.78'

Left justification and padding		
0	ML004*	'0***'
12345678	ML0010*	'12345678**'
12345678	ML0+12*	'12345678+***'
-12345678	ML0+12*	'12345678-***'
12345678	ML0-12*	'12345678 ***'
12345678	ML0(12*	'12345678 ***'
-12345678	ML0(12*	'(12345678)**'
12345678	ML0C12*	'12345678 **'
-12345678	ML0C12*	'12345678CR**'

Right justification and padding

0	MR004*	'***0'
12345678	MR0010*	'**12345678'
12345678	MR0+12*	'***12345678+'
-12345678	MR0+12*	'***12345678-'
12345678	MR0-12*	'***12345678 '
12345678	MR0(12*	'***12345678 '
-12345678	MR0(12*	'**(12345678)'
12345678	MR0C12*	'**12345678 '
-12345678	MR0C12*	'**12345678CR'

Masked Decimal Input Conversion Examples

The following table sets out a variety of combinations of masked decimal conversion features.

Value	Conversion	Result
''	MD0	''
'0'	MD0	'0'
Sign handling		
'12345678'	MD0	'12345678'
'-12345678'	MD0	'-12345678'
'12345678-'	MD0	'-12345678'
'<12345678>'	MD0	'-12345678'
'(12345678)'	MD0	'-12345678'
'12345678CR'	MD0	'-12345678'
'12345678DB'	MD0	'-12345678'
Scale factors		
'123456.78'	MD2	'12345678'
'123456.78'	MD23	'1234567.8'
Currency symbols and thousands separators		
'12,345'	MD0,	'12345'
'$123,456.78'	MD2,$	'12345678'
'($123456.78)'	MD22$(	'-12345678'

Time conversion (MT)

The time conversion code converts a time from its internal representation (number of seconds since midnight) to a string representing hours, minutes and seconds or vice versa.

The full format of this conversion code is

MT {**H**} {**S**} {*c*}

where

H specifies that the time is to appear in 12-hour format with either AM or PM appended. If **H** is not specified, 24-hour conversion is used for output conversion and assumed for input conversion.

S specifies that output conversion is to include the seconds field. Input conversion determines whether seconds are included by examination of the data to be converted.

c is the character to separate the hours, minutes and seconds fields. If omitted, a colon is used. The separator character should be enclosed in quotes if required to avoid syntactic ambiguity (for example MT'h' for French format times such as 09h30).

Examples

Conversion	Data	Result
MT	0	00:00
MT	31653	08:47
MT	63306	17:35
MTH	0	12:00am
MTH	31653	08:47am
MTH	63306	05:35pm
MTS	31653	08:47:33
MTS	63306	17:35:06
MTHS	63306	05:35:06pm
MTS.	63306	17:35:06
MT'h'	63306	17h35

Radix conversion (MB, MO, MX)

The radix conversion codes convert a number to/from binary (MB), octal (MO) or hexadecimal (MX).

Input Conversion

The MB, MO and MX conversions take a number represented by a character string of binary, octal or hexadecimal digits and converts it to an internal integer value.

Addition of the 0C suffix to these codes (MB0C, MO0C, MX0C) takes a character string holding a series of binary, octal or hexadecimal digits and translates each group of 8, 3 or 2 digits to the corresponding ASCII character. If the source data is not an exact multiple of 8, 3 or 2 digits in length, as appropriate to the conversion type, implied leading zeros are added.

Output Conversion

The MB, MO and MX conversions convert a number to binary, octal or hexadecimal form as a character string. Non-integer values are truncated towards zero. Negative values are treated as unsigned 32 bit values. Leading zeros are suppressed.

The addition of the 0C suffix to any of these conversion codes treats the source data as a character string and converts each character to its binary, octal or hexadecimal representation.

Examples

Input conversion:

Source data	Conversion	Result
1110	MB	14
37777777762	MO	-14
31342E36	MX	14.6
010000010100001001000011	MB0C	ABC
101102103	MO0C	ABC
414243	MX0C	ABC

Output conversion:

Source data	Conversion	Result
19	MB	10011
19	MO	23
19	MX	13
ABC	MB0C	010000010100001001000011
ABC	MO0C	101102103
ABC	MX0C	414243

Radix conversion (MCDX, MCXD)

Used as an output conversion, MCDX converts a number from decimal to hexadecimal and MCXD converts from hexadecimal to decimal. Used as an input conversion, the roles of these two codes are reversed.

The final character of the conversion code name is optional. They can be written as MCD and MCX.

Field extraction (<f,v,s>)

The field extraction code, only supported for output conversion, extracts a field, value or subvalue from the source data. It is used most frequently in conjunction with other conversion codes.

<*f*> Extracts field *f*.
<*f*,*v*> Extracts field *f*, value *v*.
<*f*,*v*,*s*> Extracts field *f*, value *v*, subvalue *s*.

Pattern matching conversion (P)

The **P** conversion code attempts to match the supplied data against one or more pattern templates

The full format of this conversion code is

P(*template***)**{**;(***template***)**...}

where

template is a pattern template as for the **MATCHES** operator and must be enclosed in brackets. If more than one *template* is supplied, they may be separated by semicolons (;) or forward slashes (/).

The **P** conversion code tests whether the input data matches *template*. If a match is found, the original data is returned. If no match is found, a null string is returned.

If more than one *template* is provided, the input value is tested against each in turn.

A null input value always returns a null result.

Examples

Conversion	**Data**	**Result**
P(3A)	123	
P(3A)	ABC	ABC
P(1-2N)	74	74
P(1-2N)	123	
P(2A);(3N)	12	
P(2A);(3N)	AB	AB
P(2A);(3N)	123	123
P(2A)		

Range Check Conversion (R)

The **R** conversion code checks whether a numeric value is within a specified range.

The full format of this conversion code is

R*n*,*m*{**;***n*,*m*...}

where

n*,*m specifies a range of numeric values. Negative values are allowed. If more than one *n*,*m* pair is supplied, they may be separated by semicolons (;) or forward slashes (/).

The R conversion code tests whether the input data is an integer value in the range *n* to *m*. If the value is within the specified range, the conversion returns the input data. If the value is outside the range, a null string is returned.

If more than one *n*,*m* pair is provided, the input value is tested against each in turn.

A null input value always returns a null result regardless of the values of *n* and *m*.

A non-numeric data item will return the original data. The **STATUS()** function would then return 1 to indicate an error.

Examples

Conversion	**Data**	**Result**
R3,5	1	
R3,5	3	3
R-2,0	-3	
R-2,0	-1	-1
R1,3;6,8	7	7
R1,3;6,8	5	
R1,3	0002	0002
R1,3		
R1.3	A	A

Substitution conversion (S)

The **S** (substitution) conversion code allows an application to handle zero or null data items as a special case.

The full format of this conversion code is

S;*value1***;***value2*

The **S** code returns a value determined by *value1* if the source data is not zero or null, or the value determined by *value2* if the source data is zero or null.

The *value1* and *value2* items may be:

A number specifying the field from @RECORD (the current record being processed in a query) to be returned. A value of zero returns the content of @ID.

A literal string enclosed in single quotes, double quotes or backslashes.

An asterisk indicating that the original data is to be returned.

If either *value* is omitted, it defaults to a null string.

Examples

A file has a date field that contains zero when it is not significant. Using a date conversion would return this as 31 Dec 1967. The S conversion code could be used to replace the zero by a null string before applying the date conversion. The dictionary conversion code field could be

```
S;*;''VMD4DMY
```

The following table shows a variety of conversions for a data record of "F1FMF2" and a record id of "ID".

Conversion	Data	Result
S;1;2	0	F2
S;1;2		F2
S;1;2	5	F1
S;1;2	XX	F1
S;*;'ZZ'	0	ZZ
S;*;'ZZ'	2	2
S;0	0	
S;0	1	ID
S;;0	0	ID

File translation conversion

The **T** conversion code uses the source data as a record id to the named file and returns data from this record.

The format of the conversion code is

T*file*;*cv*;*i*;*o*

where

file is the file name. This may be prefixed by either DICT followed by a space or by an asterisk with no space to reference the dictionary part of the file. Where necessary to avoid ambiguity, the file name may be enclosed in quotes.

c identifies the action to be taken if the requested record does not exist of the field to be extracted is null. This is a single letter:
- C Returns the record id.
- V Displays a warning message and returns a null value.
- X Returns a null value
- I Like V for input conversion, C for output conversion
- O Like C for input conversion, V for output conversion

v specifies the value position to be extracted from the returned data. If omitted, all values are returned with value and subvalue marks replaced by spaces.

i specifies the field position of the data to be returned when performing an input conversion.

o specifies the field position of the data to be returned when performing an output conversion.

This conversion code is closely related to the **TRANS()** function. Where possible, **TRANS()** should be used in preference to the T conversion code for best performance.

Text substring conversion

The text substring extraction code returns a portion of the source data.

The format of the conversion code is

T*m***,***n*
T*m*

The first form returns *n* characters starting at character *m* from the source data. The second form returns the last *m* characters of the source data.

User defined conversions

Users may add their own conversion codes to the system by writing a QMBasic subroutine to perform the conversion.

The format of the conversion code is

U*subrname*

or

U*subrname***.***extension*

where

subrname is the catalogue name of the subroutine to be called. To allow creation of substitutes for Pick user exits, this name may commence with a digit.

extension is optional qualifying information for the conversion code. This can be accessed within the subroutine in the @CONV variable.

The subroutine should have four arguments:

CONV.SUBR(*result*, *src*, *status*, *oconv*)

where

result should be set to the result of the conversion.

src is the item to be converted.

status is the value to be set for the **STATUS()** function.

oconv indicates whether this is an input (0) or output (1) conversion.

See the U50BB subroutine in the BP file of the QMSYS account for an example of a Pick user exit routine.

3.9 Format Specifications

Format specifications appear in field 5 of C-type, D-type and I-type dictionary items to determine the default format of output from the **LIST** and **SORT** query processor commands. They are also used in the QMBasic **FMT()** function and with the query processor **FMT** keyword.

The full form of a format code is

{*field.width*} {*fill.char*} *justification* {*n*{*m*}} {*conv*} {*mask*}

where

field.width is the width of the field into which the data is to be formatted. If *field.width* is omitted, *mask* must be specified.

fill.char is the character to be used to expand the string to *field.width* characters. If omitted, a space is used by default. Where *fill.char* is a digit, it must be enclosed in single or double quotes.

justification indicates the justification mode to be applied. It takes one of the following values:

C specifies centered justification. The data is centered in a field of *field.width* characters, additional *fill.char* characters being added to either side if the data is shorter than *field.width*. If the data is longer than *field.width*, text marks are inserted at intervals of *field.width* from the start of the data.

L specifies left justification. The data is left aligned in a field of *field.width* characters, additional *fill.char* characters being appended if the data is shorter than *field.width*. If the data is longer than *field.width*, text marks are inserted at intervals of *field.width* from the start of the data.

R specifies right justification. The data is right aligned in a field of *field.width* characters, additional *fill.char* characters being inserted at the start if the data is shorter than *field.width*. If the data is longer than *field.width*, text marks are inserted at intervals of *field.width* from the start of the data.

T specifies text justification. Text marks are inserted to break the data into fragments of no more than *field.width* characters, aligning breaks onto the positions of spaces in the data. Where there is no suitable space at which to break the data, the text mark is inserted *field.width* characters after the last break position. The final fragment is padded using *fill.char* to be *field.width* characters in length.

When the data is displayed, output moves to a new line where a text mark is present in the formatted data.

U specifies left justification and is treated identically to the **L** code by the QMBasic **FMT()** function. Within the query processor,

data formatted with this code that is wider than *field.width* is not wrapped over multiple lines but extends into the space to its right, possibly overwriting whitespace in later columns.

n specifies the number of decimal places to appear in the result when formatting numeric data. The value is rounded in the normal manner. If *n* is zero, the value is rounded to an integer.

m specifies the scaling factor to be applied. The value being formatted is scaled by moving the decimal point *m* - *p* places to the left, where *p* is the current precision value.

conv is any meaningful combination of the following codes:

$ specifies that the national currency symbol should be used as a prefix to the converted data on output conversion and may be present on input conversion. The default currency symbol is a dollar sign but this may be changed by use of the **NLS** command or the **SETNLS** QMBasic statement.

, indicates that the national language convention thousands delimiter is to be inserted every third digit to the left of the decimal point when converting numeric data. This delimiter defaults to a comma.

B appends db to negative numbers, two spaces to positive numbers. Use the **CRDB.UPCASE** keyword of the **OPTION**command to change this to DB.

C appends cr to negative numbers, two spaces to positive numbers. Use the **CRDB.UPCASE** keyword of the **OPTION**command to change this to CR.

D appends db to positive numbers, two spaces to negative numbers. Use the **CRDB.UPCASE** keyword of the **OPTION**command to change this to DB.

E encloses negative number in angle brackets (<...>). Positive numbers are followed by a single space.

M appends a minus sign to negative numbers.

N suppresses any sign indicator.

Z indicates that a value of zero should be represented by a null string.

mask specifies a mask to be used to format the data. If omitted, *field.width* must be specified. Both can be used together.

The mask consists of a character string containing #, * or % characters and other characters. Each #, * or % is substituted by one character from the source data. Other characters are copied directly to the result string. Multiple #, * or % characters may be represented by a single #, * or % followed by a number indicating the number of characters to be inserted. Characters having special meaning within the format string may be prefixed by a backslash (\) to

indicate that they are to be treated as text.

The value 1234567 with a format specification of 9L#2-#3-#2 would return 1234567.

Where the *mask* specifies more characters than in the data being converted, positions corresponding to # characters in the mask are replaced by the *fill.char*, positions corresponding to * characters in the mask are replaced by asterisks and positions corresponding to % characters in the mask are replaced by zeros. If the data is left aligned, the padding is inserted in the rightmost positions. If the data is right aligned, the padding is inserted in the leftmost positions.

If the *mask* specifies fewer characters than in the data being converted, part of the source data will be lost. A left aligned format will truncate the source data and a right aligned format will lose data from the start of the source.

Data formatting attempts to handle the data as a number if the decimal places, currency symbol, comma insertion or null zero features are included in the format specification. If these features are all absent, or if the data cannot be converted to a number, it is handled as a string. The difference in handling is relevant when processing data such as a string with leading zeros.

Format Code Examples

The following table shows some uses of format codes.

Value	Format code	Result
'ABCDE'	'8L'	'ABCDE '
'ABCDE'	'8R'	' ABCDE'
'ABCDE'	'8'*'L'	'ABCDE***'
'0012345'	'8R'	' 0012345'
'0012345'	'8RZ'	' 12345'
'0000000'	'84RZ'	' '
'12345'	'8"0"R'	'00012345'
'1234567'	'15R2'	' 1234567.00'
'1234567'	'15R2$,'	' $1,234,567.00'
'12345.67'	'15*R2$,'	'*****$12,345.67'
'1234567'	'14L2'	'1234567.00 '
'43'	'L###m'	'43 m'
'43'	'R###m'	' 43m'
'43'	'"0"R###m'	'043m'
'1234567890'	'L###-#######'	'123-4567890'
'123456789'	'L#3-#3-#3'	'123-456-789'
'12345'	'L#'	'1'
'12345'	'R#'	'5'
'123456789'	'L#5'	'12345'
'123456789'	'R#5'	'56789'
'12345'	'L#6'	'12345 '

'12345'	'R#6'	' 12345'
'A LONG LINE'	'6T'	'A LONG™LINE '
'A LONG LINE'	'7T'	'A LONG™LINE '
'A LONG LINE'	'8T'	'A LONG™LINE '
'A LONG LINE'	'8R'	'A LONG L™INE'
'BANANAS'	'3T'	'BAN™ANA™S '

3.10 Locks

In order to prevent undesirable interaction between processes, QM provides a system of locks. Consider, for example, a process that reads a record, decrements a value in that record and writes it back to the file. There is no problem here if only one process is operating. If, however, there is a second process performing a similar operation on the file, there is a danger that both processes read the record, then both write back an updated copy. Only one of the updates will actually occur as they both started from an identical version of the original data, unaware that there was another process updating the record.

Although the single user environment of a PDA appears not to require locking, the PDA version of QM retains support for the locking operations for use with QMNet connections and to minimise changes that need to be made when porting applications from other platforms.

Three types of lock are available on files; file, read and update locks. Each has a different role and care should be taken to use them correctly.

A **file lock** applies to the entire file and prevents any other user from obtaining any lock on the file or records therein. File locks are usually only needed during operations that must handle the file in a consistent "snap shot" manner when, for example, summing the values of some field from all records. A process can only acquire a file lock if no other process has any locks on the file or its records. Conversely, no other process can obtain any other sort of lock within the file while the file lock is active. Use of file locks can have a severe effect on performance and hence they should only be used where absolutely necessary.

A file lock is obtained by the **FILELOCK** statement and is released by the **FILEUNLOCK** or **RELEASE** statements, or on closing the file.

A **read lock** (sometimes called a **shared lock**) applies to an individual record and prevents other processes from obtaining the file lock or an update lock on the same record. Any number of processes may acquire read locks on the record at the same time. An attempt to obtain a read lock will fail if another process has the file is locked or has an update lock on the record. Read locks can be used to ensure that a program sees a consistent view of a set of records, without the risk that some other process has changed any of these records.

An **update lock** also applies to an individual record and prevents other processes from obtaining the file lock or either type of record lock on the same record. Only one process may acquire an update lock on a record at a time. An attempt to obtain an update lock will fail if another process has the file is locked or has a read or update lock on the record.

A read or update lock may be acquired on a record that does not exist in the file. This provides a means of locking a record that is about to be written for the first time.

Read and update locks are obtained by the **READL** or **READU** statements (and others). These locks are released on closing the file, by the **RELEASE** statement or on return to the command prompt. Additionally, read and update locks are normally released by writing or deleting the locked record, however, the **WRITEU** and **DELETEU** statements provide a means of writing or deleting without releasing the lock.

Although it is possible to hold very many record locks at a time, this tends to indicate poor application design and may have an adverse effect on performance. The system wide limit on the number of concurrent locks is determined by the NUMLOCKS configuration parameter. If this limit is reached, the program will behave as though the record is locked by another user, taking the

LOCKED clause of the relevant QMBasic statement with a **STATUS()** value of -1 or, if no **LOCKED** clause is present, waiting for space to become available. A message will be written to the system error log file.

Where an attempt to obtain a lock fails, the QMBasic language provides two methods of handling the situation. A program may either wait automatically for the lock to be released or it may regain control and take some action of its own (see the **LOCKED** clause of the QMBasic file handling statements).

A process is not affected by its own locks. Thus it is possible to take a record lock on a record from a file for which the file lock is held or, conversely, to take the file lock while holding one or more record locks. Taking a read lock on a record for which an update lock is held or vice versa will convert the lock type.

Locks are associated with the underlying operating system file, not the VOC reference to the file. QM will correctly track locks relating to the same file however it was opened. Where a file has been opened more than once simultaneously by a single process, the locks are released on the final close of the file.

Locks are also associated with the particular file variable referenced when they are acquired. Thus, if an application opens the same file more than once, closing one of the file references will automatically release any locks acquired using that file variable but leave other locks in place. Similarly, use of the form of the **RELEASE** statement that takes only a file variable will release locks associated with that file variable. This mechanism ensures that developers do not need to be aware of how other modules within the application operate.

Lock Rule Enforcement

The lock handling operations of QMBasic only operate with correctly structured applications. The non-locking versions of the **READ** and **WRITE** operations, etc, take no part in the locking system and hence can access a file regardless of its lock state. The individual statement descriptions give more information.

A correctly written application never writes or deletes a record without locking it first, however, for compatibility with other multivalue database products, this is not enforced by default except within transactions. A poorly written program that uses **READ** in place of **READU** and then writes the record could overwrite a record that is locked by another user. The MUSTLOCK configuration parameter can be used to enforce tight control of locks, eliminating this potential problem. This parameter is not supported on the PDA version of QM.

Enabling lock rule enforcement may not be easy when porting existing applications to QM. Because multivalue systems have not enforced these rules in the past, programmers sometimes omitted use of locks in situations where there would never be contention. For example, overnight processing might not use locks because the developer knew that it is run at a time when there are no other users on the system. Programs that write a record that is known not to exist also appear not to need locks. Both of these examples actually represent bad programming practice as the assumption made by the developer may subsequently turn out not to be true due to changes in business operation.

Task Locks

QM also provides **task locks**, sometimes known as **process synchronisation locks**, that are not related to any particular file and are typically used to ensure that some task cannot be performed by

two users simultaneously.

A task lock is simply an numbered entry in a 64 element locking table. A process acquires a task lock using the **LOCK** command or the QMBasic **LOCK** statement. If the lock is already owned by another user, the process either waits for it to be released or handles the situation for itself. On completion of the task, the process can release the lock using the **CLEAR.LOCKS** command or the QMBasic **UNLOCK** statement.

Task locks can be difficult to use because the lock is not related to a file, record, etc and the application designer must choose one that is not also used for some other purpose. Because task locks are shared across all accounts, this implies a possible unwanted interaction between different applications.

3.11 Alternate Key Indices

An **alternate key index** provides a method to access data file other than by the primary key (record id).

Consider a file holding information about orders with, for example, 100000 records in it. For simplicity, assume that these records are made up of 10 orders from each of 10000 customers. To locate all the orders placed by a specific customer would require all 100000 records to be processed to find the 10 that we want.

Using an alternate key index on the customer number field of the order records, QM can look up the customer in the index and then go directly to the 10 order records.

An alternate key index is created using the **CREATE.INDEX** command. This defines the index content but does not populate it. The **BUILD.INDEX** command builds the actual index and activates it. From that point forwards, QM will maintain the index automatically and the query processor will use it automatically. No changes are required to application software.

The functions of the **CREATE.INDEX** and **BUILD.INDEX** commands are combined in the **MAKE.INDEX** command.

Once an index has been built, it is maintained totally automatically by QM such that it is impossible to write or delete a record without the corresponding index updates being applied. The query processor will also use the index totally automatically where it appears relevant.

Indices can be built on real data stored in the file (dictionary D-type or A/S-type without a correlative) or on calculated values (dictionary I-type or A/S-type with a correlative). When using calculated values, it is essential that the expression relies only on data from the file to which the index applies and is not time variant. Thus an index using data retrieved from another file using the **TRANS()** function, a T-conversion or a subroutine that performs a read will fail because the index will not be updated if the remote file is modified. Similarly, an index built using a calculation that uses the date or time (age calculated from a date of birth, for example) will fail because the expression does not always return the same output value for the same input.

These are both examples of the one and only rule that determines whether an index based on a calculated value will work: **The virtual attribute expression must always return the same value when evaluated for the same data record**.

For an index to be effective, each entry in the index should lead to a very small proportion of the data in the file. Index entries that lead to very large numbers of records are less effective and may also be costly to access or update. The worst case of this is indexing on a simple yes/no value.

A file may have up to 32 indices. The more indices there are, the longer it will take to update a record in the data file though this should be outweighed by the advantage of being able to use the indices in queries. Also, it should be remembered that indexing on a multivalued field may require many index entries to be updated when writing a data record.

Indices can be deleted using the **DELETE.INDEX** command if they are no longer wanted. A report of any or all indices on a file can be produced with the **LIST.INDEX** command.

Programmers can gain access to the index itself using the QMBasic **SELECTINDEX** statement and advanced index scanning operations can be performed using **SELECTLEFT**,

SELECTRIGHT, **SETLEFT** and **SETRIGHT**.

3.12 Triggers

A **trigger** is an optional user written function associated with a hashed file and configured to be executed when certain file operations are performed. Executed before a write or delete, the trigger can be used to apply data validation. Executed after a record is written or deleted, the function can trigger other events such as related file updates. Trigger functions can also be executed after a read and before or after a clear file operation.

The trigger function is simply a catalogued QMBasic subroutine which is automatically executed as part of the file operation. The subroutine is passed a mode flag to indicate the action being performed, the record id, the record data (read or write operations) and a flag indicating whether the QMBasic ON ERROR clause is present. The subroutine may do whatever processing the application designer wishes. If the write or delete is to be disallowed, the pre-write or pre-delete trigger function should set the @TRIGGER.RETURN.CODE variable to a non-zero value such as an error number or an error message text to cause the write or delete to take its ON ERROR clause if present or to abort if omitted. The **STATUS()** function will return ER$TRIGGER when executed in the program that initiated the file operation. Programs should test **STATUS()** rather than testing for @TRIGGER.RETURN.CODE being non-zero to determine whether the trigger function has disallowed the write or delete as @TRIGGER.RETURN.CODE is only updated when the error status is set.

The trigger function is set up using the **SET.TRIGGER** command. After it has been set up, the trigger function is loaded into memory when the file is opened and is called for all write or delete operations. Modifying and recataloguing the trigger function will have no effect on processes that have the file open until they close and reopen it.

If the trigger function is not in the catalogue or has the incorrect number of arguments, no error occurs until the first write or delete is attempted. Note that the trigger function must be visible to all accounts that may reference the file. Where a file is used by multiple accounts, this can be achieved by using global cataloguing, sharing a private catalogue, or ensuring that the VOC entry for a locally catalogued trigger function is present in each account. Although it would be possible for a shared file to use a different trigger function depending on the account from which it is referenced, this is not recommended. Files that are to be accessed via QMNet require that associated trigger functions are globally catalogued.

The interface into a trigger function is:

SUBROUTINE *name*(*mode*, *id*, *data*, *on.error*, *fvar*)

where

name is the trigger subroutine name.

mode indicates the point at which the trigger function is being called:

1	FL$TRG.PRE.WRITE	before writing a record
2	FL$TRG.PRE.DELETE	before deleting a record
4	FL$TRG.POST.WRITE	after writing a record
8	FL$TRG.POST.DELETE	after deleting a record
16	FL$TRG.READ	after reading a record
32	FL$TRG.PRE.CLEAR	before clearing the file

64 FL$TRG.POST.CLEAR after clearing the file

Other values may be used in the future. Trigger functions should be written to ignore unrecognised values.

id is the id of the record to be written or deleted.

data is the data. This is a null string for a delete or clearfile action.

on.error indicates whether the program performing the file operation has used the ON ERROR clause to catch aborts.

fvar is the file variable that can be used to access the file. Beware that reading, writing or deleting records via this file variable may cause a recursive call to the trigger function. This argument can be omitted for compatibility with earlier releases.

When writing trigger functions, the original data of the record to be written or deleted can be examined by reading it in the usual way. Trigger functions should not attempt to write the record for which they are called. Neither should they release the update lock on this record as this could cause concurrent update of the record.

If the value of *data* is changed by a pre-write trigger function, the modified data is written to the file. Similarly, a read trigger can modify the data that will be returned to the application that requested the read. Changes to the value of *id* will not affect the database update in any way.

Trigger functions may perform all of the actions available to other QMBasic subroutines including performing updates that may themselves cause trigger functions to be executed.

3.13 Data Encryption

QM supports three data encryption methods:

Ad hoc encryption is provided by two QMBasic functions, ENCRYPT() and DECRYPT(). These take two arguments; the string to be processed and the encryption key. Internally, these use the AES 128 bit encryption algorithm but the encrypted data is further processed to ensure that it can never contain the mark characters or ASCII C0 control characters and can, therefore, be stored as a field within a data record or in a text file.

It is the user's responsibility to provide a mechanism to prevent disclosure of the key string. The key provided by the user can be of any length and may contain any characters. QM will automatically transform this into a form that is valid for use with the AES algorithm. For best security, avoid very short encryption keys which could be determined by repeated attempts to decrypt the data.

Because this style of encryption is performed outside of QM's control, it is unlikely to be practical to build alternate key indices on encrypted data.

Record level encryption encrypts an entire record using a single, user defined key and the AES 128, 192 or 256 bit encryption algorithm. Because this encryption occurs deep inside the QM file system, it is possible to have alternate key indices on fields within a file that uses record level encryption. Note, however, that the index file itself is not encrypted and hence indexed fields are partially exposed outside of the encryption system.

Field level encryption allows users to encrypt specific fields within a file, possibly using different keys or algorithms for each encrypted field. It is not possible to build an alternate key index on an encrypted field. Field level encryption results in a slight increase in record size because of a transformation performed to ensure that the encryption process can never produce data that contains the mark characters.

With either level of encryption, an application may use many different encryption keys and each key can be made accessible to a selected set of users. A user cannot open a file that uses record level encryption unless they have access to the key. When using field level encryption, read operations will return null strings for fields to which the user has no access and write operations will preserve the previous content of these fields.

The encryption system is managed by a user (or multiple users) known as the **security administrator**. This user is responsible for management of the **key vault**, a file that defines the names and actual values of all encryption keys used on the system. The key vault is itself encrypted using the **master key** which should be known only by the security administrator. This key value is entered when the key vault is created by first use of CREATE.KEY. If the key vault is moved to another system or a new licence is applied, the master key must be re-entered either via the licence entry screen or by use of the RESET.MASTER.KEY command.

Because QM uses key names rather than the actual keys in operations such as creating files or setting encryption rules, there is no need to restrict knowledge of the key names. The security administrator sets the actual encryption key value when the key is entered into the key vault and this can subsequently be applied to data files without knowing what encryption is being used. For example, the security administrator might define a key named CARDNO for use on fields containing credit card numbers. Developers can freely apply this without knowing the encryption key. To ensure that data is not lost in the event of a major system failure, the master key and details of each key name / key value pair should be stored securely off-site in some way. All security

administrator commands require entry of the master key though this is remembered for the duration of the user's session.

A new encryption key is created using the **CREATE.KEY** command, available only to users with administrative rights in the QMSYS account. This command assigns the actual encryption key and the algorithm to be associated with the key name. The AES 128, 192 and 256 bit algorithms require a key length of 16, 24 or 32 bytes respectively, however, to enable administrators to use convenient keys of any length up to 64 characters, QM will transform the key entered by the user into a form that is valid for the AES algorithms. Specifying a key that is approximately the required internal length give best security.

Defining a key name makes it accessible to the user that defined it. To make it accessible to other users, the security administrator uses the **GRANT.KEY** command, specifying the key name and the login names of the users or user groups (not Windows) to whom access is to be granted. Access to a key can subsequently be removed using the **REVOKE.KEY** command. If a key is no longer used, it can be removed from the key vault using **DELETE.KEY**.

The security administrator can use the **LIST.KEYS** command to report the name, algorithm and access rights of each encryption key in the key vault. There is no way to report the key string associated with the key. This same command can be used with a filename to report the encryption key names used by the file.

The actual encryption process uses the key string defined in the key vault. If a file that uses encryption is moved to another system, the data in that file will be accessible if the encryption key names used by the file are added to the new system's key vault with the same encryption algorithm and key string.

The master key is used only to encrypt the key vault. The master key must be re-entered if the key vault is moved to another system or possibly as a result of relicensing the system. This is an automatic part of the QM licensing process and helps to ensure security if, for example, a backup tape of the system is stolen. If the master key is forgotten, there is no way to retrieve it from the key vault and hence the vault and all encrypted files would become inaccessible.

A file is created for record level encryption by use of the **ENCRYPT** keyword to the **CREATE.FILE** command, specifying the name of the encryption key to be used.

For field level encryption, the developer creates the file, populates the dictionary and then uses the **ENCRYPT.FILE** command to specify the names of each field to be encrypted and the name of the key to be applied. If the file is not empty, the newly defined encryption is applied to the data. This command can also be used to apply record level encryption to an existing file.

To allow files to be moved to systems where the encryption key name clashes with a name already defined on that system, the **SET.ENCRYPTION.KEY.NAME** command can be used to update the key name index stored in the encrypted data file.

When used with QMClient or QMNet, access to encrypted data is based on the access rights of the user name under which the process connects to the server system. Because QMClient is a general library that can be used in various programming environments, it is not possible to apply the encryption at the client side.

3.14 Transactions

A **transaction** is a group of related database updates to be treated as a unit that must either happen in its entirety or not at all. From a programmer's point of view, the updates are enclosed between two QMBasic statements, **BEGIN TRANSACTION** and **END TRANSACTION**. All writes and deletes appearing during the transaction are cached and only take place when the program executes a **COMMIT** statement. The program can abort the transaction by executing a **ROLLBACK** statement which causes all updates to be discarded.

An alternative transaction syntax is available using the **TRANSACTION START**, **TRANSACTION COMMIT** and **TRANSACTION ABORT** statements. The two styles may be mixed in a single application.

Transactions affect the operation of file and record locks. Outside a transaction, locks are released when a write or delete occurs. Because transactional database updates are deferred until the transaction is committed, all locks acquired inside the transaction are held until the commit or rollback. Because of this change to the locking mechanism, converting an application to use transactions is usually rather more complex than simply inserting the transaction control statements into existing programs. The retention of locks can give rise to deadlock situations.

There are some restrictions on what a program may do inside a transaction. In general, QM tries not to enforce prohibitive rules but leaves the application designer to consider the potential impact of the operations embedded inside the transaction. Note carefully, that developers should try to avoid user interactions (e.g. **INPUT** statements) inside a transaction as these can result in locks being held for long periods if the user does not respond quickly.

Example

```
BEGIN TRANSACTION
   READU CUST1.REC FROM CUST.F, CUST1.ID ELSE ROLLBACK
   CUST1.REC<C.BALANCE> -= TRANSFER.VALUE
   WRITE CUST1.REC TO CUST.F, CUST1.ID

   READU CUST2.REC FROM CUST.F, CUST2.ID ELSE ROLLBACK
   CUST2.REC<C.BALANCE> += TRANSFER.VALUE
   WRITE CUST2.REC TO CUST.F, CUST2.ID
   COMMIT
END TRANSACTION
```

The above program fragment transfers money between two customer accounts. The updates are only committed if the entire transaction is successful.

3.15 Select Lists

Select lists are lists of things to be processed, usually record keys from a file. The list may contain all record keys or only those where the key or record data meets some specified criteria. Using select lists simplifies and speeds up many data processing operations using commands or within QMBasic programs. There are 11 select lists numbered 0 to 10. List 0 is referred to as the **default select list** and is used by some verbs such as **COPY** to determine the records (or files for other verbs) to be processed.

Select lists are created by the **SELECT** or **SSELECT** query processor commands. The **SELECT** command builds a list of keys of records meeting the specified criteria but with no apparent ordering to the list. The **SSELECT** command is similar but the list is in order of record key value. The **SELECT** command is faster both during generation of the list and subsequent processing of records as its order reflects the placement of records within the file.

Select lists can also be created by the QMBasic **SELECT** statement. This statement builds a list of all records in the file and provides no means of including or excluding records by selection criteria. Programs can then read keys sequentially from the list using the **READNEXT** statement.

Select lists may also be saved to records in the $SAVEDLISTS file using **SAVE.LIST** and later restored using **GET.LIST**. Lists that have been written to other files by QMBasic programs may be restored using **FORM.LIST**. The **EDIT.LIST** command allows editing of select lists. Saved select lists may be copied using **COPY.LIST**, deleted using **DELETE.LIST** or merged using **MERGE.LIST**.

A select list represents a "snapshot" of the file at the time when it was generated. Adding, deleting or modifying records will not affect the select list. Thus, if a file may be modified by another process between generation of the select list and retrieval of records for processing, the program must allow for records that have been deleted or no longer meet the selection criteria.

A special type of select list, an **exploded list**, is constructed using the BY.EXP or BY.EXP.DSND keywords of the query processor. In an exploded select list, the multivalued field from which it was created generates a separate entry for each value or subvalue. The internal representation of this list includes information to identify the value and subvalue positions of the corresponding data element. This can be retrieved by the QMBasic **READNEXT** statement and is used automatically by some operations within the query processor.

Part

QM Commands

4 QM Commands

*	Comment
$ECHO	Paragraph tracing
!	Synonym for SH
ABORT	Abort processing and return to command prompt
ACCOUNT.RESTORE	Restore a Pick style ACCOUNT-SAVE tape
ACCOUNT.SAVE	Save an account to tape in Pick compatible format
ADMIN.USER	Username administration for network connections
ALIAS	Create a temporary alias for a command
ANALYSE.FILE	Analyse structure and usage of dynamic file
ANALYZE.FILE	Synonym for ANALYSE.FILE
AUTOLOGOUT	Set inactivity timer
BASIC	Compile QMBasic programs
BELL	Enable or disable audible alarm
BLOCK.PRINT	Print text using large characters
BLOCK.TERM	Display text using large characters
BREAK	Enable, disable or query break key
BUILD.INDEX	Build an alternate key index
CATALOG	Synonym for CATALOGUE
CATALOGUE	Add program to system catalogue
CD	Synonym for COMPILE.DICT
CLEAN.ACCOUNT	Remove records from $HOLD, $COMO and $SAVEDLISTS
CLEAR.ABORT	Clear the abort status in an ON.ABORT paragraph
CLEAR.DATA	Clear the data queue
CLEAR.FILE	Remove all records from a file
CLEAR.INPUT	Clear keyboard type-ahead
CLEAR.LOCKS	Release task locks
CLEAR.PROMPTS	Clear inline prompt responses
CLEAR.SELECT	Clear one or all select lists
CLEAR.STACK	Clear the command stack
CLEARDATA	Synonym for CLEAR.DATA
CLEARINPUT	Synonym for CLEAR.INPUT
CLEARPROMPTS	Synonym for CLEAR.PROMPTS
CLEARSELECT	Synonym for CLEAR.SELECT
CLR	Clear display
CNAME	Rename a file or record within a file
COMO	Activate or deactivate command output files
COMPILE.DICT	Compile I-types in a dictionary
CONFIG	Display licence and configuration parameters
CONFIGURE.FILE	Change file configuration parameters
COPY	Copy records
COPYP	Copy records using Pick style syntax
COPY.LIST	Copy a saved select list
COUNT	Count records
CREATE.ACCOUNT	Make a new QM account
CREATE.FILE	Create a file
CREATE.INDEX	Create an alternate key index
CREATE.KEY	Creates a data encryption key
CREATE.USER	Create user name for network connection
CS	Synonym for CLR
CT	Display records from a file

DATA	Add text to the data queue for associated verb or program
DATE	Display the date and time
DATE.FORMAT	Selects default date format
DEBUG	Debug QMBasic program
DELETE	Delete records from a file
DELETE.ACCOUNT	Delete a QM account
DELETE.CATALOG	Synonym for DELETE.CATALOGUE
DELETE.CATALOGUE	Delete a program from the system catalogue
DELETE.COMMON	Delete a named common block
DELETE.FILE	Delete a file
DELETE.INDEX	Delete an alternate key index
DELETE.KEY	Deletes a data encryption key
DELETE.LIST	Delete a saved select list
DELETE.USER	Delete user name for network connection
DISPLAY	Display text
DUMP	Display records from a file in hexadecimal and character format
ECHO	Disable or enable keyboard echo
ED	Line editor
EDIT	Synonym for ED
EDIT.LIST	Edit a saved select list
ENCRYPT.FILE	Applies encryption to a file
FILE.SAVE	Save all accounts to tape in Pick compatible format
FIND.ACCOUNT	Find an account on a FILE.SAVE tape
FORMAT	Apply conventional formatting to a QMBasic program
FORM.LIST	Create a select list from a file record
FSTAT	Collect and report file statistics
GENERATE	Generate a QMBasic include record from a dictionary
GET.LIST	Retrieve a previously saved select list
GET.STACK	Restore a saved command stack
GO	Jump to a label within a paragraph
GRANT.KEY	Grants access to a data encryption key
HELP	Display help
HSM	Hot Spot Monitor performance monitoring tool
HUSH	Disable or enable display output
IF	Conditional execution in paragraphs
LIST	List records from a file
LIST.COMMON	List named common blocks
LIST.DIFF	Form difference of two saved select lists
LIST.FILES	List details of open files
LIST.INDEX	List details of an alternate key index
LIST.INTER	Form intersection of two saved select lists
LIST.ITEM	List records from a file in internal format
LIST.KEYS	Lists details of encryption keys
LIST.LABEL	List records from a file in address label format
LIST.LOCKS	List task lock status
LIST.READU	List file, read and update locks
LIST.UNION	Form union of two saved select lists
LIST.USERS	List user names for network connection
LIST.VARS	List user @-variables
LISTF	List all files defined in the VOC
LISTFL	List all local files defined in the VOC
LISTFR	List all remote files defined in the VOC
LISTK	List all keywords defined in the VOC
LISTM	List all menus defined in the VOC

LISTPA	List all paragraphs defined in the VOC
LISTPH	List all phrases defined in the VOC
LISTPQ	List all PROCs defined in the VOC
LISTQ	List all indirect file references in the VOC
LISTR	List all remote items defined in the VOC
LISTS	List all sentences defined in the VOC
LISTU	List users currently in QM
LISTV	List all verbs defined in the VOC
LOCK	Set a task lock
LOGIN.PORT	Login a serial port from within another QM session
LOGMSG	Write a message to the error log
LOGOUT	Terminate a phantom process
LOGTO	Change to an alternative account
LOOP / REPEAT	Defines loop within paragraph
MAKE.INDEX	Create and build an alternate key index
MAP	Display a list of the catalogue contents
MED	Edit a menu definition
MERGE.LIST	Create a select list by merging two other lists
MESSAGE	Send a message to selected other users
MODIFY	Modify records in a file
NLS	Set or report national language support values
NSELECT	Remove items from a select list
OFF	Synonym for QUIT
OPTION	Set, clear or display options
PASSWORD	Change user password for network connection
PAUSE	Display "Press return to continue" prompt
PDEBUG	Runs the phantom debugger
PDUMP	Generate a process dump file
PHANTOM	Initiate a background process
PRINTER	Administer print units
PSTAT	Report process status
PTERM	Set or display terminal characteristics
QSELECT	Construct a select list from the content of selected records
QUIT	Terminate session or revert to lower command level
RELEASE	Release record or file locks
RENAME	Synonym for CNAME
REPORT.SRC	Display @SYSTEM.RETURN.CODE at command prompt
REPORT.STYLE	Sets the default style for query processor reports
RESET.MASTER.KEY	Resets the master encryption key
RESTORE.ACCOUNTS	Restore all accounts from a FILE.SAVE tape
REVOKE.KEY	Removes access to a data encryption key
RUN	Run a compiled QMBasic program
SAVE.LIST	Save a select list
SAVE.STACK	Save the command stack
SCRB	Create or edit a screen definition
SEARCH	Search file for records containing string(s)
SECURITY	Enable, disable or report system security
SED	Screen editor
SEL.RESTORE	Selective restore from an ACCOUNT.SAVE or FILE.SAVE tape
SELECT	Select records meeting criteria
SET	Set a user @variable
SET.DATE	Set QM processing date
SET.DEVICE	Attach a tape device
SET.ENCRYPTION.KEY.NAME	Updates encryption key names for a file

SET.EXIT.STATS	Set final exit status value
SET.FILE	Set a Q-pointer to a remote file
SET.QUEUE	Define a Pick style form queue
SET.TRIGGER	Set, remove or display trigger function for a dynamic file
SETPORT	Set communications parameters of a serial port
SETPTR	Set print unit characteristics
SH	Execute shell command
SHOW	Build select list interactively
SLEEP	Suspend process until specified time
SORT	List records sorted by record key
SORT.ITEM	List records sorted by record key in internal format
SORT.LABEL	List records in address label format, sorted by record key
SP.ASSIGN	Set printer options using a Pick style form queue
SP.CLOSE	Close a print unit previously in "keep open" mode
SP.OPEN	Open a print unit in "keep open" mode
SP.VIEW	View and print records from $HOLD or other files
SPOOL	Send record(s) to the printer
SSELECT	Select records meeting criteria, sorting list by record key
STATUS	Display list of active phantom processes
STOP	Terminate an active paragraph
SUM	Report total of named fields
T.ATT	Synonym for SET.DEVICE
T.DET	Detach a previously assigned tape device
T.DUMP	Save a file
T.EOD	Position a tape device to the end of the recorded data
T.FWD	Move a tape device forward by one file
T.LOAD	Restore a file
T.RDLBL	Read the label from a tape device
T.READ	Read data from a tape device
T.REW	Rewind a tape device
T.STAT	Report the status of a tape device
T.WEOF	Write end of file marker to a tape device
TERM	Set or display terminal window size
TIME	Display date and time
UNLOCK	Unlock a record or file
UPDATE.ACCOUNT	Update VOC items from NEWVOC
UPDATE.LICENCE	Apply new licence information
UPDATE.RECORD	Database maintenance tool
WHO	Display user number and account name
WHERE	Display pathname of current account

4.1 * (Comment)

The * (comment) command allows comment text to be embedded in sentences and paragraphs.

Format

* {*text*}

A comment line has its first non-space character as an asterisk. There must be at least one space separating the asterisk from any *text*. The comment is ignored except that any inline prompt sequences within *text* will be executed. This enables prompts to be resolved in a convenient and logical order ahead of the need to use the responses.

Although comments are mainly used within stored paragraphs, they may be entered at the keyboard in response to the command prompt. The comment will be recorded in any active como file.

The value of @SYSTEM.RETURN.CODE is not affected by a comment.

4.2 $ECHO

The **$ECHO** command inserted in a paragraph enables or disabled paragraph tracing.

Format

$ECHO {**ON**}
$ECHO OFF

The **$ECHO** command (optionally with a qualifier of **ON**) enables paragraph tracing. When this mode is active, the command processor displays the paragraph name, line number and sentence for each line executed.

The **$ECHO OFF** command disables paragraph tracing.

Example

The following paragraph might be used to delete all items in the BP.OUT file for which there is no corresponding source record in the BP file.

```
VOC CLEAN.BP
1: PA
2: $ECHO
3: SELECT BP.OUT
4: NSELECT BP
5: IF @SELECTED = 0 THEN STOP
6: DELETE BP.OUT
7: DATA Y
```

Running this with the $ECHO on line 2 shows are trace of each command prior to execution:

```
:CLEAN.BP
CLEAN.BP 3: SELECT BP.OUT
223 record(s) selected to list 0
CLEAN.BP 4: NSELECT BP
17 record(s) selected to select list 0
CLEAN.BP 5: IF @SELECTED = 0 THEN STOP
CLEAN.BP 6: DELETE BP.OUT
Use active select list (First item 'J7')? Y
17 record(s) deleted
```

4.3 ABORT

The **ABORT** command terminates all active processing and returns to the command prompt.

Format

ABORT{*text*}

where

text is the optional message text to be displayed.

The **ABORT** command is intended for use where a paragraph detects an application fault and needs to terminate all active processing. All active commands, sentences, paragraphs, menus, etc are discarded. Unless the command was run using the QMBasic **EXECUTE** statement with the TRAPPING ABORTS option, just before return to the command prompt, QM checks for an executable item (usually a paragraph) in the VOC named ON.ABORT and, if this is found, runs it.

The ON.ABORT paragraph may examine the @ABORT.CODE variable to determine why it was invoked. The **ABORT** command sets this variable to 1. The *text*, if present, will be stored in @ABORT.MESSAGE

The value of @SYSTEM.RETURN.CODE is not affected by the **ABORT** command.

See also:
CLEAR.ABORT, **STOP**

4.4 ACCOUNT.RESTORE

The **ACCOUNT.RESTORE** command restores a Pick style ACCOUNT-SAVE tape.

Format

ACCOUNT.RESTORE {*options*}

where

options is any combination of the following:

BINARY	Suppresses translation of field marks to newlines when restoring directory files. Use this option when restoring binary data.
DET.SUP	Suppresses display of the name of each file as it is restored.
DIRECTORY	Causes new files to be created as directory files. Existing files are not reconfigured.
NO.CASE	Causes new files to be created with case insensitive record ids. Existing files are not reconfigured.
NO.INDEX	Do not create alternate key indices.
NO.OBJECT	Omits restore of object code. This is particularly useful when migrating to QM from other environments.
POSITIONED	Assumes that the tape is already positioned at the start of the data to be restored.

The **ACCOUNT.RESTORE** command processes a Pick style "compatible mode" tape or pseudo tape and restores data from it into a QM system.

The tape to be restored must first be opened to the process using the **SET.DEVICE** command.

Items in the save that originated in the MD file are restored to a file named MD-RESTORE from where the user can then determine which are relevant to QM and require transfer to the VOC file. Similarly, if a save includes a VOC file, this will be restored to VOC-RESTORE.

Note that restoring a file from a different database product may take considerably longer than restoring the same save on the other product because the file hashing order will be different and the data will not appear in group by group order.

The format of ACCOUNT.SAVE tapes varies between multivalue products. A Pick style "compatible mode" (R83 format) tape commences with

Label
EOF block
Label
Descriptor block
EOF block
Label
Data.....

ACCOUNT.RESTORE therefore normally starts by skipping forwards to the third label block. On some systems, the tape commences simply with a label block followed immediately by the data. To allow for the possibility of this and other formats, the **T.RDLBL** and **T.READ** commands can be used to position the tape before the first data block. Use of the **POSITIONED** option in **ACCOUNT.RESTORE** will then omit all other positioning from within **ACCOUNT.RESTORE** itself.

ACCOUNT.RESTORE reads the account name and other information from the label it finds on the tape. This account name is then offered as the default account name in a confirmation dialog. If the name supplied in this dialog exists in the accounts register, the tape is restored into that account.

If the account name supplied is not found in the accounts register, **ACCOUNT.RESTORE** prompts for a system pathname to be used as the path to the account. Therefore one can restore a backup of an existing account by issuing an **ACCOUNT.RESTORE** command and then supplying a different name for the account. Any required items can then be copied into another account via a Q-pointer.

See also:
ACCOUNT.SAVE, **FILE.SAVE**, **FIND.ACCOUNT**, **RESTORE.ACCOUNTS**, **SEL.RESTORE**, **SET.DEVICE**, **T.ATT**, **T.DUMP**, **T.LOAD**, **T.xxx**

4.5 ACCOUNT.SAVE

The **ACCOUNT.SAVE** command creates a Pick style ACCOUNT-SAVE tape.

Format

ACCOUNT.SAVE {*account.name*} {*options*}

where

account.name is the name of the account to be saved. If omitted, the current account is saved.

options specifies options processing features:

BINARY	suppresses translation of newlines to field marks when saving directory files. Use this option when saving binary data.
DET.SUP	suppresses display of the names of files saved.
EXCLUDE.REMOTE	causes remote files to be omitted as described below.
INCLUDE.REMOTE	causes remote files to be saved as described below.

The **ACCOUNT.SAVE** command creates a Pick style "compatible mode" pseudo tape and saves a QM account to it. The account transfer tools are intended for use when migrating to QM from other systems. Although it would be possible to use this command to create a backup of a QM account, it is recommended that operating system level tools are used for this purpose.

The tape to be created must first be opened to the process using the **SET.DEVICE** command.

The command reports its progress by displaying the name of each file as it is saved unless the **DET.SUP** option is used.

ACCOUNT.SAVE normally saves all files referenced by F-type records in the VOC of the account being saved. There is a three level mechanism by which files can be excluded:

1. Field 5 of the F-type VOC entry can contain
   - D Save the dictionary but omit the data element
   - E Exclude this file from an **ACCOUNT.SAVE** or **FILE.SAVE**
   - I Include this file in an **ACCOUNT.SAVE** or **FILE.SAVE**

2. If field 5 of the VOC record does not specify any of the above flags, the **EXCLUDE.REMOTE** and **INCLUDE.REMOTE** options are used to determine whether remote files (those with a directory delimiter in their pathnames) are to be saved.

3. If neither of the above methods of file selection is used, the value of the **EXCLREM** configuration parameter is used to determine whether remote files are to be saved.

By use of a combination of the above methods, it should be possible to achieve total control of what

is included in a save.

See also:
ACCOUNT.RESTORE, **FILE.SAVE**, **FIND.ACCOUNT**, **RESTORE.ACCOUNTS**, **SEL.RESTORE**, **SET.DEVICE**, **T.ATT**, **T.DUMP**, **T.LOAD**, **T.xxx**

4.6 ADMIN.USER

The **ADMIN.USER** command allows management of the register of user names for network connections.

User management is not applicable to the PDA version of QM.

Format

ADMIN.USER

The **ADMIN.USER** command is built around a form filling interface. Initially it displays a request for a new or existing user name. The F2 key will display a pick list of registered users. Entering a blank user name exits from the command.

Selection of an existing user displays their details for possible amendment. Entry of a new user name displays an empty form into which the user's details may be entered.

The fields in this screen are:

Owner details	Unused by QM internally and may be used for any purpose.
Min password	(Windows 98/ME only) Minimum acceptable password length. Leave blank to impose no restrictions.
Force account	If set, the user is forced into this account on login. If left blank, they will be asked for an account name after entry of their user name and password.
Administrator	Is this user to have administrator rights?
Last login	Displays the date and time of last login.
Action	Enter A to amend, F to file changes, D to delete this user or X to exit without saving any changes.

See also:
CREATE.USER, DELETE.USER, LIST.USERS, PASSWORD, SECURITY

4.7 ALIAS

The **ALIAS** command creates a temporary alias for a command.

Format

ALIAS *command target*	Create an alias
ALIAS *command*	Remove an alias
ALIAS	List all defined aliases

where

command	is the alias name
target	is the command to which the alias applies

The **ALIAS** command creates an alternative name by which a command can be referenced such that *command* becomes a synonym for *target*. It provides a simple mechanism by which standard commands can be linked to alternative VOC entries as a means of providing improved compatibility with other multivalue database products. For example, the **COPY** command could be linked to the Pick style variant named **COPYP** by executing

```
ALIAS COPY COPYP
```

This change affects only the current process and does not modify the VOC. Typically, **ALIAS** commands would be executed from the LOGIN paragraph.

The second form of the **ALIAS** command removes a previously defined alias for *command*.

The third form lists all currently defined aliases.

4.8 ANALYSE.FILE

The **ANALYSE.FILE** command (which may be entered using the American spelling) reports information regarding the structure and efficiency of a dynamic file. It can also be used to produce a simplified report of a directory file.

Format

ANALYSE.FILE {**DICT**} *file.name* {*options*}

where

file.name is the name of the file to be processed. The optional **DICT** prefix indicates that the dictionary portion of the file is to be used.

options are chosen from the following.

LPTR {*n*} Directs output to the specified logical print unit. If *n* is omitted, the default printer is used.

NO.PAGE Suppresses paging of the output. This option is ignored if **LPTR** is used.

STATISTICS Extends the analysis to report record and group usage statistics.

```
Account            : C:\QMSYS
File name          : MESSAGES
Path name          : C:\QMSYS\MESSAGES

Type               : Dynamic, version 1
Group size         : 1 (1024 bytes)
Large record size  : 819
Minimum modulus    : 1
Current modulus    : 103 (0 empty, 27 overflowed, 1 badly)
Load factors       : 80 (split), 50 (merge), 80 (current)
File size (bytes)  : 146432 (106496 + 39936), 89905 used
Total records      : 1706 (1704 normal, 2 large)

         Per group: Minimum    Maximum    Average
Group buffers     :       1          3       1.28
Total records     :       9         28      16.56
Used bytes        :      36       1020     824.19

  Bytes per record: Minimum    Maximum    Average
All records       :      16       4029      52.70
Normal records    :      16        804      49.82
Large records     :     984       4029    2506.50
```

The above example shows analysis of a dynamic file.

4.9 AUTOLOGOUT

The **AUTOLOGOUT** command sets an inactivity period after which a process will automatically be logged out.

Format

AUTOLOGOUT {*period*}

where

period is the inactivity time in minutes. A value of zero disables the timer.

The **AUTOLOGOUT** command prevents users leaving inactive sessions logged in. If the process is waiting for input for the given time, it will automatically be logged out. The ON.EXIT paragraph will be executed if it exists.

Executing the **AUTOLOGOUT** command with no *period* option displays the current setting.

Example

```
AUTOLOGOUT
Autologout is disabled

AUTOLOGOUT 4

AUTOLOGOUT
Autologout period is set to 4 minute(s)
...wait...
Inactivity time expired - Process logged out
Process terminated
```

In this example, the **AUTOLOGOUT** command is used to examine the current setting. The inactivity period is then set to four minutes and the setting displayed again. After four minutes of inactivity, the process is automatically logged out.

4.10 BASIC

The **BASIC** verb runs the QMBasic compiler.

Format

BASIC {*file.name*} {*record.name...*} {*options*}

where

file.name	is the name of the directory file holding the QMBasic source program. If omitted, the *filename* defaults to BP.
record.name	is the name of the record within the file. Multiple record names may be specified. An asterisk as the only *record.name* compiles all programs in the file. If no names are specified and the default select list is active, the list will be used to specify the programs to be compiled.
options	are as listed below.

When using a select list or an asterisk to compile all programs, record names with a .H or .SCR suffix are ignored.

The following options are accepted by the **BASIC** verb

CHANGED	Compile only if the program is not already in the output file or the date and time of modification of the source program record as given in the operating system directory entry is later than that of the compiled program. Used in conjunction with a select list it enables all modified programs to be compiled with a single command.
DEBUGGING	Include debugger control information in the compiled program. A program compiled in debug mode can be executed outside the debugger but will be slower than when compiled without the **DEBUGGING** option.
LISTING	Generate a compiler listing record with a .LIS suffix.
NOXREF	Omit cross reference tables from compiled program. This results in lower memory usage but run time error messages cannot identify source line numbers or variable names.
XREF	Generates a compiler listing record as for the **LISTING** option but includes a cross-reference table of all variables and their use.

The compiler output file, named as the source file but with a .OUT suffix, will be created automatically if it does not already exist.

@SYSTEM.RETURN.CODE is set to the number of programs successfully compiled. It will

contain a negative error code in the event of a fatal error.

The $BASIC.OPTIONS VOC Record

Compiler options that you wish to use every time you run the QMBasic compiler can be placed in an X-type VOC record named $BASIC.OPTIONS. To apply these defaults only to programs stored in a specific file, place the $BASIC.OPTIONS record in that file. The compiler looks first in the source file and then, if no record has been found, in the VOC.

The first line of the record holds the type code X. The second and subsequent lines of this record should contain compiler option keywords from the list below. The keywords allowed are:

CATALOGUE {**LOCAL** | **GLOBAL**}	Automatically catalogues programs after compilation using the program name as the catalogue name. The LOCAL and GLOBAL keywords may be used to specify that the program is to be catalogued in the given mode instead of in the private catalogue. The $NO.CATALOGUE compiler directive can be used in specific program modules to override this action. Alternatively, the $CATALOGUE compiler directive in a program can set an alternative catalogue name or mode.
DEBUGGING	Compiles the program in debug mode.
DEFINE *name* {*value*}	Defines token *name* in the same way as the $DEFINE compiler directive. The *value* may be a number or a quoted string. If omitted, the token is assigned a null string as its value.
LISTING	Generates a listing record in the compiler output file.
MODE *option.name*	Sets the given compilation mode as described for the $MODE compiler directive. Multiple MODE lines must be used to set more than one option.
NOCASE.STRINGS	Compiles the program with case insensitive string operations. See the $NOCASE.STRINGS compiler directive for more details.
NOXREF	Compiles the program with no cross reference tables. This results in slightly lower memory usage but prevents QM producing detailed messages in the event of an error.
WARNINGS.AS.ERRORS	Causes the compiler to treat warning messages as fatal errors.
XREF	Generates a listing record in the compiler output file, including a cross-reference table of all variables and their use.

Unrecognised keywords in this record are ignored.

Examples

```
BASIC PROGRAMS PROG1 LISTING
```

This command compiles the program in record PROG1 of the PROGRAMS file. A listing record is produced.

```
SELECT BP
BASIC CHANGED
```

This sequence of commands compiles all programs in the BP file which have been updated since they were last compiled. Note that the compiler will omit all records with names ending with .H or .SRC, the two standard suffix codes for include records.

See also:
CATALOGUE, DELETE.CATALOGUE, MAP

4.11 BELL

The **BELL** command determines whether the audible alarm is sounded by various QM verbs (typically on encountering error conditions) or by QMBasic programs using the @SYS.BELL function in a print operation directed to the terminal.

Format

BELL OFF	To disable the audible alarm
BELL ON	To enable the audible alarm

@SYSTEM.RETURN.CODE is returned as

0	after **BELL OFF**
1	after **BELL ON**
-ve	after an error

Printing CHAR(7) to the terminal sounds the audible alarm regardless of the setting of the bell status.

4.12 BLOCK.PRINT and BLOCK.TERM

The **BLOCK.PRINT** command prints text on the default printer using large characters. The **BLOCK.TERM** is similar but directs its output to the terminal

Format

BLOCK.PRINT *text*

BLOCK.TERM *text*

where

text is the text to be printed or displayed.

The **BLOCK.PRINT** and **BLOCK.TERM** commands print *text* using a large font constructed from a 7 x 7 matrix of characters. On an 80 character printer or terminal, a maximum of 8 characters will fit on a line. The command will wrap long text across multiple lines, breaking on spaces where possible.

4.13 BREAK command

The **BREAK** command controls the action taken on use of the break key. It can be used, for example, the suppress quits during critical parts of an application.

Format

BREAK OFF	To suppress quits
BREAK ON	To enable quits
BREAK CLEAR	To cancel deferred breaks
BREAK COUNT	To report the number of active **BREAK OFF** commands
BREAK ON USER *n*	To enable the break key for the specified user

QM maintains a count of the number of times that breaks are disabled. Each **BREAK OFF** command increments this count. The **BREAK ON** command decrements the count unless it is already zero. The **BREAK COUNT** command reports the current value of the break inhibit counter.

If the break key is pressed whilst breaks are suppressed, the break is deferred until the count returns to zero by a subsequent use of **BREAK ON**. The normal action prompt will then appear. The **BREAK CLEAR** statement cancels any deferred break event.

For all of the above forms, @SYSTEM.RETURN.CODE is returned as the current value of the break inhibit counter unless an error occurs, in which case it is set to a negative error code.

The final form, **BREAK ON USER** *n*, is only available to users registered as administrators and enables the break key for the specified user**.** @SYSTEM.RETURN.CODE is returned as zero unless an error occurs, in which case it is set to a negative error code.

4.14 BUILD.INDEX

The **BUILD.INDEX** command populates an alternate key index

Format

BUILD.INDEX *filename field(s)*

BUILD.INDEX *filename* **ALL**

where

filename is the name of the file for which the index is to be built.

field(s) is one or more field names for which indices have been created.

The **BUILD.INDEX** command deletes any existing index data for the named field(s) and populates the index by processing all records currently in the file. The **ALL** keyword can be used to build all indices that have been created for the file.

BUILD.INDEX is best performed immediately after using **CREATE.INDEX** to construct the index. Once the index has been built, it will be maintained automatically whenever changes are made to the file and will be used automatically by the query processor.

The **BUILD.INDEX** command requires exclusive access to the file and may take some time to complete for a very large file. It is therefore best executed at quiet times.

See also:
CREATE.INDEX, **DELETE.INDEX**, **LIST.INDEX**, **MAKE.INDEX**

4.15 CATALOGUE

The **CATALOGUE** command (which may be entered with the American spelling for compatibility with other products) adds a compiled QMBasic program to the global or private catalogue file or as a locally catalogued entry in the VOC.

Format

CATALOGUE {*file.name* {*catalogue.name*}} *record.name* {*options*}

where

file.name is the name of the directory file holding the program. If omitted, this defaults to BP, the .OUT suffix being added automatically.

catalogue.name is the name by which the program or subroutine is to be catalogued. If omitted, the *record.name* is used. The catalogue name is translated to uppercase though calls from QMBasic programs are case insensitive. Except as described below, catalogue names must start with a letter. Subsequent characters may be letters, digits, periods, percent signs, dollar signs, hyphens or underscores.

For compatibility with other database systems, the *catalogue.name* may also commence with a digit though such catalogued items can only be used as user defined conversion codes and not as call names in programs.

record.name is the name of the record within the specified file. The *record.name* may be specified as an asterisk to catalogue all programs in *file.name*. If *record.name* is omitted and the default select list is active, this list will be used to determine the programs to be catalogued.

options are any of the following:

LOCAL The program is to be catalogued in the VOC.

GLOBAL The program is to be catalogued for use by all accounts.

NO.QUERY Suppresses all confirmation prompts.

NOXREF Catalogues the program without any symbol and line cross-reference information. This results in lower disk and memory usage but prevents full diagnostic messages in case of run time errors.

The **CATALOGUE** command makes a program or subroutine available for access via the QMBasic CALL statement. Catalogued programs can also be executed as command simply by entering their name at the command prompt or within a stored sentence or paragraph.

Private Cataloguing

Without either the **LOCAL** or **GLOBAL** keyword, the program is copied to the private catalogue in the account from which the command is executed and is available only to users of that account.

The private catalogue is normally a subdirectory, cat, under the account directory but can be moved by creating an X-type VOC entry named $PRIVATE.CATALOGUE in which field 2 contains the pathname of the alternative private catalogue directory. This only takes effect when QM is re-entered or on use of the **LOGTO** command. This feature is particularly useful where two or more accounts are to share a common private catalogue.

Global Cataloguing

With the **GLOBAL** keyword, the program is copied to the global catalogue file in the QMSYS directory and is available from all accounts. Global cataloguing is also implied by adding one of the following prefix characters to the *catalogue.name* of the program:

*	User subroutine prefix provided for compatibility with other systems
!	User callable system supplied subroutines
_	Internal undocumented subroutines
$	System subroutines, only callable from internal mode programs

Local Cataloguing

With the **LOCAL** keyword, an entry is written to the VOC file allowing calls only from the account in which the program is catalogued. This is useful during testing or for functions that are not called frequently. The first call to programs catalogued in this way are slower than to private or globally catalogued programs. Once the program has been loaded into memory, speed will be identical.

The VOC entry for a locally catalogued program is of type V (verb) and has a dispatch field of CS. The third field holds the pathname of the executable program.

See also:
BASIC, **DELETE.CATALOGUE**, **MAP**

4.16 CLEAN.ACCOUNT

The **CLEAN.ACCOUNT** command clears the $HOLD, $COMO and $SAVEDLISTS files.

Format

CLEAN.ACCOUNT

The **CLEAN.ACCOUNT** command is used to remove records from the $HOLD, $COMO and $SAVEDLISTS files. Periodic use of this command will ensure that redundant records are not left in these files. The $COMO file is not cleared if a como file is active when the command is issued.

4.17 CLEAR.ABORT

The **CLEAR.ABORT** command clears the abort status in an ON.ABORT paragraph.

Format

CLEAR.ABORT

When an application generates an abort event, QM discards all programs, paragraphs, menus, etc running in the process and returns to the command processor. Before displaying the command prompt, the system checks for an ON.ABORT item in the VOC (usually a paragraph) and, if found, executes it.

The ON.ABORT paragraph is intended as a means of preventing a user ever arriving at the command prompt if the application fails. Typically, the ON.ABORT paragraph simply terminates the session but it might log the event or perform other processing. If the processing in the ON.ABORT paragraph causes a further abort, the session is terminated.

Sometimes, it may be useful to restart the application from the ON.ABORT paragraph. In this case, a further abort should probably re-enter the ON.ABORT paragraph. The normal action of automatic termination of the session on the second abort can be suppressed by clearing the abort status in the ON.ABORT paragraph. It then becomes the developer's responsibility to avoid endless loops if the ON.ABORT action generates a further abort.

See also:
ABORT command, QMBasic **ABORT** statement

4.18 CLEAR.DATA

The **CLEAR.DATA** command (synonym **CLEARDATA**) clears the data queue created by the **DATA** command or the QMBasic **DATA** statement.

Format

CLEAR.DATA

The data queue is cleared automatically on return to the command prompt. The **CLEAR.DATA** command allows the queue to be cleared within a paragraph, for example, when recovering from premature termination of a program that uses the data queue.

@SYSTEM.RETURN.CODE is not affected by this command.

Example

```
PA
RUN ARCHIVE.PREVIOUS.YEAR
DATA Y
SELECT ORDERS WITH DATE BEFORE "1 JAN <<@YEAR>>"
DELETE ORDERS
```

The above paragraph might be used to archive old order data at the start of a new business year and then delete the old records from the ORDERS file. The archive program asks the user if a report is to be printed and the DATA statement is used to provide the answer to this question from within the paragraph. Because it is using a select list, the DELETE command will prompt the user for confirmation before deleting the selected records.

If the archive program fails before asking whether a report is required, the "Y" in the data queue will not be read by this program and will still be in the queue when the **DELETE** command is executed. It will therefore be used erroneously to answer the delete confirmation prompt.

This sort of situation can be avoided by inserting a **CLEAR.DATA** statement before the **SELECT** . In general, it is good practice to insert a **CLEAR.DATA** after any command that uses **DATA** and could terminate without reading the queued data. This action is not automatic because the data queue is frequently used to pass data from one program to another.

See also:
CLEAR.INPUT

4.19 CLEAR.FILE

The **CLEAR.FILE** command deletes all records from a file.

Format

CLEAR.FILE {**DATA** | **DICT**} *file.name*

If neither the **DATA** keyword nor the **DICT** keyword is not specified, only the data portion of the file is cleared.

If the **DICT** keyword is specified, only the dictionary portion of the file is cleared.

In the case of a dynamic file, the file returns to its minimum modulus and all overflow space is released.

4.20 CLEAR.INPUT

The **CLEAR.INPUT** command (synonym **CLEARINPUT**) clears all unprocessed characters entered at the keyboard.

Format

CLEAR.INPUT

The **CLEAR.INPUT** command clears all keyboard type-ahead. It may be useful, for example, after a program terminates at an error to ensure that unprocessed keyboard data is not treated as input to the next program.

@SYSTEM.RETURN.CODE is not affected by this command.

See also:
CLEAR.DATA

4.21 CLEAR.LOCKS

The **CLEAR.LOCKS** command releases task locks.

Format

CLEAR.LOCKS {*lock.number*}

where

lock.number	is the number of the task lock (0 to 63) to be released. If omitted, all task locks held by the process are released.

@SYSTEM.RETURN.CODE is set to the lock number if releasing a single lock or 64 if releasing all locks. Errors result in negative error code values.

Examples

```
CLEAR.LOCKS 5
Released task lock 5
```

This example shows the **CLEAR.LOCKS** command used to release a specific task lock.

```
CLEAR.LOCKS
All task locks released
```

This command releases all task locks held by the process.

See also:
LIST.LOCKS, **LOCK**

4.22 CLEAR.PROMPTS

The **CLEAR.PROMPTS** command (synonym **CLEARPROMPTS**) clears all stored inline prompts and responses.

Format

CLEAR.PROMPTS

Inline prompt responses are cleared automatically on return to the command prompt. The **CLEAR.PROMPTS** command allows responses to be cleared within a paragraph should this be necessary for correct processing of later inline prompts.

@SYSTEM.RETURN.CODE is not affected by this command.

See also:
Inline prompts

4.23 CLEAR.SELECT

The **CLEAR.SELECT** command (synonym **CLEARSELECT**) clears an active select list. It is useful to prevent use of a select list by a subsequent command when, for example, the **SELECT** was performed in error.

Format

CLEAR.SELECT	Clears select list 0, the default list
CLEAR.SELECT *list.number*	Clears the specified list (0 to 10)
CLEAR.SELECT ALL	Clears all select lists

@SYSTEM.RETURN.CODE is returned as the list.number when clearing a specific select list, 11 when clearing all select lists or a negative error code.

4.24 CLEAR.STACK

The **CLEAR.STACK** command clears the command stack.

Format

CLEAR.STACK

The **CLEAR.STACK** command removes all entries from the current command stack.

@SYSTEM.RETURN.CODE is not affected by this command.

See also:
GET.STACK, **SAVE.STACK**

4.25 CLR

The **CLR** command (synonym **CS**) clears the terminal screen.

Format

CLR

@SYSTEM.RETURN.CODE is not affected by this command.

4.26 CNAME

The **CNAME** command (synonym **RENAME**) changes the name of a file or record(s) within a file.

Format

CNAME *old.file.name***,** *new.file.name*

CNAME *old.file.name* **TO** *new.file.name*

or

CNAME {**DICT**} *file.name old.record.id***,** *new.record.id*

CNAME {**DICT**} *file.name old.record.id* **TO** *new.record.id*

where

old.file.name	is the current name of the file to be renamed.
new.file.name	is the new name of the file to be renamed.

or

file.name	is the name of the file containing the record(s) to be renamed. The optional **DICT** prefix specifies that the dictionary portion of the file is to be processed.
old.record.id	is the current name of the record to be renamed.
new.record.id	is the new name for the renamed record.

Used with two file names, the **CNAME** command renames *old.file.name* to *new.file.name*. Only the VOC record defining the file is renamed. The underlying operating system directory representing the file is not affected.

Used with a single file name and two record names, the **CNAME** command renames a record within the file. In this format, multiple records may be renamed in a single command by repeating the *old.record.id* **TO** *new.record.id* component of the command.

The command

```
CNAME VOC OLD.NAME TO NEW.NAME
```

is equivalent to

```
CNAME OLD.NAME TO NEW.NAME
```

Examples

```
CNAME CUST.FILE A7194 TO A7149
```

This command renames record A7194 of file CUST.FILE to A7149.

```
CNAME STOCK, INVENTORY
```

This command renames the STOCK file to INVENTORY. The VOC record defining the file is renamed. The underlying operating system directories representing the data file and the dictionary are also renamed if they are the default names and the new names are acceptable operating system directory names.

```
CNAME STOCK A8135,A008135 D4923,D004923
```

This command renames two data records within the STOCK file.

4.27 COMO

The **COMO** command controls recording of terminal output in a como (command output) file.

Format

COMO ON *record.name*	Commence recording of terminal output in named record.
COMO OFF	Terminate recording of terminal output.

Como records are stored in a file named $COMO. This is created automatically when the **COMO ON** command is first used. The default pathname of $COMO under the account directory can be changed by creating the file in an alternative place. The file used for storing como data must be a directory file.

The **COMO** command is mainly intended as a diagnostic aid during application development. It can be used, for example, to look back at an error message that was overwritten on the screen before the user had time to read it.

4.28 COMPILE.DICT

The **COMPILE.DICT** command (synonym **CD**) is used to compile A, C, I and S-type records in dictionaries.

Format

COMPILE.DICT *file.name* {*Itype.name*} ... {**NO.QUERY**} {**NO.PAGE**}

COMPILE.DICT ALL {**NO.PAGE**}

COMPILE.DICT LOCAL {**NO.PAGE**}

where

file.name	is the name of the file containing the I-types to be compiled
Itype.name	is the name of the record to be compiled. Multiple names may be given in a single use of the command. If omitted, all A, C, I and S-type records in the dictionary are compiled unless the default select list is active, in which case that list is used.
NO.QUERY	suppresses the confirmation prompt if a select list is used.
NO.PAGE	suppresses pagination of output to the screen.

The **COMPILE.DICT ALL** and **COMPILE LOCAL** formats provide an easy way to compile all items in multiple files. The **ALL** keyword processes the dictionaries of all files referenced by F-type VOC entries. The **LOCAL** keyword restricts this to files that do not have a directory separator in the dictionary pathname.

A, C, I and S-type records may also be compiled using **MODIFY** and are automatically compiled by all query processor commands if necessary.

The main need for the **COMPILE.DICT** command is where the expression in one dictionary item uses the value of another. Because nested expressions are handled by a compile time substitution rather than a run time call, a change to the second expression requires the dictionary item that uses it to be recompiled. The automatic compilation performed by the query processor will not detect this need. In general, it is recommended that all dictionary items are recompiled whenever a modification is made to an expression that may be used by another dictionary item.

4.29 CONFIG

The **CONFIG** command reports your licence details and configuration parameters. It can also be used to modify the values of some parameters.

Format

CONFIG {**LPTR**}

CONFIG *param new.value*

The first format of the **CONFIG** command allows you to examine your system configuration. The report shows the licence details followed by the values of configurable parameters. The **LPTR** option directs the report to the default printer.

The second form can be used to set parameter *param* to *new.value* in the current process. Only parameters that are maintained on a per-process basis can be modified.

Examples

```
CONFIG

Version number 2.2-10
Licence number 1961491396, System id LWWK-FTXT
Maximum users  50, available 43
Expiry date    31 DECEMBER 2007
Licensed to Manor Developments Limited

MUSTLOCK   0
NUMFILES   60
NUMLOCKS   70
OBJECTS    0
OBJMEM     0 kb
SORTMEM    1024 kb
SORTWORK   c:\temp
```

The first section of output corresponds to the licence data entered when the system was installed or subsequently relicensed. The second section shows the values of configurable parameters from the qm.ini file in the Windows directory or the /etc/qmconfig file on other platforms.

Example

```
CONFIG MUSTLOCK 1
```

This command modifies the value of the MUSTLOCK parameter to be 1. Only the process in which the command is executed is affected.

4.30 CONFIGURE.FILE

The **CONFIGURE.FILE** command changes the configuration of a file.

Format

CONFIGURE.FILE {**DICT**} *file.name parameters*

where

file.name	is the name of the file to be configured.
parameters	are the new settings of the file configuration parameters. The following parameters may be specified:

DYNAMIC	Converts file to dynamic hashed type. Ignored if file is already dynamic.
DIRECTORY	Converts file to directory type. Ignored if file is already a directory.
GROUP.SIZE *n*	sets the group size in units of 1024 bytes. Values in the range 1 to 8 are permitted.
MINIMUM.MODULUS *n*	sets the minimum modulus for the file. Any positive non-zero value may be used.
LARGE.RECORD *bytes*	sets the large record size in bytes.
SPLIT.LOAD *pct*	sets the split load factor for the file.
MERGE.LOAD *pct*	sets the merge load factor for the file.
DEFAULT	resets all parameters to their default values.
NO.CASE	converts the file to use case insensitive record ids.
CASE	converts the file to use case sensitive record ids.
NO.RESIZE	disables file resizing.
RESIZE	enables file resizing.
IMMEDIATE	causes an immediate file resize, if required.

Parameters which are not specified retain their existing values.

The **CONFIGURE.FILE** command adjusts the settings of one or more file parameters. Changes to the file type or group size result in immediate restructuring of the file and require exclusive access. Changes only affecting other dynamic file parameters will occur steadily as the file is updated unless the IMMEDIATE option is used.

Note that converting a file from case sensitive ids to case insensitive ids will result in loss of data if

the file contains records that contain two or more record using keys with alternative casing of the same text.

The NO.RESIZE option disables the normal automatic split/merge operations that occur in dynamic files. The IMMEDIATE option can be used later to force the deferred splits/merges to be applied. See the description of dynamic files for more details on the use of this feature.

The resizing operations of the IMMEDIATE option are fully interruptable and can be performed while the file is in use.

Examples

```
CONFIGURE STOCK MINIMUM.MODULUS 200 SPLIT.LOAD 75
```

This command changes the minimum modulus and split load percentage of the STOCK file. The actual change will take effect as the file is updated by future access.

```
CONFIGURE STOCK DIRECTORY
```

This command changes the file to be a directory file.

4.31 COPY

The **COPY** command copies selected records from one file to another, or within the same file.

Format

COPY FROM {**DICT**} *src.file* {**TO** {**DICT**} *tgt.file*} {*src.rec*{,*tgt.rec*}} {*options*}

where

src.file	is the file from which the records are to be copied.
tgt.file	is the file to which the records are to be copied. If omitted, records are copied within the *src.file*.
src.rec	is the name of the record to be copied.
tgt.rec	is the name of the record to which *src.rec* is to be copied. If omitted, the record is not renamed.
options	are taken from the following:

ALL	Copy all records from *src.file* to *tgt.file*. This option cannot be used with named records or a select list.
BINARY	Copy data in binary mode, suppressing translation between field marks and newlines when copying between a hashed file and a directory file in either direction. This mode is implied if both are directory files.
DELETING	Delete the record(s) from *src.file* after copying.
NO.QUERY	Suppresses confirmation prompt when using a select list.
OVERWRITING	Overwrite existing record(s) of the same name in *tgt.file*. Without this option, records which already exist are not copied. This option may not be used with **UPDATING**.
REPORTING	Display the id of each record as it is copied.
UPDATING	Only copy records if they already exist in the target file. This option may not be used with **OVERWRITING**.

Any number of source and target record pairs may be specified. If all records in the file are to be copied, the keyword **ALL** may be used in place of specified record names.

If no source records are specified and the default select list is active, this list is used to determine

the records to be copied. A confirmation prompt is issued before copying commences unless the **NO.QUERY** keyword is used.

The **COPY** command does not normally overwrite existing records. The keyword **OVERWRITING** allows this operation. Thus a command of the form

```
COPY FROM src.file TO tgt.file ALL
```

would only copy records that do not already exist in the target file.

Conversely, the keyword **UPDATING** copies records only if they already exist in the target file.

The **DELETING** keyword causes **COPY** to delete records from the source file after they have been successfully copied to the target file.

The **REPORTING** keyword causes a message to be displayed for each record copied.

@SYSTEM.RETURN.CODE is returned as the number of records copied or a negative error code.

Example

```
COPY FROM NEWVOC TO VOC ALL OVERWRITING
```

This command copies all records from the NEWVOC file to the VOC, replacing existing records of the same name. This could be used, for example, if the VOC had been damaged by an accidental deletion of some standard records.

See also:
COPYP

4.32 COPYP

The **COPYP** command copies selected records from one file to another, or within the same file using Pick syntax.

Format

COPYP {**DICT** }*src.file* {*id.list*} {*options*}

where

src.file is the file from which the records are to be copied. The optional DICT prefix indicates that the dictionary portion of the file is to be used.

id.list is a list of ids of the records to be copied. If specified as an asterisk, all records in the source file are copied. If omitted, an active select list is used.

options is a list of option codes. These must be prefixed by an open parenthesis. The available codes are:

- **B** Copy data in binary mode, suppressing translation between field marks and newlines when copying between a hashed file and a directory file in either direction. This mode is implied if both are directory files.
- **D** Deletes the source records after copying.
- **I** Suppresses display of record ids.
- **N** Suppresses pagination when displaying records on the terminal.
- **O** Overwrites existing records in the target file.
- **P** Sends the record data to a printer.
- **S** Suppresses field numbers with P or T.
- **T** Sends the record data to the terminal.

If the P or T options are used, the records identified by *id.list* are sent to the printer or the screen.

If neither the P nor T options are used, the command prompts for a space separated list of destination record ids. If there are more ids in *id.list* than in the destination list, the source id is used as the destination id for the extra items.

The destination list can begin with a file name prefixed by an open parenthesis to direct output to a different file. The name can optionally be followed by a close parenthesis.

@SYSTEM.RETURN.CODE is returned as the number of records copied or a negative error code.

The **ALIAS** command can be used to make **COPYP** the default for **COPY** without removing the ability for other users or software packages to access the original **COPY** command.

Examples

COPYP ACCOUNTS * (D
To: (SAVED.ACCOUNTS
17 record(s) copied and deleted.

This command copies all records from the ACCOUNTS file to the SAVED.ACCOUNTS file, deleting the originals.

COPYP BP PRT.INVOICE
To: PRT.INVOICE2
53 record(s) copied.

This command copies record PRT.INVOICE in the BP file to a record named PRT.INVOICE2 in the same file.

See also:
COPY

4.33 COPY.LIST

The **COPY.LIST** command copies a saved select list to another file or a different record in the same file. Alternatively, the list can be output to the display.

Format

COPY.LIST *src.list* {**,** *tgt.list*} {**FROM** *src.file*} {**TO** *tgt.file*} {*options*}

where

src.list	is the name of the saved select list that is to be copied. If *src.list* is given as *****, all saved select lists in the source file are copied.
tgt.list	is the name to be used for the copied select list. If omitted, the list retains its original name. A *tgt.list* name cannot be specified when copying all saved lists from the source file.
src.file	is the name of the file holding the *src.list* to be copied. If omitted, the default saved lists file **$SAVEDLISTS** is used.
tgt.file	is the name of the file to receive the copied select list. If omitted, the default saved lists file **$SAVEDLISTS** is used.
options	may be any of the following

CRT	Output the select list to the display. Neither *tgt.list* nor *tgt.file* may be specified with this option.
DELETING	Delete *src.list* after copying.
LPTR {*n*}	Output the select list to logical print unit *n*. If *n* is not specified, the default print unit is used.
NO.PAGE	Used with the **CRT** option, this option suppresses the normal pause between successive pages of output.
OVERWRITING	If *tgt.list* already exists in *tgt.file*, this option allows overwriting of the existing list. Without this option, a message is displayed and no copy occurs.

The **COPY.LIST** command is used to copy saved select lists. The **FROM** and **TO** options allow copying from and to files other than the default **$SAVEDLISTS** file. When the default file is used, it will be created if it does not already exist.

The **COPY.LIST** command does not affect any active select lists.

Example

```
COPY.LIST INVENTORY TO INVENT.LISTS OVERWRITING
```

This command copies the select list previously stored in **$SAVEDLISTS** as INVENTORY to a record of the same name in file INVENT.LISTS. Any existing record of the same name is overwritten.

See also:
DELETE.LIST, **EDIT.LIST**, **GET.LIST**, **SAVE.LIST**

4.34 CREATE.ACCOUNT

The **CREATE.ACCOUNT** command creates a new QM account.

Format

CREATE.ACCOUNT *acc.name pathname* {**NO.QUERY**}

where

acc.name	is the name to be given to the new account. This name must start with a letter and may not contain spaces. The name will be translated to uppercase and must not exceed 32 characters in length. The command will prompt for this if it is not given on the command line.
pathname	is the pathname of the operating system directory to hold the account. The directory will be created if it does not already exist but the parent directory must already exist. The command will prompt for this if it is not given on the command line.
NO.QUERY	suppresses the confirmation prompts when the *pathname* directory already contains a VOC file or when creating a new directory.

The **CREATE.ACCOUNT** command creates a new account and populates the VOC file from the NEWVOC template stored in the QMSYS account. The new account is added to the register of accounts in the **ACCOUNTS** file in the QMSYS account.

If no *pathname* is specified on the command line, **CREATE.ACCOUNT** prompts for the pathname. The command will look in the VOC of the QMSYS account for an X-type record named $ACCOUNT.ROOT.DIR and, if this is found, will use field 2 of this record to specify a directory name under which the account should be created by default. This default pathname can be selected by entering a null response to the pathname prompt.

Example

```
CREATE.ACCOUNT  SALES  D:\SALES
```

This command creates a new QM account named SALES in the D:\SALES directory.

See also:
DELETE.ACCOUNT, UPDATE.ACCOUNT

4.35 CREATE.FILE

The **CREATE.FILE** command is used to create a QM file.

Format

CREATE.FILE {*portion*} *file.name* {**,** *subfile*} {*type*} {*configuration*}
{**USING DICT** *other.file*} {**ENCRYPT** *keyname*} {**NO.QUERY**}

where

portion	identifies the part of the file to create. This may be **DATA** to create just the data portion, **DICT** to create just the dictionary portion or omitted to create both.
file.name	is the name of the VOC record to be created to refer to the file. The operating system pathname used for the data file is the same as *file.name*. The directory for the dictionary component of a file has a .DIC suffix.
subfile	is the name of the subfile to be created in a multifile.
type	specifies the file type as **DIRECTORY** or **DYNAMIC**. If omitted, a dynamic file is created by default. Dictionaries are always created as dynamic files regardless of any *type* argument.

The *configuration* options are available only when creating a dynamic file and specify the file's configuration and location. These options are:

PATHNAME *path*	specifies the pathname of an existing operating system directory under which the file is to be created.
MINIMUM.MODULUS *n*	sets the minimum modulus for the file. Any positive non-zero value may be used. The default is 1.
GROUP.SIZE *size*	sets the group size as a multiple of 1024 bytes. This must be in the range 1 to 8. If omitted, the default group size is taken from the GRPSIZE configuration parameter.
LARGE.RECORD *bytes*	sets the large record size in bytes. The default is 80% of the group size.
SPLIT.LOAD *pct*	sets the split load factor for the file. The default is 80%.
MERGE.LOAD *pct*	sets the merge load factor for the file. The default is 50%.
VERSION *vno*	allows creation of files with internal formats compatible with older releases of QM.
NO.CASE	creates a file where the record ids will be treated as case insensitive. QM will write records preserving the casing

specified by whatever performs the write. Reads will locate records regardless of casing.

NO.RESIZE creates the file with resizing disabled. See **CONFIGURE.FILE** and dynamic files for more information.

The **USING DICT** clause allows creation of a data file that is to share the dictionary of an existing file. The effect of this option is to copy the content of field 3 of the VOC entry for *other.file* into field 3 of the newly created entry rather than setting up a new dictionary.

The **ENCRYPT** keyword enables record level data encryption and prefixes the name of the encryption key to be used.

The **NO.QUERY** option suppresses any confirmation prompts associated with the requested action.

Multifiles

A multifile is a collection of data files that share a common dictionary. Commands and application software refer to an individual subfile within the multifile by using a name that consists of the file name and subfile name separated by a comma.

When creating a multifile element, the default action of **CREATE.FILE** is to create a subdirectory named *file.name* under the account and create the element within this directory as *subfile*. An alternative location can be specified using the **PATHNAME** parameter.

The **CREATE.FILE** command can convert an existing simple file into a multifile. The existing data becomes a subfile with the same name as the file.

Examples

```
CREATE.FILE STOCK MINIMUM.MODULUS 150 GROUP.SIZE 4
```

This statement creates a dynamic file named STOCK with minimum modulus of 150 and group size 4.

```
CREATE.FILE SALES ENCRYPT SALESKEY
```

This statement creates a dynamic file named SALES and applies record level data encryption using the SALESKEY key.

```
CREATE.FILE DATA PROGRAMS DIRECTORY PATHNAME D:\APPS
```

This statement creates the data portion of a directory file named PROGRAMS. The full pathname for this directory file is specified as D:\APPS\PROGRAMS rather than using the default location.

```
CREATE.FILE ACCOUNTS,NORTH
```

This statement creates a multifile component named NORTH within the ACCOUNTS file.

See also:
CONFIGURE.FILE, **DELETE.FILE**, **LISTF**, **LISTFL**, **LISTFR**, data encryption, **CREATE.KEY**, **ENCRYPT.FILE**

4.36 CREATE.INDEX

The **CREATE.INDEX** command creates an alternate key index.

Format

CREATE.INDEX *filename field(s)* {**NO.NULLS**} {**PATHNAME** *index.path*}

where

filename is the name of the file for which the index is to be built.

field(s) is one or more field names for which indices are to be created.

The **CREATE.INDEX** command creates the file structures to hold an alternate key index. The index must subsequently be populated using **BUILD.INDEX** before it can be used.

The *field(s)* referenced in the command must correspond to D, I, A, S or C-type dictionary items. The dictionary items can be deleted once the index has been constructed as all details of the indexed field are stored in the index file but this is not recommended. The value to be indexed must not exceed 255 characters. Values longer than this will not be included in the index.

Indices constructed on I or C-type dictionary items or on A or S-type items that use correlative expressions should be such that they always produce the same result when executed for the same data record. Examples of possibly invalid I-type expressions would be those that use the date or time and those that use the **TRANS()** function to access other files.

The **NO.NULLS** specifies that no entry is to be added to the index for records where the indexed field is null.

Normally, the indices are stored as subfiles in the directory that represents the data file. The **PATHNAME** option allows the indices to be stored in an alternative location. This might be useful, for example, to balance loads across multiple disks or to exclude indices from backups as they can always be recreated.

All indices for a single data file must be stored together. The **PATHNAME** option can be used when creating the first index and specifies the pathname of a new directory that will be created at the same time as the index. If this option is included when creating subsequent indices the *index.path* must be the same as for the first index. It is suggested that the pathname should be based on the data file name for ease of recognition.

Index subfiles can be moved using the operating system level qmidx utility.

Data Encryption

Alternate key indices may be applied to files that use record level data encryption but developers should be aware that the index itself is not encrypted and hence weakens the security of the indexed fields.

Files using field level encryption cannot have indices on encrypted fields. Also, indices constructed

from calculated values such as I-types that use encrypted fields will fail if the record is updated by a user that does not have access to the relevant encryption key.

Example

```
CREATE.INDEX ORDERS DATE
BUILD.INDEX ORDERS DATE
```

The above commands create and build an index on the DATE field of the ORDERS file.

See also:
BUILD.INDEX, DELETE.INDEX, LIST.INDEX, MAKE.INDEX

4.37 CREATE.KEY

The **CREATE.KEY** command creates a data encryption key. This command can only be executed by users with administrator rights in the QMSYS account.

Format

CREATE.KEY {*keyname* {*algorithm* {*keystring*}}}

where

keyname is the name for the new encryption key.

algorithm is the encryption algorithm to be associated with the key.

keystring is the actual encryption key.

The command prompts for items not supplied on the command line.

The **CREATE.KEY** command creates a new entry in the key vault defining the encryption algorithm and actual key string to be used. If the key vault does not already exist, this command will create it, prompting for the master key to be used to encrypt the key vault. If the key vault does exist, the user will be asked to enter the master key unless it has already been entered during this session.

The *keyname* may be any sequence of up to 64 letters, digits, periods and hyphens. It is case insensitive.

The *algorithm* may be any of AES128, AES192 and AES256. The name is case insensitive.

The *keystring* is up to 64 characters, is case sensitive and can contain any character. For best security, the length of the *keystring* should be close to the actual length needed by the selected algorithm. This is 16, 24 or 32 characters for the 18, 192 and 256 bit algorithms respectively. The **CREATE.KEY** command will automatically transform the supplied key to the required length if necessary.

Once a key has been defined, it may be referenced in commands that set up encryption without needing to enter the master key. The *keyname* does not need to be treated as a secure item. The *keystring*, on the other hand, must not be disclosed. It is strongly recommended that a copy of the *keystring* is maintained off-site in case it is ever necessary to rebuild the key vault.

The **CREATE.KEY** automatically grants access to the key to the user that created it. Other users can be granted access using the **GRANT.KEY** command

Example

```
CREATE.KEY CARDNO AES256
```

The above command creates a 256 bit encryption key named CARDNO. The actual encryption string will be entered in response to a prompt.

See also:
Data encryption, **CREATE.FILE**, **DELETE.KEY**, **ENCRYPT.FILE**, **GRANT.KEY**, **LIST.KEYS**, **RESET.MASTER.KEY**, **REVOKE.KEY**, **SET.ENCRYPTION.KEY.NAME**

4.38 CREATE.USER

The **CREATE.USER** command creates a new user name in the register of users for network security checks.

User management is not applicable to the PDA version of QM.

Format

CREATE.USER {*username* {*account*}}

where

username	is the name of the user to be created. User names may be up to 32 character in length. On Windows systems the name is case insensitive. If omitted, a prompt is displayed for the user name.
account	is the name of the account to be entered when this user logs in. If not specified, an account name prompt will be issued when the user logs in.

The new user will not have administrator rights. See the **ADMIN.USER** command for a more powerful method of managing user names.

On Windows 98/ME, the new user is created with no password. Either the **PASSWORD** command should be used to apply a password or the user should be encouraged to set a password on first login.

On later versions of Windows and other platforms, this command does not affect the underlying operating system user name database. If the **SECURITY** command is used to enable QM's internal security system, users connecting directly to QM via a network who do not appear in the user register will be rejected. If the security system is not enabled, a previously unknown user will be added to the register automatically.

See also:
ADMIN.USER, **DELETE.USER**, **LIST.USERS**, **PASSWORD**, **SECURITY**

4.39 CT

The **CT** (Copy to Terminal) command displays the content of record(s) from a file.

Format

CT {**DICT**} *filename* {*record* ... | *****} {*options*}

where

filename	is the name of the file to be processed. The **DICT** keyword indicates that the dictionary portion of *filename* is to be used.
record	is the name of the record to be displayed. Multiple record names may be given in a single command. If the default select list (list 0) is active, this list is used as the source of record names. . If the default select list (list 0) is active, this list is used as the source of record names. Specifying a record name of an asterisk (*) displays all records in the file. If no record name is given and the default select list is active, this list will be used to determine which records are reported.
options	are chosen from the following:

BINARY	Display the record as a binary data item.
HEX	Display the data in each field in hexadecimal format.
LPTR *n*	Redirects the output to printer *n*. If *n* is omitted, the default printer is used.
NO.QUERY	When using a select list, the confirmation prompt is omitted.

The **CT** command displays the specified records from *file*. Each record is preceded by the file and record names.

When using the default select list as the source of record ids to be processed, a confirmation prompt is issued prior to commencing the display. This can be suppressed using the **NO.QUERY** option.

By default, the report shows each line (field) of the record on a separate line, prefixed with the line number. Lines that are wider than the output device are wrapped to the next line.

The **HEX** option, produces a report in which the data is displayed in hexadecimal form, two hexadecimal digits per character.

The **BINARY** option treats the record as binary data in which field marks are simply part of the data. The record is shown in both hexadecimal and character format, 16 bytes per line. Non-printing characters are displayed as dots (.) except for the field mark, value mark and subvalue mark which as shown as ^,] and \. Each line is prefixed by the byte offset (from zero) of the first byte on the line.

Example

```
SELECT VOC WITH F1 LIKE X...
```

```
CT VOC
```

This command sequence would display each X type record from the VOC.

```
CT READERS 2
READERS 2
1: Cartwright, D
2: 7 Spring GroveyNottingham
3: 1-1y3-1
```

The above command displays the record with id 2 from the READERS file. The `y` in the final line is a terminal dependent representation of the value mark character.

See also: DUMP

4.40 DATA

The **DATA** command supplies data to be used by an associated verb or QMBasic program which would normally take input from the keyboard. It may only be used in paragraphs.

Format

DATA {*text*}

where

text is the data to be used by the verb or program.

The **DATA** command must immediately follow the verb to which it is to apply. Multiple **DATA** commands may be used to supply data to be processed consecutively by the associated verb or program. Any intervening blank lines or comments in a sequence of **DATA** commands will be ignored except for processing of inline prompts.

When the verb or program executes an **INPUT** statement, the data from the **DATA** command(s) will be used. If all stored data has been used, keyboard input proceeds as normal.

Data stored by the **DATA** command or the QMBasic **DATA** statement is cleared on return to the command prompt. Thus unused data where, for example, a program terminates at an error, will not be carried forward to a later command. The **CLEAR.DATA** command can be used to clear the data queue within a paragraph.

The **DATA** command cannot be used to provide text for inline prompts.

Example

```
PA
* <<History>>
LOOP
   IF <<A,Record name>> = "" THEN GO DONE
   ED BP <<Record name>>
   DATA I * <<History>>
   DATA FI
REPEAT
DONE:
```

This paragraph inserts a history comment at the top of QMBasic programs. The editor commands to insert the text are provided using **DATA** commands. Note how the history text, which is only required once as it is common to all files edited, is obtained first using an inline prompt in a comment. The names of the records to be edited are then obtained in a loop which is terminated when a null name is entered.

4.41 DATE

The **DATE** command displays the current date and time.

Format

DATE {*date*}

DATE INTERNAL

where

date is an internal or external format date.

If no *date* is specified, the date and time are reported in the form

```
Tuesday, March 8, 1994  10:30 AM
```

See **TIME** for an alternative format date and time report.

If *date* is specified, the converted form of this date (internal to external or vice versa) is reported.

The **DATE INTERNAL** form shows the internal day number for the current date.

Examples

```
DATE
Tuesday, February 15, 2000 00:12:50 PM

DATE 10012
Tuesday, May 30, 1995

DATE 1 Oct 99
11597

DATE INTERNAL
14447
```

4.42 DATE.FORMAT

The **DATE.FORMAT** command selects the date format to be used by default or displays this setting.

Format

DATE.FORMAT OFF

DATE.FORMAT { **ON** }

DATE.FORMAT DISPLAY

DATE.FORMAT INFORM

DATE.FORMAT *conv.code*

DATE.FORMAT OFF selects American date format (month, day, year) as the default for date conversions.

DATE.FORMAT ON or **DATE.FORMAT** with no qualifying information selects European date format (day, month, year) as the default for date conversions.

DATE.FORMAT DISPLAY displays the current setting of the date format mode. If a non-default conversion code has been set, this is also displayed. @SYSTEM.RETURN.CODE is set to 0 for American date format or 1 for European date format.

DATE.FORMAT INFORM sets @SYSTEM.RETURN.CODE as described above but does not display the date setting.

DATE.FORMAT *conv.code* sets the default conversion code that will be used for date conversions that specify a code of D with no qualifying options. The *conv.code* must be a valid date conversion code. Specifying *conv.code* as D reverts to the standard default setting.

Examples

```
DATE.FORMAT ON
DATE.FORMAT DISPLAY
European date format is on
```

The above commands set European date format and then confirm this selection.

4.43 DEBUG

The **DEBUG** command enters the QMBasic program debugger.

Format

DEBUG {*file.name*} *record.name* {**LPTR**} {**NO.PAGE**}

where

file.name	is the name of the directory file holding the program to be run. If omitted, this defaults to BP. The .OUT suffix for the output file is supplied automatically.
record.name	is the name of the compiled program.
LPTR	causes output to logical print unit 0 to be directed to the printer. This is identical in effect to a **PRINTER ON** statement being performed within the program.
NO.PAGE	suppresses pagination of output to the terminal.

The **DEBUG** command enables detailed tracing of the operation of a QMBasic program to aid development and maintenance.

4.44 DELETE

The **DELETE** command deletes specified records from a file.

Format

DELETE {**DICT**} *file.name* {*record.name* ...}

DELETE {**DICT**} *file.name* {**NO.QUERY**}   To use a select list

DELETE {**DICT**} *file.name* **ALL** {**NO.QUERY**}

where

DICT	indicates that the records are to be deleted from the dictionary portion of the named file.
file.name	is the name of the file holding the records to be deleted.
record.name	is the name of the record to be deleted. Multiple record names may be specified in a single **DELETE** command.
ALL	causes all records to be deleted.
NO.QUERY	suppresses the confirmation prompt when using a select list.

If no record names are specified and the default select list is active, this list is used to determine the names of the records to be deleted. A confirmation prompt is issued before deletion commences unless the **NO.QUERY** option is used.

The **DELETE** command reports the number of records deleted on completion.

@SYSTEM.RETURN.CODE is returned as the number of records deleted unless the delete fails in which case it contains the error code.

Examples

```
SELECT STOCK WITH PART.NO < 10000
DELETE STOCK
71 records deleted
```

This example selects all records from the STOCK file with PART.NO less than 10000 and deletes them.

```
DELETE PARTS.FILE A12745 A84543 C36590
Record A84543 not found
2 records deleted
```

This example attempts to delete three specific records from PARTS.FILE. One of the records does

not exist.

4.45 DELETE.ACCOUNT

The **DELETE.ACCOUNT** command deletes a QM account.

Format

DELETE.ACCOUNT *acc.name*

where

acc.name	is the name of the account to be deleted. This name must be registered in the ACCOUNTS file in the QMSYS account (visible to all accounts as QM.ACCOUNTS).

The **DELETE.ACCOUNT** command deletes the named account and its entry in the accounts register. The user will be prompted to confirm whether the account directory is to be deleted.

Before deleting the account, QM checks whether any files in the account are referenced from other accounts and, if so, displays a list of these files.

Example

```
DELETE.ACCOUNT SALES
```

This command deletes the account named SALES.

See also:
CREATE.ACCOUNT, UPDATE.ACCOUNT

4.46 DELETE.CATALOGUE

The **DELETE.CATALOGUE** command (synonym **DELETE.CATALOG**) removes an entry from the system catalogue.

Format

DELETE.CATALOGUE {*name*...} {**GLOBAL** | **LOCAL**}

where

name	is a list of the catalogue call names of the programs or subroutines to be deleted. If the default select list is active, this will be used to identify the catalogue entries to be deleted and the *name* should be omitted.
GLOBAL	indicates that a globally catalogued version of this subroutine is to be removed.
LOCAL	indicates that a locally catalogued version of this subroutine is to be removed.

If neither the **GLOBAL** nor the **LOCAL** keyword is present, the **DELETE.CATALOGUE** command deletes entries from the private catalogue unless *name* has a prefix character that identifies a globally catalogued item.

The private catalogue is normally a subdirectory, cat, under the account directory but can be moved by creating an X-type VOC entry named $PRIVATE.CATALOGUE in which field 2 contains the pathname of the alternative private catalogue directory. This only takes effect when QM is re-entered or on use of the **LOGTO** command. This feature is particularly useful where two or more accounts are to share a common private catalogue.

See also:
BASIC, **CATALOGUE**, **MAP**

4.47 DELETE.COMMON

The **DELETE.COMMON** command deletes one or all named common blocks.

Format

DELETE.COMMON *name*

DELETE.COMMON ALL

where

name	is the name of the common block to be deleted. The keyword **ALL** causes all named common blocks to be deleted.

The **DELETE.COMMON** command deletes the named common block. It is particularly useful when debugging programs.

Common blocks can only be deleted if there is no active program referencing them. When the **ALL** keyword is used, blocks that cannot be deleted are ignored and no error is reported. When deleting a specific common block, a non-fatal error occurs if the block is in use.

Examples

```
DELETE.COMMON COM1
```

This command deletes common block COM1.

```
DELETE.COMMON ALL
```

This command deletes all named common blocks.

See also:
LIST.COMMON

4.48 DELETE.FILE

The **DELETE.FILE** command deletes one or both portions of a file.

Format

DELETE.FILE {**DATA** | **DICT**} *file.name* {**,** *subfile*} {*options*}

where

file.name	is the VOC name of the file to be deleted. The **DATA** prefix may be used to delete only the data portion of the file. The **DICT** prefix may be used to delete only the dictionary portion of the file.
subfile	is the subfile to be deleted from a multifile. If omitted and *file.name* refers to a multifile, the entire multifile will be deleted. Use of a subfile name implies use of the **DATA** keyword, leaving the dictionary in place.
options	are chosen from the following:

FORCE	is used to delete files with non-default names.
NO.QUERY	suppresses the confirmation prompt when using a select list.

If no file name is specified and the default select list is active, the **DELETE.FILE** command will use this list to determine the files to be deleted.

Deleting the data portion of a file deletes the associated operating system directory and clears field 2 of the VOC record describing the file. Deleting the dictionary portion of a file deletes the directory representing the dictionary and clears field 3 of the VOC record.

If the **DELETE.FILE** command results in a VOC record with fields 2 and 3 both null, the VOC record is also deleted. Thus deleting both portions of a file, the data portion of a file which had no dictionary or the dictionary portion of a file which had no data portion would also delete the VOC record.

Where the operating system name of the file recorded in the VOC entry is not the default name for the file (*file.name* for the data portion, *file.name***.DIC** for the dictionary portion), the **DELETE.FILE** command prompts for confirmation unless the **FORCE** option is used. This traps accidental deletion of files which are remote to the account or for which *file.name* is not the primary VOC reference.

Example

```
DELETE.FILE DICT INVENTORY
```

This command deletes the dictionary part of the file named INVENTORY.

See also:
CREATE.FILE, LISTF, LISTFL, LISTFR

4.49 DELETE.INDEX

The **DELETE.INDEX** command deletes an alternate key index.

Format

DELETE.INDEX *file.name field(s)*	to delete specific indices
DELETE.INDEX *file.name* **ALL**	to delete all indices

where

file.name	is the VOC name of the file holding the indices.
field(s)	are the names of indexed fields to be deleted.

The **DELETE.INDEX** command deletes the named indices. It requires exclusive access to the file to do this. Once an index has been deleted, any queries against the named *field(s)* may require processing of the entire file to locate records.

Example

```
DELETE.INDEX ORDERS DATE
```

This command deletes the index on the DATE field of the ORDERS file.

See also:
BUILD.INDEX, **CREATE.INDEX**, **LIST.INDEX**, **MAKE.INDEX**

4.50 DELETE.KEY

The **DELETE.KEY** command deletes a data encryption key. This command can only be executed by users with administrator rights in the QMSYS account.

Format

DELETE.KEY {*keyname*}

where

keyname is the name of the encryption key to be deleted. This is case insensitive.

The command prompts for the key name if it is not supplied on the command line.

The **DELETE.KEY** command deletes an entry in the key vault defining the encryption algorithm and actual key string. The user will be asked to enter the master key unless it has already been entered during this session.

Any data in data files encrypted using this key will become inaccessible.

Example

```
DELETE.KEY CARDNO
```

The above command deletes the encryption key named CARDNO.

See also:
Data encryption, **CREATE.FILE**, **CREATE.KEY**, **ENCRYPT.FILE**, **GRANT.KEY**, **LIST.KEYS**, **RESET.MASTER.KEY**, **REVOKE.KEY**, **SET.ENCRYPTION.KEY.NAME**

4.51 DELETE.LIST

The **DELETE.LIST** command deletes a previously saved select list.

Format

DELETE.LIST *list.name*

where

list.name is the name of the record in $SAVEDLISTS that is to be deleted.

The **DELETE.LIST** command deletes a previously saved select list from the $SAVEDLISTS file. It has no effect on any active select lists.

Example

```
DELETE.LIST INVENTORY
Deleted saved list 'INVENTORY'.
```

This example deletes a select list saved as INVENTORY.

See also:
COPY.LIST, **EDIT.LIST**, **GET.LIST**, **SAVE.LIST**

4.52 DELETE.USER

The **DELETE.USER** command deletes a user name from the register of users for network security checks.

User management is not applicable to the PDA version of QM.

Format

DELETE.USER {*username*}

where

username	is the name of the user to be deleted. If omitted, a prompt is displayed for the user name.

The named user is deleted from the user name register. It is possible to delete a user who is logged in.

See the **ADMIN.USER** command for a more powerful method of managing user names.

On Windows NT onwards and on all non-Windows platforms, this command does not affect the underlying operating system user name database, however, users who do not appear in the register will not be able to connect directly to QM over a network if QM's internal security system is enabled.

See also:
ADMIN.USER, **CREATE.USER**, **LIST.USERS**, **PASSWORD**, **SECURITY**

4.53 DISPLAY

The **DISPLAY** command displays text at the user's terminal.

Format

DISPLAY *text* {**:**}

DISPLAY @(*col*,*row*)*text* {**:**}

The optional colon at the end of the line suppresses the normal newline after the *text* is displayed.

The second format positions the cursor to the given column and row (both numbered from zero) before displaying the *text*. There must be no spaces in the cursor position element. Any spaces following the close bracket are treated as part of the *text*. The QMBasic @() function variants with a negative value for the first (or only) argument are also supported.

The @SYSTEM.RETURN.CODE variable is not affected by this command.

Example

A paragraph containing

```
DISPLAY Hello :
DISPLAY world
```

would display

```
Hello world
```

4.54 DUMP

The **DUMP** command displays the content of record(s) from a file in hexadecimal and character format.

Format

DUMP {**DICT**} *filename* {*record* ... | *****} {*options*}

where

filename	is the name of the file to be processed. The **DICT** keyword indicates that the dictionary portion of *filename* is to be used.
record	is the name of the record to be displayed. Multiple record names may be given in a single command. If the default select list (list 0) is active, this list is used as the source of record names. . If the default select list (list 0) is active, this list is used as the source of record names. Specifying a record name of an asterisk (*) displays all records in the file. If no record name is given and the default select list is active, this list will be used to determine which records are reported.
options	are chosen from the following:

LPTR *n*	Redirects the output to printer *n*. If *n* is omitted, the default printer is used.
NO.QUERY	When using a select list, the confirmation prompt is omitted.

The **DUMP** command displays the specified records from *file*. Each record is preceded by the file and record names.

The record is treated as binary data in which field marks are simply part of the data. It is shown in both hexadecimal and character format, 16 bytes per line. Non-printing characters are displayed as dots (.) except for the field mark, value mark and subvalue mark which as shown as ^,] and \. Each line is prefixed by the byte offset (from zero) of the first byte on the line.

When using the default select list as the source of record ids to be processed, a confirmation prompt is issued prior to commencing the display. This can be suppressed using the **NO.QUERY** option.

The **DUMP** command is equivalent to use of CT with the **BINARY** option.

Example

```
DUMP READERS 2
READERS 2
00000000: 43 61 72 74 77 72 69 67 68 74 2C 20 44 FE 37 20 |
Cartwright, D^7
00000010: 53 70 72 69 6E 67 20 47 72 6F 76 65 FD 4E 6F 74 |
Spring Grove]Not
00000020: 74 69 6E 67 68 61 6D FE 31 2D 31 FD 33 2D 31    |
tingham^1-1]3-1
```

The above command dumps the record with id 2 from the READERS file.

See also: CT

4.55 ECHO

The **ECHO** command suspends or enables echoing of keyboard input.

Format

ECHO OFF	Disable echoing of keyboard input
ECHO ON	Enable echoing of keyboard input
ECHO	Toggle echo status

The **ECHO** command allows temporary suspension of keyboard input echo. Echoing is automatically resumed in the event of an abort.

The @SYSTEM.RETURN.CODE variable is not affected by this command.

4.56 ED

The **ED** command enters the QM line editor. The synonym **EDIT** can be used.

Format

ED {**DICT**} *file.name* {*record.id*} {**NO.QUERY**}

where

DICT	indicates that records from the dictionary portion of the file are to be edited.
file.name	is the name of the file holding the record(s) to be edited.
record.id	is the name of the record to be edited. Multiple record ids may be given in which case each record is edited in turn.
NO.QUERY	suppresses the confirmation prompt if a select list is used.

If no *record.id* is specified and the default select list is active, this list is used to identify the records to be edited. If no *record.id* is specified and the default select list is not active, the **ED** command prompts for the *record.id*.

A *record.id* of * either on the command line or as the first *record.id* entered in response to the prompt will cause **ED** to select all records of the file and edit each in turn.

The editor maintains an update lock on the record that is being edited.

Overview

The editor takes its commands from the keyboard or the DATA queue. Each command line contains one editor command. Commands are retained in a stack similar to the command processor stack and can be repeated without complete retyping. Commands that take arguments specifying their exact function can be repeated by entering just the command name.

ED normally rejects commands and input text that contain non-printing characters. Where a non-printing character is to be entered, it can be typed as ^*nnn* where *nnn* is the decimal value of the character. Alternatively, the NPRINT command can be used to enable entry of non-printing characters.

The editor operates in two modes; edit and input. In edit mode, commands affect the current line (field). In input mode, new data is entered into the record. The editor numbers lines from one and the line number is displayed as a four digit number followed by a colon whenever lines are displayed or during input. The editor command prompt is four hyphens followed by a colon.

Positioning Commands

The commands listed below alter the position of the current line. In addition, entering a blank line at the command prompt advances the current position by one line, displaying the newly selected line.

n
Entering a number at the command prompt positions the current line to line *n*.

+n
Moves the current line position forward by *n* lines.

-n
Moves the current line position backward by *n* lines.

B
The **B** (bottom) command moves to the last line of the record.

F{*n*} {*string*}
The **F** (find) command moves forward to the next line containing *string* starting at column position *n* (from one). If *n* is omitted, *string* must occur at the start of the line.

The *string* must be preceded by a single space or a delimiter chosen from

! " # $ % & ( ) * + , - . / : = @ [ ] \ _ ` ' { } |

All characters after the delimiter will be treated as part of the string to be located. The string is case sensitive by default but the **CASE** command can be used to select case insensitive searches. See the **W** command for a description of wildcards.

If *string* is omitted, the string used by the most recent **F** command is used. If no **F** command has been executed, the editor moves forward by one line.

G*n*
The **G***n* (go to) command moves to line *n*. This is identical to the *n* command described above.

G<
The **G<** command moves to the first line of the currently defined block.

G>
The **G>** command moves to the last line of the currently defined block.

L{*n*} {*string*}
The **L** (locate) command moves forward to the next line containing *string* which must be preceded by a single space or a delimiter chosen from

! " # $ % & ( ) * + , - . / : = @ [ ] \ _ ` ' { } |

All characters after the delimiter will be treated as part of the string to be located. The string is case sensitive by default but the **CASE** command can be used to select case insensitive searches. See the **W** command for a description of wildcards.

The optional line count, *n*, limits the search to *n* lines from the current position. If *n* is present, all occurrences of *string* in the region to be searched are displayed and the current position is left at the end of the search region.

If *string* is omitted, the string used by the most recent **L** command is used. If no **L** command has been executed, the editor moves forward by one line.

M {*pattern*}
The **M** (match) command moves forward to the next line matching *pattern*. The *pattern*

argument is any valid pattern as used for the query processor **LIKE** operator. There must be a space before *pattern*.

If *pattern* is omitted, the string used by the most recent **M** command is used. If no **M** command has been executed, the editor moves forward by one line.

PO*n*
The **PO***n* (position) command moves to line *n*. This is identical to the *n* command described above.

T
The **T** (top) command moves to before line 1. There is no current line after this action.

Displaying Text

L*n*
The **L***n* (list) command displays *n* lines, moving the current line forward to the final displayed line. It is similar to the **P** command except that *n* must be included. Omitting *n* results in execution of a locate command as described above.

P{*n*}
The **P** (print) command displays *n* lines starting at the current line, moving the current line forward to the final displayed line. The value of *n* defaults to 23 on first use of the **P** command and to the value of *n* for the most recently executed **P** command thereafter. There must be no space between **P** and *n*.

PL{{**-**}*n*}
The **PL** (print lines) command displays *n* lines relative to the current line position. Negative values of *n* print lines before the current line. The value of *n* defaults to 23 on first use of the **PL** command and to the value of *n* for the most recently executed **PL** command thereafter. There must be no space between **PL** and *n*. The current line position is not changed by this command.

PP{*n*}
The **PP** (print position) command displays *n* lines surrounding the current line position. The value of *n* defaults to 23 on first use of the **PP** command and to the value of *n* for the most recently executed **PP** command thereafter. There must be no space between **PP** and *n*.

Inserting Text

I {*text*}
The **I** (insert) command inserts *text* after the current line, making this the current line. There must be a single space before *text*. Any additional spaces are treated as part of the inserted text. To insert a blank line type **I** followed by a single space.

If the **I** command is entered with no *text* and no space after the **I**, the editor enters input mode. It will prompt for successive lines until a blank line is entered at which point it returns to edit mode. Entering a line containing just a single space inserts a blank line.

IB {*text*}
The **IB** (insert before) command is similar to the **I** command described above except that *text* is

inserted before the current line.

LOAD {{*filename*} *record.id*}

The **LOAD** command inserts part or all of the specified record into the record being edited after the current line position. If *filename* is omitted, it defaults to the file associated with the current record. After the operation is complete, the current line is the first line of the newly inserted text.

The editor prompts for the start and end line numbers to be inserted. These default to the first and last lines respectively.

Deleting Lines

D{*n*}

The **D***n* (delete) command deletes *n* lines starting at the current line position. If *n* is not specified, only the current line is deleted. The line after the last line deleted becomes current.

DE{*n*}

Same as **D***n* described above.

Commands that Edit the Current Line

A {*string*}

The **A** (append) command appends *string* to the current line. A single space must separate *string* from the command. Any further spaces are treated as part of the inserted text.

If *string* is omitted, the most recent **A** command is repeated.

B *string*

The **B** (break) command splits the current line into two after *string*. The *string* argument must be present and is preceded by a single space. Any additional spaces are treated as part of *string*.

C/*old.string*/*new.string*/{*n*}{**G**}{**B**}

The **C** (change) command changes *old.string* to *new.string* in the current line. The delimiter around the strings may be any of

! " # $ % & ( ) * + , - . / : = @ [ ] \ _ ` ' { } |

The optional *n* component specifies that *n* lines starting at the current line are to be changed.

G causes all occurrences of *old.string* to be replaced. Without **G** only the first occurrence on the line is changed.

B applies the change to the currently defined block rather than the current line. **B** and *n* may not be used together.

The *n*, **G**, and **B**, qualifiers can be placed before the first string delimiter as an alternative to the syntax shown above.

Entering **C** with no strings repeats the last substitution.

Searches for *old.string* are case sensitive by default. See the **CASE** command for a way to

select case insensitive searches. See the **W** command for a description of wildcards.

CAT {*string*}
The **CAT** command concatenates the current line, *string* and the following line to form a single line. Omitting *string* merges the lines with no intervening characters. There must be a single space between the command and the *string*. Any additional spaces are treated as part of *string*.

DUP {*n*}
The **DUP** command duplicates the current line *n* times. The value of *n* defaults to one. The first line added by **DUP** becomes the current line.

R/*old.string*/*new.string*/{*n*}{**G**}{**B**}
Identical to **C** described above.

R {*text*}
The **R** (replace) command replaces the current line with the specified *text*. There must be a single space before *text*. Any additional spaces are treated as part of the replacement text. To replace a line by a blank line, type **R** with no *text*. The space may be omitted in this case.

Working with Multivalued Data

EV
The **EV** (edit values) command enters a mode where each value of the current line becomes a line of its own in a new editable item. To edit subvalues, use the **EV** command when already in EV mode. Used with a dictionary I-type entry, the **EV** command breaks compound I-types into separate lines to simplify editing.

QV
Exits from EV mode and returns to the previous edit text, discarding any changes made while in EV mode.

SV
Exits from EV mode and returns to the previous edit text, saving any changes made while in EV mode.
The **D***n* (delete) command deletes *n* lines starting at the current line position. If *n* is not specified, only the current line is deleted. The line after the last line deleted becomes current.

Block Edit Commands

Blocks are defined by two pointers; the start and end line. Block operations enable the entire block to be deleted, moved or copied.

<
Sets the current line to be the start line of the block. When used at the top of the record, the < command clears the block pointers.

>
Sets the current line to be the end line of the block.

<>
Sets the block to be just the current line.

BLOCK

Toggles block verification mode. When enabled, **COPY**, **DROP** and **MOVE** commands cause a prompt for confirmation prior to performing the operation. Block verification mode is enabled by default.

COPY

Copies the currently defined block to immediately after the current line position without affecting the original block.

DROP

Deletes the currently defined block.

MOVE

Copies the currently defined block to immediately after the current line position and deletes the original block.

PB

The **PB** (print block) command displays the currently defined block.

File Handling Commands and Leaving the Editor

DELETE
FD

Prompts for confirmation and then deletes the entire record from the file.

After the record has been deleted, the editor either terminates, continues with the next record from a select list or prompts for a new record id depending on the way in which it was entered.

The confirmation prompt can be suppressed using the ED.NO.QUERY.FD mode of the **OPTION** command.

FILE {{**DICT**} {*filename*} *record.id*}

If no arguments are included, the **FILE** command (which may be abbreviated to **FI**) writes the record being edited back to its file.

If *record.id* is specified, the modified record is saved under the new name. A confirmation prompt will be issued if a record of this name already exists.

If both *filename* and *record.id* are given, the record is saved to the specified file and record. Again, a confirmation prompt will be issued if a record of this name already exists.

After the record has been saved, the editor either terminates, continues with the next record from a select list or prompts for a new record id depending on the way in which it was entered.

Two extended forms of the FI command are available for use when editing QMBasic programs:

FIB {{*filename*} *record.id*} Files the record and then runs the QMBasic compiler.

FIBR {{*filename*} *record.id*} Files the record, runs the QMBasic compiler and, if the compilation is successful, runs the compiled program.

N

When using a select list, the **N** command moves to the next record in the list. A confirmation

prompt is issued if there are unsaved changes.

QUIT
EX

The **QUIT** command (which may be abbreviated to **Q**) and its synonym **EX** terminates editing of the current record. A confirmation prompt is issued if there are unsaved changes.

If a select list is in use, the editor will move on to the next record. Use the **X** command described below to terminate the entire edit in this case.

SAVE {{**DICT**} {*filename*} *record.id*}

If no arguments are included, the **SAVE** command writes the record being edited back to its file.

If *record.id* is specified, the modified record is saved under the new name. A confirmation prompt will be issued if a record of this name already exists.

If both *filename* and *record.id* are given, the record is saved to the specified file and record. Again, a confirmation prompt will be issued if a record of this name already exists.

Unlike the **FILE** command, editing continues after saving the record. The **SAVE** command does not change the names associated with the record being edited. A subsequent **SAVE** or **FILE** with the file and record names omitted will use the original names, not those of an intermediate **SAVE** command.

UNLOAD {{{**DICT**} *filename*} *record.id*}

The **UNLOAD** command saves part or all of the record being edited into the named file and record. If *filename* is omitted, it defaults to the file associated with the current record.

The editor prompts for the start and end line numbers to be saved. These default to the first and last lines respectively.

X

The **X** command aborts an edit when a select list is in use without saving any changes made to the record. A confirmation prompt is issued if there are unsaved changes. Any further entries in the select list are discarded and the editor terminates.

Miscellaneous Commands

?

The **?** command displays status information about the editor and the record being edited. This includes

The file name and record id
The current line number
Block start and end line positions
The command, if any, which will be reverted by OOPS.
Non-printing character expansion mode status (^)
Non-printing character entry mode status (NPRINT)
Block verify mode status (BLOCK)
The setting of search case sensitivity (CASE)

^

Toggles non-printing character expansion mode. When this mode is enabled, non-printing

characters are displayed as ^*nnn* where *nnn* is the decimal character number.

CASE OFF
Sets case insensitive mode for the **C**, **F** and **L** commands.

CASE ON
Sets case sensitive mode for the **C**, **F** and **L** commands. This is the default mode of the editor.

COL
Displays a column number ruler to aid alignment of inserted text

HELP {*topic*}
The **HELP** command displays a short description associated with the command identified by *topic*. If *topic* is omitted, this command enters the full help system. If *topic* is present but not recognised, **ED** tries to find a help page on this topic from the full help system.

NPRINT
Toggles non-printing character entry mode. When this mode is enabled, non-printing characters may be included in commands and input text. When disabled, non-printing characters are rejected but may still be entered using the ^*nnn* notation where *nnn* is the decimal character number.

OOPS
The **OOPS** command undoes the most recent function that modified the record. It cannot be used to forget positioning functions.

STAMP
The **STAMP** command inserts a single comment line below the current line indicating the account name, user name, date and time of the modification.

SPOOL
The **SPOOL** command prints a copy of the record on the default printer. If changes have been made but not yet written to the file, the printed version includes these changes. The optional lines qualifier specifies the number of lines to be printed starting at the current line. If this is omitted, the entire record is printed.

W{*char*}
Specifies a wildcard character that may be used in the **C** and **R** text replacement commands or the **F** and **L** search commands. Use of char within the search string of these commands will match against any single character. The wildcard character may not be a letter or the caret symbol (^). Use of the **W** command with no *char* qualifier turns off the wildcard.

XEQ {*command*}
The **XEQ** command executes the specified *command* which may be any command valid at the command prompt. The *command* may include any of the following items to substitute text into the command:

@FILE	The file name
@ID	The record id
@LINE	The text of the current line
@FM	A field mark (to separate multiple commands)
@VM	A value mark
@SM	A subvalue mark

Pre-Stored Edit Commands

Frequently used sequences of editor commands may be saved in a file and subsequently executed by entering just one command. Pre-stored command sequences can also include loops to repeat a series of commands.

Command sequences are saved using the **.S** command. This has several different syntaxes:

.S *item*	Save the most recent command
.S*n item*	Save command *n*
.S *item n***,***m*	Save commands *n* to *m*
.S *item n m*	Save commands *n* to *m*

In each case, *item* may be given as either a record id to be created in the default $ED file or as a file name and record id separated by a space. The values *n* and *m* may be given in either order. The commands are always saved in the same sequence as they appear on the editor command stack. The first line in the saved item has a type code of E as its first character followed by text describing when it was created.

The $ED file will be created automatically first time that the **.S** command is used to save commands in this file.

Multi-line inserts cannot be repeated from a saved command sequence, will cause the **.S** command to fail and, if edited into the pre-stored sequence manually, will be cause a warning message to be displayed when the command sequence is executed.

Alternatively, a user can create a $ED pre-stored item by using the editor:

```
ED $ED item.name
```

The first field of the item must contain E as its first character. Subsequent fields contain one editor instruction in the sequence that the user requires the operations to be performed.

A saved command sequence is executed by a command of the form

.X *item*

where *item* is either a record id in $ED or a file name and record id separated by a space. Unlike other command stack operations, **.X** *item* command is added to the command stack so that **.X** *n* can be used to repeat the pre-stored sequence.

Other useful command stack extensions for use with stored edit commands are:

.D *item*	Delete the specified item
.L *item*	List the item. If the record id is given as an asterisk, a list of stored edit sequences in the file is displayed.
.R *item*	Recall a previously saved set of commands to the stack.

A stored edit sequence may include the **PAUSE** command. Execution stops and the user may decide whether to continue by entering **.XR** or to terminate the sequence by entering **.XK**. Other editing commands may be executed before either of these responses is entered.

The **LOOP** command can be used to repeat a series of steps in the stored commands. The format is

LOOP *lineno count*

The edit continues with the command on *lineno*. Note that the first edit command in the pre-stored sequence is on line 2 as line 1 holds the type code and description. The **LOOP** will be performed *count* times before dropping through to the next command. Both *lineno* and *count* default to 1 if omitted.

Note that a sequence such as
001 I xyz
002 LOOP 1 3
executes the insert command four times because the **LOOP** jumps back three times.

A loop may validly include use of the **FI** command to file the record. When processing records from a select list, the pre-stored sequence continues execution from one record to the next.

Editor Command Stack

The following commands manipulate the editor command stack. Unless otherwise stated, the stack position argument, *n*, defaults to one.

.A{*n*} *string*
Append *string* to entry *n* of the editor command stack.

.C{*n*}/*old.string*/*new.string*/
Change *old.string* to *new.string* in line *n* of the editor command stack.

.D{*n*}
Delete line *n* of the editor command stack.

.I{*n*} *string*
Insert *string* as entry *n* of the editor command stack.

.L{*n*}
List *n* lines of the editor command stack. The value of *n* defaults to nine.

.R{*n*}
Recall line *n* of the editor command stack to the top of the stack.

.X{*n*}
Execute line *n* of the editor command stack.

See also **ED Pre-Stored Commands** above for additional command stack features.

Setting Default Modes

On entry, **ED** looks for an X-type VOC record named $ED.OPTIONS and, if this exists, examines fields 2 onwards of this record for options that set the default modes for the editor. These may be:

BLOCK {**ON** | **OFF**}	Turn on/off prompting for confirmation on **COPY**, **DROP** and **MOVE**. Default is ON.

CASE {**ON** | **OFF**}	Turn on/off case sensitivity for searches (**C**, **F**, **L**). Default is ON.
NPRINT {**ON** | **OFF**}	Turn on/off acceptance of non-printing characters on input. Default is OFF.

Unrecognised options or qualifiers are ignored.

4.57 EDIT.LIST

The **EDIT.LIST** command invokes the **ED** line editor to edit a saved select list in the $SAVEDLISTS file.

Format

EDIT.LIST *list.name*

where

list.name is the name of the saved select list to be edited. If omitted, a prompt is output.

The **EDIT.LIST** command enters **ED** to edit the named saved select list. All editing functions are available and care should be taken to ensure that the record remains a valid select list.

See also:
COPY.LIST, **DELETE.LIST**, **GET.LIST**, **SAVE.LIST**

4.58 ENCRYPT.FILE

The **ENCRYPT.FILE** command sets the data encryption key for specific fields or the entire record.

Format

ENCRYPT.FILE *filename field***,** *keyname ...*

ENCRYPT.FILE *filename keyname*

where

filename	is the name of the file to which encryption is to be applied.
field	is the name or field number of the field to which encryption is to be applied.
keyname	is the name of the encryption key to be used. This is case insensitive.

The first form of the **ENCRYPT.FILE** command sets the encryption key for one or more fields within a file that uses field level encryption. Encryption cannot be applied to a field that is used for an alternate key index.

The second form of the **ENCRYPT.FILE** command sets the encryption key for record level encryption. Alternate key indices can be defined in files that use record level encryption but, because the index itself is not encrypted, the indexed fields have reduced security.

If the file contains data records when this command is used, the file is processed to apply the encryption. A system failure or other process abort during this update will leave the file in a partially encrypted state and hence render it unusable. Always back up a file before using this command if the file contains data.

Examples

```
ENCRYPT.FILE CUSTOMERS CCARD,CARDNO
```

The above command encrypts the CCARD field of the CUSTOMERS file using the CARDNO encryption key.

```
ENCRYPT.FILE CUSTOMERS CKEY
```

The above command encrypts the CUSTOMERS file using the CKEY encryption key for record level encryption.

See also:
Data encryption, **CREATE.FILE**, **CREATE.KEY**, **DELETE.KEY**, **GRANT.KEY**, **LIST.KEYS**, **RESET.MASTER.KEY**, **REVOKE.KEY**, **SET.ENCRYPTION.KEY.NAME**

4.59 FILE.SAVE

The **FILE.SAVE** command creates a Pick style FILE-SAVE tape.

Format

FILE.SAVE {*account.list*} {*options*}

where

account.list	is a list of the names of the accounts to be saved. If omitted and the default select list is active, this list is used to determine the accounts to be saved. Otherwise, all accounts referenced in the QMSYS ACCOUNTS file are saved.
options	specifies options processing features:

BINARY	suppresses translation of newlines to field marks when saving directory files. Use this option when saving binary data.
DET.SUP	suppresses display of the names of files saved.
EXCLUDE.REMOTE	causes remote files to be omitted as described below.
INCLUDE.REMOTE	causes remote files to be saved as described below.
NO.QUERY	suppresses the confirmation prompt when using a select list..

The **FILE.SAVE** command creates a Pick style "compatible mode" tape and saves one or more QM accounts to it.

The tape to be created must first be opened to the process using the **SET.DEVICE** command.

The command reports its progress by displaying the name of each file as it is saved unless the **DET.SUP** option is used.

FILE.SAVE normally saves all files referenced by F-type records in the VOC of the account being saved. There is a three level mechanism by which files can be excluded:

1. Field 5 of the F-type VOC entry can contain
   - D Save the dictionary but omit the data element
   - E Exclude this file from an **ACCOUNT.SAVE** or **FILE.SAVE**
   - I Include this file in an **ACCOUNT.SAVE** or **FILE.SAVE**

2. If field 5 of the VOC record does not specify any of the above flags, the **EXCLUDE.REMOTE** and **INCLUDE.REMOTE** options are used to determine whether remote files (those with a directory delimiter in their pathnames) are to be saved.

3. If neither of the above methods of file selection is used, the value of the **EXCLREM** configuration parameter is used to determine whether remote files are to be saved.

By use of a combination of the above methods, it should be possible to achieve total control of what is included in a save.

See also:
ACCOUNT.RESTORE, **ACCOUNT.SAVE**, **FIND.ACCOUNT**, **RESTORE.ACCOUNTS**, **SEL.RESTORE**, **SET.DEVICE**, **T.ATT**, **T.DUMP**, **T.LOAD**, **T.xxx**

4.60 FIND.ACCOUNT

The **FIND.ACCOUNT** command locates an account on a Pick style FILE.SAVE tape.

Format

FIND.ACCOUNT *account.name*

where

account.name	is the name of the account to be located.

The **FIND.ACCOUNT** command can be used to position a multi-account FILE.SAVE tape to a specified account. The account can then be restored using the **ACCOUNT.RESTORE** command with the POSITIONED option.

The tape to be restored must first be opened to the process using the **SET.DEVICE** command.

Use of **FIND.ACCOUNT** with an account name that is not present on the tape can be used display a list of accounts that are on the tape.

See also:
ACCOUNT.RESTORE, **ACCOUNT.SAVE**, **FILE.SAVE**, **RESTORE.ACCOUNTS**, **SEL.RESTORE**, **SET.DEVICE**, **T.ATT**, **T.DUMP**, **T.LOAD**, **T.xxx**

4.61 FORMAT

The **FORMAT** command reformats QMBasic source programs to aid readability.

Format

FORMAT {*file.name*} {*record.name*} {**CASE**}

where

file.name	is the name of the directory file holding the QMBasic source program. If omitted, the *filename* defaults to BP.
record.name	is the name of the record within the file.

If the *record.name* is omitted and select list 0 is active, this is used as the source of record names to be formatted. Entries in this select list with a .H suffix are ignored. Thus the command

```
SELECT BP
```

is adequate to construct the select list.

The **FORMAT** command reformats a QMBasic program to comply with a conventional indentation standard. Programs may be entered with no regard to indentation and subsequently tidied up using **FORMAT**.

FORMAT will not move line breaks. Statements must be correctly delimited. The format actions performed are:

The **PROGRAM**, **FUNCTION** or **SUBROUTINE** statement and compiler directives are adjusted to start at the leftmost column.

Statements inside conditional blocks (**THEN**, **ELSE**, **ON ERROR**, **LOCKED**, **CASE**, etc.) are indented by three columns.

WHILE and **UNTIL** statements are aligned with their corresponding **LOOP** or **FOR** statement.

Multiple spaces between language elements are reduced to a single space.

Spaces before commas in statements or argument lists are removed. A single space will follow such a comma.

Labels are aligned to the left margin and any further text except comments is moved to the next line.

A comment on the same line as a statement is not moved unless not to do so would place it over the statement or with less than one space before the semicolon.

Lines holding left aligned comments are not changed.

Comment lines which commence with spaces are moved to the alignment of the surrounding code except where the preceding line was a comment (excluding trailing comments) in which case the line is aligned with the preceding line.

EQUate and **$DEFINE** lines are unchanged to preserve possible user defined column alignment.

The **CASE** option converts all language elements, labels and data names to lowercase. Names corresponding to **EQUate** or **$DEFINE**d tokens retain the casing of the definition.

Where a **$INCLUDE** directive is encountered, the include record is read to establish any **EQUATE** or **$DEFINE** tokens in it. All references to these tokens in the record being formatted are converted to upper case. The include record itself is not changed.

If **FORMAT** fails because of faulty syntax such as unmatched **THEN** and **END** statements, the source record remains unchanged. Diagnostic messages to aid location of such errors are displayed.

Example

```
         1         2         3         4         5
12345678901234567890123456789012345678901234567890123456789
SUBROUTINE GET.DATE(PROMPT.TEXT, VALUE)
LOOP
DISPLAY PROMPT.TEXT:;* Prompt for date
INPUT NEW.DATE
VALUE = ICONV(NEW.DATE,"DDMY");* Convert the date
WHILE STATUS()
REPEAT
END
```

A program initially entered as above, after formatting becomes

```
         1         2         3         4         5
12345678901234567890123456789012345678901234567890123456789
SUBROUTINE GET.DATE(PROMPT.TEXT, VALUE)
   LOOP
      DISPLAY PROMPT.TEXT :  ;* Prompt for date
      INPUT NEW.DATE
      VALUE = ICONV(NEW.DATE, "DDMY")  ;* Convert the date
   WHILE STATUS()
   REPEAT
END
```

With the **CASE** option this becomes

```
         1         2         3         4         5
12345678901234567890123456789012345678901234567890123456789
subroutine get.date(prompt.text, value)
   loop
      display prompt.text :  ;* Prompt for date
      input new.date
      value = iconv(new.date, "DDMY")  ;* Convert the date
```

```
      while status()
      repeat
   end
```

4.62 FORM.LIST

The **FORM.LIST** command creates an active select list from a list of record keys in a file.

Format

FORM.LIST {**DICT**} *file.name record.id*

where

file.name	is the name of the file holding the list of record keys to be used to form the select list. The **DICT** qualifier specifies that the dictionary of the file is to be processed.
record.id	is the name of the record in *file.name* holding the list of record keys to be used to form the select list.

The **FORM.LIST** command reads the named record and uses it to form active select list zero. Any previously active select list zero is discarded. Typically, the list of record keys has been generated by a user written program.

Example

```
FORM.LIST INVENT.LISTS INVENTORY
92 records selected.
```

In this example, a record named INVENTORY in file INVENT.LISTS is restored to become active select list zero.

4.63 FSTAT

The **FSTAT** command collects and report file access statistics.

Format

FSTAT ON *file.name...*	Enable statistic collection
FSTAT *file.name...* {**LPTR**}	Report statistics
FSTAT OFF *file.name...*	Disable statistics collection
FSTAT GLOBAL {**LPTR**}	Report global system statistics
FSTAT RESET	Clear global statistics counters
FSTAT	Periodic global statistics display

where

file.name is the name of the file to be processed. Multiple file names may be included in a single command. Alternatively, if no *file.name* is specified and the default select list is active, this list will be used to determine the files to be processed.

LPTR directs the report to the default printer. When reporting for multiple files, each file's data appears on a separate page.

The **FSTAT** command controls collection and reporting of file access statistics for dynamic files and any associated alternate key indices. Directory files cannot be used with this command but are included in the global statistics.

Use of **FSTAT** with the **ON** keyword clears the statistics counters associated with the file and enables collection of statistics. The overhead for data collection is extremely low except that a file that is opened to read only a few records will require a write to update the counters on disk when the file is closed. The **LISTF**, **LISTFL** and **LISTFR** commands can be used to determine which files have file statistics enabled.

The second form of **FSTAT** displays or prints a report of the file access statistics. Data collection must be enabled when this mode is used. When using a select list, entries that do not correspond to dynamic files for which statistics are enabled will be ignored.

Use of **FSTAT** with the **OFF** keyword disables collection of statistics.

The **GLOBAL** keyword displays a report of statistics accumulated across all files regardless of whether statistics collection is enabled for the individual files. The global counters are reset when QM is started. On Windows NT and later, this occurs automatically when the last user leaves QM unless QMSvc has been configured to maintain a persistent shared memory image. The counters can be reset manually by use of the **RESET** keyword.

Use of the **FSTAT** command with no arguments displays a periodic display of the global statistics, updated once per second. This shows four columns; the overall data since the counts were last reset, the data since **FSTAT** was entered, the data for the last second and average per-second values since **FSTAT** was entered.

The figures displayed by **FSTAT** are:

Opens	The number of times the file has been opened.
Reads	The number of read operations performed. This covers all types of read action (e.g. READ, READU, READL, MATREAD, MATREADU, MATREADL, etc). Reads that fail because a lock is held by another user are not counted.
Writes	The number of write operations performed.
Deletes	The number of delete operations performed. This includes deletes attempted for records that did not exist.
Clears	The number of times the file was cleared.
Selects	The number of QMBasic style SELECT operations performed.
Splits	The number of dynamic file split actions.
Merges	The number of dynamic file merge actions.
AK Reads	The number of records read from alternate key indices. This includes both application level reads (e.g. SELECTINDEX) and internal reads performed when updating an AK.
AK Writes	The number of records written to alternate key indices.
AK Deletes	The number of records deleted from alternate key indices.

Example

```
                              GLOBAL FILE STATISTICS
12:02:33

            ....System  .....Total  ..........  ...Average
            .....Total  ..this run  ...Per sec  ...per sec
Period        00:17:05    00:00:34
Opens              124           0           0         0.0
Reads           273161      143505        4228      4220.7
Writes          258086      134876        3958      3966.9
Deletes          13901        8628         269       253.8
Clears               0           0           0         0.0
Selects              0           0           0         0.0
Splits            4937          10           0         0.3
Merges               0           0           0         0.0
AK Reads        501091      269179        7924      7917.0
AK Writes       344094      178509        5221      5250.3
AK Deletes      156997       90670        2705      2666.8
```

4.64 GENERATE

The **GENERATE** command generates a QMBasic include record from a dictionary.

Format

GENERATE *file.name*

where

file.name is the name of the file to be processed.

Well structured QMBasic programs should not reference fields by field number but should instead use names defined using **EQUATE** tokens. The **GENERATE** command processes the dictionary of a named file and constructs an include record with an entry for each field. Optionally, it can also produce tokens for conversion codes associated with fields.

The generation process is controlled by an X-type record named $INCLUDE in the dictionary. The fields of this record are:

1 X

2 Target file name for include record. Defaults to BP.

3 Record name to be produced for dynamic array style tokens. Defaults to *file.name* with .H suffix.

4 Token prefix for dynamic array style tokens. Each token produced is constructed from the field name with this prefix. The prefix is separated from the field name by a dot.

5 Text to be inserted into copyright line.

6 "S" if only a single entry is to be included for any field. This is the default. "M" if multiple D-type records for the same field location should produce separate include tokens.

7 Include conversion code tokens? "N" omits conversion tokens. "Y" generates tokens for fields that have conversion codes. "A" generates tokens for all fields including those with a null conversion code.

8 Type to create: D for dynamic array tokens (default), M for matrix tokens. Both may be used together.

9 Record name to be produced for matrix style tokens. Defaults to *file.name* with .MAT.H suffix.

10 Matrix name for matrix style tokens. Defaults to *file.name*.

11 Token prefix for matrix style tokens. Each token produced is constructed from the field name with this prefix. The prefix is separated from the field name by a dot.

If the $INCLUDE record does not exist, it will be created when **GENERATE** is first run for the file. A prompt will be issued for the type of tokens to be generated (field 8) and the prefix character to be inserted into fields 4 and/or 11. All other fields will be left empty except for field 1 (X).

When creating the matrix style include record for use with **MATREAD**, the matrix is dimensioned to have one more element than the highest field number referenced in the dictionary. This allows for

the different ways in which normal and Pick style matrices handle unexpected fields.

4.65 GET.LIST

The **GET.LIST** command is used to restore a previously saved select list.

Format

GET.LIST *list.name* { **TO** *list.no* }

where

list.name	is the name of the record in **$SAVEDLISTS** that is to be restored.
list.no	is the select list number in the range 0 to 10 to which *list.name* is to be restored. If omitted, select list zero is used.

The **GET.LIST** command retrieves a previously saved select list from **$SAVEDLISTS**. If the target list *list.no* was already active, the retrieved list replaces the previous list.

Examples

```
GET.LIST OVERDUE.INVOICES
57 records selected.
```

This example restores the default select list from a list named OVERDUE.INVOICES in the **$SAVEDLISTS** file.

```
GET.LIST INVENTORY TO 3
91 records selected.
```

This example restores a select list saved as INVENTORY to select list 3.

See also:
COPY.LIST, **DELETE.LIST**, **EDIT.LIST**, **SAVE.LIST**

4.66 GET.STACK

The **GET.STACK** command restores a previously saved command stack.

Format

GET.STACK {*stack.name*}

where

stack.name	is the name of the saved command stack. A prompt is issued if this name is omitted.

The **GET.STACK** command replaces the current command stack with the record named *stack.name* from the $SAVEDLISTS file. The previous content of the command stack is discarded.

Example

```
GET.STACK <<@LOGNAME>>
Command stack restored from 'jsmith'
```

This command restores the command stack from a record with id as the user's login name in the $SAVEDLISTS file.

See also:
CLEAR.STACK, **SAVE.STACK**

4.67 GO

The **GO** command is used within paragraphs to jump to a labelled line.

Format

GO *label*{**:**}

Any number of lines in a paragraph may be labelled. A label name consists of any sequence of characters except for spaces and mark characters. The label must be terminated with a colon and, if there is a command on the same line as the label, there must be at least one space after the colon.

The label name in the **GO** command may be followed by an optional colon with no intervening spaces.

The command processor scans forwards through the current paragraph for a line with the given label. An error is reported if the label is not found and the paragraph is aborted. It is valid for a paragraph to contain multiple instances of the same label name though this is not recommended as it can make maintenance more difficult.

It is not possible to jump backwards within a paragraph or from a **GO** command in one paragraph to a label in another paragraph.

Example

A paragraph containing the sequence

```
DISPLAY Line 1
GO SKIP
DISPLAY Line 2
DISPLAY Line 3
SKIP: DISPLAY Line 4
DISPLAY Line 5
```

would display

```
Line 1
Line 4
Line 5
```

4.68 GRANT.KEY

The **GRANT.KEY** command grants access to a specific data encryption key. This command can only be executed by users with administrator rights in the QMSYS account.

Format

GRANT.KEY *keyname* {**GROUP**} *name* ...

where

keyname is the name of the encryption key. This is case insensitive

name ... is a list if usernames for users to be granted access. If prefixed by the **GROUP** keyword, this is a list of user groups. On Windows systems, user and group names are stored as entered but treated as case insensitive internally. On other platforms, user and group names are case sensitive.

The **GRANT.KEY** command grants access to an encryption key to one or more users or user groups. The user will be asked to enter the master key unless it has already been entered during this session.

No error occurs if the user or group specified already has access to the key.

Example

```
GRANT.KEY CARDNO jsmith bjones
```

The above command grants access to the encryption key named CARDNO for users jsmith and bjones.

See also:
Data encryption, **CREATE.FILE**, **CREATE.KEY**, **DELETE.KEY**, **ENCRYPT.FILE**, **LIST.KEYS**, **RESET.MASTER.KEY**, **REVOKE.KEY**, **SET.ENCRYPTION.KEY.NAME**

4.69 HELP

The **HELP** command provides help on a wide variety of topics. This command is not available on the PDA version of QM.

Format

HELP {*topic*}

where

topic is the initial topic to display. This may be the name of a verb or a topic category. If omitted, an initial menu covering major product areas is displayed.

The HELP command invokes the Windows help system in the same way as selection of the help option from the QM program group. The help system is not available for users connecting from non-Windows clients though there is a browser based HTML help package available by download.

The operation of this system depends on the way in which the user has entered QM:

- For QM Console users on a Windows server, the help system is invoked on the server for the specified topic.
- For QMTerm users, a command is sent to the QMTerm session to cause it to open a help window on the client system. The qm.hlp file must be installed in the QMSYS directory of the client system.
- For other network users, QM checks the definition of the terminal type in use and, if the u8 (asynchronous command) entry is defined, executes the winhlp32 program on the client system. The qm.hlp file must be installed in the default location (c:\qmsys\qm.hlp).
- For terminals where the u8 code is not defined, the help system must be run from the QM program group.

4.70 HSM

The **HSM** command controls the Hot Spot Monitor performance monitoring tool. This command is not available on the PDA version of QM.

Format

HSM ON {**USER** *n*}	Start monitoring, clearing the counters
HSM OFF	Stop monitoring
HSM {**DISPLAY**}{**USER** *n*}	Display performance data

The Hot Spot Monitor records the number of times each program module is called and the processor time in seconds spent in that module.

The **HSM ON** command clears any old data and starts monitoring.

The **HSM OFF** command terminates monitoring.

The **HSM DISPLAY** command displays the collected data. It may be used while monitoring is active or after it has been switched off. The **DISPLAY** keyword can be omitted.

The **USER** *n* option causes the command to affect the specified user and is useful in monitoring processes that do not display a command prompt.

Example

```
HSM ON
... processing ...
HSM DISPLAY
Calls.. CP time... Program
      1       0.000  !SCREEN
     13       0.060  $CPROC
     18       0.000  !PARSER
      1       0.000  PRINT.DEFERED
      4       0.010  $SETPTR
      1       0.000  CHARGE.TOTAL
     19       0.034  CALC.INVOICE.VALUE
     24       0.000  ADD.MONTH
      3       0.000  REVERSE
      1       0.000  C:\QM\BP.OUT\PROC
      6      17.040  C:\QM\BP.OUT\FINANCE
     19      14.010  C:\QM\BP.OUT\INVOICE
      1       0.800  C:\QM\BP.OUT\CHECK_EX
      1       0.000  $HSM
```

4.71 HUSH

The **HUSH** command suspends or enables output to the display.

Format

HUSH ON	Suspend display output
HUSH OFF	Resume display output
HUSH	Toggle hush status

The **HUSH** command allows temporary suspension of display output. Output is automatically resumed in the event of an abort.

Example

```
HUSH ON
SELECT STOCK WITH QTY < REORDER.LEVEL
HUSH OFF
```

This sequence selects records from the STOCK file but suppresses any terminal output from the **SELECT** command. Use of the **COUNT.SUP** option to **SELECT** might be a better alternative in this example.

4.72 IF

The **IF** command allows conditional execution of sentences within paragraphs.

Format

IF *value.1 rel.op value.2* **THEN** *sentence*

where

value.1, *value.2*	are two items to be compared. These may be inline prompts, constants or @-variables as described below.
rel.op	is the relational operator to be applied to the two values.
sentence	is the sentence to be executed if the condition is true.

The **IF** command compares two values using a specified relational operator. The values may be inline prompts, constants or @-variables. Null strings or string constants which include spaces should be enclosed in single or double quotation marks. The *value.1* and *value.2* items need to be quoted if they may evaluate to strings with embedded spaces or to reserved words such as the relational operators.

Note that because inline prompts are evaluated as the first stage of processing a command, an inline prompt in the *sentence* component of an **IF** statement will be evaluated before determining whether the condition is true. To avoid this problem, a statement such as

```
IF @SYSTEM.RETURN.CODE = 1 THEN LIST <<Filename>>
```

must be written as

```
IF @SYSTEM.RETURN.CODE # 1 THEN GO SKIP
   LIST <<Filename>>
SKIP:
```

The relational operator may be any of:

<	LT	BEFORE	LESS	
<=	LE	=<		
=	EQ	EQUAL		
>=	GE	=>		
>	GT	AFTER	GREATER	
#	NE	<>	><	NOT
LIKE	MATCHES	MATCHING		
UNLIKE	NOT.MATCHES			
~	SAID	SPOKEN		

The function of each relational operator as applied to values of different types is the same as its QMBasic equivalent

Multiple conditions may be linked by the keywords **AND** and **OR**. These operators are of equal priority and are evaluated left to right. Use of brackets to alter the order of interpretation is not supported in the **IF** command.

Example

```
PA
BASIC <<Program name>>
IF @SYSTEM.RETURN.CODE = 1 THEN CATALOGUE <<Program name>>
```

This paragraph compiles a QMBasic program (the record name of which it obtains using an inline prompt) and, if successful, adds the program to the system catalogue. In this example, use of the inline prompt in the conditioned statement is not a problem as the prompt was displayed as part of processing of the previous line.

4.73 LIST.COMMON

The **LIST.COMMON** command lists named common blocks.

Format

LIST.COMMON

The **LIST.COMMON** command displays a list of all currently created QMBasic named common blocks for the process in which the command is executed.

Example

```
LIST.COMMON
SYS.FILES
SCREEN.DATA
```

See also:
DELETE.COMMON

4.74 LIST.DIFF

The **LIST.DIFF** command creates a new named select list from the entries that appear in one named list but not in another named list.

Format

LIST.DIFF *list1* {*list2* {*tgt.list*}} {**COUNT.SUP**}

where

list1, *list2*	identify the select lists to be merged. These must correspond to the names of records in the $SAVEDLISTS file. If *list2* is omitted, a prompt is displayed for the name.
tgt.list	is the name of the new list to be created in $SAVEDLISTS. It is valid for *tgt.list* to be the same as one of the source lists. if *tgt.list* is omitted, a prompt is displayed for this name.
COUNT.SUP	indicates that display of the record count in the merged list is to be suppressed.

The **LIST.DIFF** command allows construction of one select list from two others. The resultant list will contain all of the items that are in *list1* but not in *list2*.

The result list will replace any existing list with the name *tgt.list*. The ordering of *tgt.list* is undefined.

@SYSTEM.RETURN.CODE is set to the number of items in the new list or a negative error code.

Example

```
LIST.DIFF FRANCE.CUSTOMERS MAJOR.CUSTOMERS MERGED.CUSTOMERS
41 records selected.
```

This example merges two previously saved select lists, one holding keys for customers in France, the other for major customers to form a new list containing non-major French customers.

See also:
LIST.INTER, **LIST.UNION**, **MERGE.LIST**

4.75 LIST.FILES

The **LIST.FILES** command displays details of open files.

Format

LIST.FILES {**DETAIL**}

The **LIST.FILES** command displays the number of files currently open, the peak number of files open and the limit on the number of open files as set by the NUMFILES configuration parameter.

The **DETAIL** option extends the report to show a list of open file pathnames.

The NUMFILES configuration parameter is a hard limit on the number of files that may be open at one time by all QM users. A file opened by multiple users only counts as one file. Attempting to exceed this limit will cause the application to fail. The displayed peak open count is useful in determining whether the value of NUMFILES is large enough.

Example

```
LIST.FILES DETAIL
Number of files open = 4. Peak = 16. Limit (NUMFILES) = 40.

C:\QM\VOC
C:\QMSYS\$IPC
C:\QM\BP
C:\QM\&SED.EXTENSIONS&
```

4.76 LIST.INDEX

The **LIST.INDEX** command reports details of one or more alternate key indices.

Format

LIST.INDEX *filename field(s)* {**STATISTICS**} {**DETAIL**}

The **LIST.INDEX** command displays information about alternate key indices for the named *field(s)*. The keyword **ALL** can be used to report all indices on the file.

The basic report appears as below.

```
Alternate key indices for file ORDERS
Number of indices = 1

Index name...... En Type Nulls S/M Fmt Field/Expression
DATE              Y   D    Yes   S   R  17
```

The columns following the index name show:

En	Y if the index is enabled (built and active). N if it requires building.
Type	A, C, D, I or S corresponding to the dictionary entry type use to define the index.
Nulls	Yes or No depending whether records with null values of the indexed field are included in the index.
S/M	S or M corresponding to the single/multi-valued nature of the indexed data.
Fmt	L or R corresponding to left or right alignment of the indexed data.
Field/Expression	The field number or evaluated expression.

Use of the **STATISTICS** (short form **STATS**) keyword extends the report to include statistical information about the index showing the number of index entries (different field values) and the minimum, average and maximum number of records per index entry.

Use of the **DETAIL** keyword shows the statistics and also shows up to 63 characters of each key value and the number of records for that key value.

See also:
BUILD.INDEX, **CREATE.INDEX**, **DELETE.INDEX**, **MAKE.INDEX**

4.77 LIST.INTER

The **LIST.INTER** command creates a new named select list from the entries that appear in both of two other named lists.

Format

LIST.INTER *list1* {*list2* {*tgt.list*}} {**COUNT.SUP**}

where

list1, *list2*	identify the select lists to be merged. These must correspond to the names of records in the $SAVEDLISTS file. If *list2* is omitted, a prompt is displayed for the name.
tgt.list	is the name of the new list to be created in $SAVEDLISTS. It is valid for *tgt.list* to be the same as one of the source lists. if *tgt.list* is omitted, a prompt is displayed for this name.
COUNT.SUP	indicates that display of the record count in the merged list is to be suppressed.

The **LIST.INTER** command allows construction of one select list from two others. The resultant list will contain all of the items that are in both *list1* and *list2*.

The result list will replace any existing list with the name *tgt.list*. The ordering of *tgt.list* is undefined.

@SYSTEM.RETURN.CODE is set to the number of items in the new list or a negative error code.

Example

```
LIST.INTER FRANCE.CUSTOMERS MAJOR.CUSTOMERS MERGED.CUSTOMERS
41 records selected.
```

This example merges two previously saved select lists, one holding keys for customers in France, the other for major customers to form a new list containing the major customers in France.

See also:
LIST.DIFF, **LIST.UNION**, **MERGE.LIST**

4.78 LIST.KEYS

The **LIST.KEYS** command lists details of encryption keys.

Format

LIST.KEYS {**LPTR** {*unit*}}
LIST.KEYS *filename* {**LPTR** {*unit*}}

where

filename is the name of the file to be reported.

The first form of the **LIST.KEYS** command is available only to users with administrator rights in the QMSYS account. It produces a report of the encryption key names defined in the key vault, showing the encryption algorithm name and the users who have access to the key. The actual encryption key is not reported. The user will be asked to enter the master key unless it has already been entered during this session.

The second form of the **LIST.KEYS** command is available to all users and produces a report of the encryption keys used by the named file.

In either form, the **LPTR** keyword can be used to direct the output to a printer. If the print *unit* number is omitted, the default printer (unit 0) is used.

Examples

```
LIST.KEYS
 Key..............  Algorithm  Users..............
Groups.............
 CARDNO             AES128     jsmith
                               bjones
 RHKEY              AES256     jsmart
```

The above example shows the report from the first format of the **LIST.KEYS** command. There are two encryption keys defined on this system.

```
LIST.KEYS CLIENTS
Filename: CLIENTS
Pathname: /usr/sales/CLIENTS

Field 7, CARDNO
Field 22, RHKEY
```

The above example shows the report from the second format of the **LIST.KEYS** command. The CLIENTS file uses field level encryption with a different key for each encrypted field.

See also:

Data encryption, **CREATE.FILE**, **CREATE.KEY**, **DELETE.KEY**, **ENCRYPT.FILE**, **GRANT.KEY**, **RESET.MASTER.KEY**, **REVOKE.KEY**, **SET.ENCRYPTION.KEY.NAME**

4.79 LIST.LOCKS

The **LIST.LOCKS** command reports the state of the 64 system wide task locks.

Format

LIST.LOCKS

The **LIST.LOCKS** command displays a table of locks showing the user number of the process holding each of the 64 task locks where appropriate. The displayed user number is followed by an asterisk if it is the process from which the **LIST.LOCKS** command was executed.

Examples

```
LIST.LOCKS
 0:       1:       2:       3:       4:       5:       6:       7: 1*
 8:       9:      10:      11:      12:      13:      14:      15:
16:      17:      18:      19: 3    20:      21:      22:      23:
24:      25:      26:      27:      28:      29:      30:      31:
32:      33:      34:      35:      36:      37:      38:      39:
40:      41:      42:      43:      44:      45:      46:      47:
48:      49:      50:      51:      52:      53:      54:      55:
56:      57:      58:      59:      60:      61:      62:      63:
```

This example shows the display when task locks 7 and 19 are in use. Lock 7 is held by user 1 who also issued the **LIST.LOCKS** command. Lock 19 is held by user 3.

```
LIST.LOCKS
No task locks reserved by any user
```

In this example, there are no task locks in use.

See also:
CLEAR.LOCKS, LOCK

4.80 LIST.READU

The **LIST.READU** command displays details of file and record locks.

Format

LIST.READU {*user*} {**DETAIL**} {**NO.PAGE**} {**LPTR** {*n*}} {**WAIT**}

where

user	is the user number for which the locks are to be reported. If omitted, all locks are displayed.
DETAIL	includes the limit, current count and peak number of record locks.
NO.PAGE	suppresses display pagination.
LPTR {*n*}	directs output to logical print unit *n*. If *n* is omitted, it defaults to zero, the default print unit.
WAIT	includes details of users waiting for locks held by other users.

The **LIST.READU** command displays or prints details of file, read and update locks held by one or all users.

Example

```
Record lock limit = 400, Current = 3, Peak = 73
User File Path......................... Type
Id...........................
   1     2 D:\SALES\STOCK              RU   P-174-43
   1     2 D:\SALES\STOCK              RU   P-967-47
   5     2 D:\SALES\STOCK              RU   P-954-55
   2     4 D:\SALES\INVOICES           FX
   3     4 D:\SALES\INVOICES           WAIT 17565
```

In the above report, users 1 and 5 hold record update locks in file 2 (D:\SALES\STOCK) and user 2 has a file lock on file 4 (D:\SALES\INVOICES). User 3 is waiting to lock record 17565 in file 4 but is blocked by user 2. Details of users waiting for locks are only shown if the **WAIT** keyword is used.

The first line of the above report is only shown if the **DETAIL** keyword is used. Note that the counts are for active record locks only. The file lock and the user waiting for a lock in this example do not contribute to these numbers. The peak number of locks is useful in determining a good value for the **NUMLOCKS** configuration parameter.

The file number is an internal reference to the file and is also needed for the **UNLOCK** command.

The lock type is shown as RL for shareable record locks, RU for record update locks and FX for

file locks. A type code of WAIT is shown for users waiting for locks.

4.81 LIST.UNION

The **LIST.UNION** command creates a new named select list from the entries that appear in either of two other named lists. Items that appear in both lists are not duplicated.

Format

LIST.UNION *list1* {*list2* {*tgt.list*}} {**COUNT.SUP**}

where

list1, *list2*	identify the select lists to be merged. These must correspond to the names of records in the $SAVEDLISTS file. If *list2* is omitted, a prompt is displayed for the name.
tgt.list	is the name of the new list to be created in $SAVEDLISTS. It is valid for *tgt.list* to be the same as one of the source lists. if *tgt.list* is omitted, a prompt is displayed for this name.
COUNT.SUP	indicates that display of the record count in the merged list is to be suppressed.

The **LIST.UNION** command allows construction of one select list from two others. The resultant list will contain all of the items that are in *list1* plus all of the items in *list2* that are not also in *list1*.

The result list will replace any existing list with the name *tgt.list*. The ordering of *tgt.list* is undefined.

@SYSTEM.RETURN.CODE is set to the number of items in the new list or a negative error code.

Example

```
LIST.INTER FRANCE.CUSTOMERS MAJOR.CUSTOMERS MERGED.CUSTOMERS
41 records selected.
```

This example merges two previously saved select lists, one holding keys for customers in France, the other for major customers to form a new list containing the major customers in France.

See also:
LIST.DIFF, **LIST.INTER**, **MERGE.LIST**

4.82 LIST.USERS

The **LIST.USERS** command lists users from the register of users for network security checks.

User management is not applicable to the PDA version of QM.

Format

LIST.USERS

The **LIST.USERS** command lists the names of all entries in the user name register. This will include an entry for Console, the pseudo name used for QMConsole connections.

The report shows the user name, the login account (if set), the date and time of last login and whether the user has administrator rights.

Example

```
LIST.USERS
User name.......................  Login account...  Last
login.....  Admin
ADMINISTRATOR                                        22 Oct 06
17:27   Yes
BERT                              QMTEST             04 Nov 02
10:40   No
Console                                              03 Nov 06
13:49   Yes
GEORGE                            SALES              03 Nov 06
09:03   No
MARTIN                                               01 Nov 06
17:23   No
```

See also:
ADMIN.USER, CREATE.USER, DELETE.USER, PASSWORD, SECURITY

4.83 LIST.VARS

The **LIST.VARS** command displays user @-variables.

Format

LIST.VARS {**ALL**}

The **LIST.VARS** command displays the values of user defined @-variables. The optional **ALL** keyword extend the display to include the standard @USER.RETURN.CODE and @USER0 to @USER4 variables.

Example

```
LIST.VARS
LOOP.CT : 7
LAST.LOG: 41926
```

See also:
SET

4.84 LISTF

The **LISTF** command lists all files defined in the VOC.

Format

LISTF {**LPTR**}

The **LISTF** command is a sentence to list all F type VOC entries. The listing shows the VOC name of the file, the file type, the description (field 1 of the VOC entry), the data portion pathname (field 2) and the dictionary pathname (field 3). The report is sorted by file name.

The file type column shows:

DH for a dynamic hash file. This type code will be followed by
- E the file uses encryption
- I the file has alternate key indices
- S file statistics are enabled
- T the file has a trigger function defined

Dir for a directory file

Mult for a multifile

Err if the file cannot be opened

The column is blank for a VOC entry with no data pathname.

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

See also:
CREATE.FILE, **DELETE.FILE**, **LISTFL**, **LISTFR**

4.85 LISTFL

The **LISTFL** command lists all files defined in the VOC that are local to the account.

Format

LISTFL {**LPTR**}

The **LISTFL** command is a sentence to list all F type VOC entries referencing files that are local to the account. Selection is performed by reporting only those records for which the data portion pathname does not contain a back slash. It is thus possible to defeat this selection process by using absolute pathnames for local files. The **CREATE.FILE** command always uses the file name only for a local file.

The listing shows the VOC name of the file, the file type, the description (field 1 of the VOC entry), the data portion pathname (field 2) and the dictionary pathname (field 3). The report is sorted by file name.

The file type column shows:

DH for a dynamic hash file. This type code will be followed by
- E the file uses encryption
- I the file has alternate key indices
- S file statistics are enabled
- T the file has a trigger function defined

Dir for a directory file

Mult for a multifile

Err if the file cannot be opened

The column is blank for a VOC entry with no data pathname.

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

See also:
CREATE.FILE, **DELETE.FILE**, **LISTF**, **LISTFR**

4.86 LISTFR

The **LISTFR** command lists all files defined in the VOC that are remote to the account.

Format

LISTFR {**LPTR**}

The **LISTFR** command is a sentence to list all F type VOC entries referencing files that are remote to the account. Selection is performed by reporting only those records for which the data portion pathname contains a back slash. It is thus possible to defeat this selection process by using absolute pathnames for local files. The **CREATE.FILE** command always uses the file name only for a local file.

The listing shows the VOC name of the file, the file type, the description (field 1 of the VOC entry), the data portion pathname (field 2) and the dictionary pathname (field 3). The report is sorted by file name.

The file type column shows:

DH for a dynamic hash file. This type code will be followed by
- E the file uses encryption
- I the file has alternate key indices
- S file statistics are enabled
- T the file has a trigger function defined

Dir for a directory file

Mult for a multifile

Err if the file cannot be opened

The column is blank for a VOC entry with no data pathname.

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

See also:
CREATE.FILE, **DELETE.FILE**, **LISTF**, **LISTFL**

4.87 LISTK

The **LISTK** command lists all keywords defined in the VOC.

Format

LISTK {**LPTR**}

The **LISTK** command is a sentence to list all K type VOC entries defining keywords.

The listing shows the keyword, the description (field 1 of the VOC entry) and the keyword value. The report is sorted by keyword value.

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

4.88 LISTM

The **LISTM** command lists all menus defined in the VOC.

Format

LISTM {**LPTR**}

The **LISTM** command is a sentence to list all M type VOC entries.

The listing shows the VOC name of the menu and its title line.

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

4.89 LISTPA

The **LISTPA** command lists all paragraphs defined in the VOC.

Format

LISTPA {**LPTR**}

The **LISTPA** command is a sentence to list all PA type VOC entries.

The listing shows the VOC name of the paragraph, the description (field 1 of the VOC entry) and the first command in the paragraph (field 2).

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

4.90 LISTPH

The **LISTPH** command lists all phrases defined in the VOC.

Format

LISTPH {**LPTR**}

The **LISTPH** command is a sentence to list all PH type VOC entries.

The listing shows the VOC name of the phrase, the description (field 1 of the VOC entry) and the phrase expansion (field 2).

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

4.91 LISTPQ

The **LISTPQ** command lists all PROCs defined in the VOC.

Format

LISTPQ {**LPTR**}

The **LISTPQ** command is a sentence to list all PQ type VOC entries.

The listing shows the VOC name of the PROC, the description (field 1 of the VOC entry) and the first command in the PROC (field 2).

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

4.92 LISTQ

The **LISTQ** command lists all indirect file references defined in the VOC.

Format

LISTQ {**LPTR**}

The **LISTQ** command is a sentence to list all Q type VOC entries.

The listing shows the VOC name of the item, the description (field 1 of the VOC entry), target account(field 2) and target file (field 3).

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

4.93 LISTR

The **LISTR** command lists all remote items defined in the VOC.

Format

LISTR {**LPTR**}

The **LISTR** command is a sentence to list all R type VOC entries.

The listing shows the VOC name of the item, the description (field 1 of the VOC entry), the target file (field 2) and the target record id (field 3).

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

4.94 LISTS

The **LISTS** command lists all sentences defined in the VOC.

Format

LISTS {**LPTR**}

The **LISTS** command is a sentence to list all S type VOC entries.

The listing shows the VOC name of the sentence, the description (field 1 of the VOC entry) and the sentence expansion (field 2).

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

4.95 LISTU

The **LISTU** command lists the users currently in QM. This command is not available on the PDA version of QM.

Format

LISTU

The **LISTU** command displays a list of users in QM. For each user, it shows their QM user number, the corresponding operating system process id and their network address or device name and user name. The network address is shown as "Console" for console users (sessions running QM directly rather than a network connection) or "Phantom" for a background process. The user executing the **LISTU** command is marked by an asterisk at the left edge of the displayed report. For phantom users, the parent user number is shown unless the original parent process has logged out.

Example

```
LISTU
  User  Pid      Puid  Login time    Origin : User name
*    1  156            15 Apr 11:48  Console: ADMINISTRATOR
     2  186            15 Apr 11:21  193.118.13.10: JSMITH
     4  196         2  15 Apr 12:02  Phantom: ADMINISTRATOR
```

4.96 LISTV

The **LISTV** command lists all verbs defined in the VOC.

Format

LISTV {**LPTR**}

The **LISTV** command is a sentence to list all V type VOC entries.

The listing shows the VOC name of the verb, the description (field 1 of the VOC entry), the verb type (field 2) and the processing function or internal dispatch code (field 3).

The **LPTR** keyword will direct the output to the printer. Other query processor keywords can be appended to the command.

4.97 LOCK

The **LOCK** command sets a task lock.

Format

LOCK *lock.number* {**NO.WAIT**}

where

lock.number	is the number of the task lock (0 to 63) to be set.
NO.WAIT	specifies that the process is not to wait if the lock is not available.

The **LOCK** command sets one of the 64 system wide task locks. Four situations exist:

If the lock is available, the process acquires the lock and continues. @SYSTEM.RETURN.CODE will be set to *lock.number*.

If the lock is already owned by this process, a warning message is displayed and execution continues. @SYSTEM.RETURN.CODE will be set to *lock.number*.

If the lock is owned by another process and the **NO.WAIT** option has been used, a message is displayed indicating the unavailability of the lock and the process continues. The value of @SYSTEM.RETURN.CODE will be negative (-ER$LCK) and can be tested to check for this situation in paragraphs.

If the lock is owned by another process and the **NO.WAIT** option has not been used, a message is displayed indicating that the process is waiting and execution is suspended until the lock becomes available. The break key may be used to interrupt this wait.

Examples

```
LOCK 5
Set task lock 5
```

In this example, task lock 5 was available when the **LOCK** command was executed.

```
LOCK 5
Waiting for task lock to become available
```

In this example, task lock 5 held by another process when the **LOCK** command was executed. The process waits for the lock to become available.

```
LOCK 5 NO.WAIT
Task lock is already in use
```

As in the previous example, task lock 5 was held by another process when the **LOCK** command

was executed. In this case, the **NO.WAIT** option causes the process to continue without waiting for the lock to become available.

See also:
CLEAR.LOCKS, LIST.LOCKS

4.98 LOGIN.PORT

The **LOGIN.PORT** command logs in a serial port from within another QM session. This command is currently only available on Windows systems.

Format

LOGIN.PORT *port* {*account*} {*params*}

where

port	is the serial port name (e.g. COM1).
account	is the QM account in which the user is to run. If omitted, the new process runs in the same account as the user issuing the command.
params	is any combination of the following serial communications parameters:

BAUD *rate*	Sets the data rate (default 9600).
BITS *n*	Sets the number of bits per character (default 8).
PARITY *mode*	Sets the parity mode: NONE (default), ODD or EVEN.
STOP.BITS *n*	Sets the number of stop bits (default 1).

The **LOGIN.PORT** command creates a new QM process that uses the named serial port as its terminal device. This process will run with the same user name as the process performing the command.

The new process will execute the MASTER.LOGIN and LOGIN paragraphs in the same way as any other QM process. The LOGIN paragraph could be used, for example, to start a program that monitors the named port for activity.

4.99 LOGMSG

The **LOGMSG** command adds a line to the system error log. This statement has no effect on the PDA version of QM.

Format

LOGMSG *text*

where

text is the message to be logged.

This command is identical in effect to use of the **LOGMSG** statement in a QMBasic program.

QM includes the option to maintain a log of system error messages in a file named errlog in the QMSYS account. The **LOGMSG** command can be used to write messages into this file. If the error log is disabled, the **LOGMSG** command will be ignored.

4.100 LOGOUT

The **LOGOUT** command terminates a QM process.

Format

LOGOUT {*user*}
LOGOUT ALL

where

user is the user number of the process to terminate. Multiple user numbers may be given.

The **LOGOUT** command aborts the specified process. The process is terminated without execution of the ON.EXIT paragraph.

If *user* is omitted, the **LOGOUT** command terminates the user's own session. A user who does not have administrator rights can only log out processes running under the same user name.

The **LOGOUT ALL** form of the command, available only in the QMSYS account to users with administrator rights, logs out all QM processes except the one from which it is issued.

Example

```
LOGOUT 2
Phantom 2 : forced logout
```

This example shows forced termination of phantom user 2.

4.101 LOGTO

The **LOGTO** command moves to an alternative account directory without leaving QM.

Format

LOGTO *name* {**RESET**}

where

name	is the name of the target account. This may be an account name as in the ACCOUNTS register of the QMSYS account or the pathname of the new account directory.
RESET	causes the command processor to discard all active paragraphs, menus, etc.

Multiple accounts are useful where there are several distinct projects. They can also be used to separate development and production versions of an application.

The **LOGTO** command closes the current VOC, moves to the account directory specified by *name* and opens the VOC of the new directory. If the **RESET** keyword is present, any active programs, menus, etc at the current command processor level are discarded. This is particularly useful when using LOGTO in a menu.

If the VOC of the current account contains an executable item named ON.LOGTO, usually a paragraph, this will be executed before moving to the new account.

If the VOC of the new account contains an executable item named LOGIN, this will be executed on arrival in the new account.

If the **LOGTO** action is successful, the account name as reported by the **WHO** command or returned as the value of the @WHO system variable is set to the new account.

LOGTO will fail if *name* cannot be found or is not a valid account.

The **QUIT** command to leave QM will return to the original account directory before exiting.

4.102 LOOP / REPEAT

The **LOOP** and **REPEAT** commands define the top and bottom of a group of sentences to be repeated within a paragraph.

Format

LOOP
sentence(s)
REPEAT

where

sentence(s) are the sentence(s) to be executed within the loop.

The **LOOP** and **REPEAT** statements surround one or more sentences to be repeated. The loop continues until the paragraph terminates by use of **STOP** or **ABORT**, something run by the paragraph causes an abort event, or a **GO** statement is used to leave the loop.

Loops may be nested to any depth. Each **REPEAT** statement is paired with a corresponding **LOOP** statement and is equivalent to a **GO** statement that allows backward jumps to a label at the position of the **LOOP** statement. The behaviour of paragraphs that branch into or out of loops can be determined by this label and **GO** equivalent.

The keywords **LOOP** and **REPEAT** are recognised by the paragraph pre-processor and not via the VOC and hence cannot be replaced by alternative words.

Example

```
PA
LOOP
   IF <<A,File to delete>> = "" THEN GO DONE
   DELETE.FILE <<File to delete>>
REPEAT
DONE:
```

This paragraph prompts for names of files to delete until a blank line is entered. Note the need for the A control option on the first inline prompt in the loop so that the prompt is repeated on each cycle.

Because the DONE label is at the end of the paragraph, the above example could alternatively be written as

```
PA
LOOP
   IF <<A,File to delete>> = "" THEN STOP
   DELETE.FILE <<File to delete>>
REPEAT
```

4.103 MAKE.INDEX

The **MAKE.INDEX** command creates and builds an alternate key index. It is equivalent to use of **CREATE.INDEX** followed by **BUILD.INDEX**.

Format

MAKE.INDEX *filename field(s)* {**NO.NULLS**} {**PATHNAME** *index.path*}

where

filename	is the name of the file for which the index is to be built.
field(s)	is one or more field names for which indices are to be created.

The **MAKE.INDEX** command creates the file structures to hold an alternate key index and then builds the index.

The *field(s)* referenced in the command must correspond to D, I, A, S or C-type dictionary items. The dictionary items can be deleted once the index has been constructed as all details of the indexed field are stored in the index file but this is not recommended. The value to be indexed must not exceed 255 characters. Values longer than this will not be included in the index.

Indices constructed on I or C-type dictionary items or on A or S-type items that use correlative expressions should be such that they always produce the same result when executed for the same data record. Examples of possibly invalid I-type expressions would be those that use the date or time and those that use the **TRANS()** function to access other files.

The **NO.NULLS** specifies that no entry is to be added to the index for records where the indexed field is null.

Normally, the indices are stored as subfiles in the directory that represents the data file. The **PATHNAME** option allows the indices to be stored in an alternative location. This might be useful, for example, to balance loads across multiple disks or to exclude indices from backups as they can always be recreated.

All indices for a single data file must be stored together. The **PATHNAME** option can be used when creating the first index and specifies the pathname of a new directory that will be created at the same time as the index. If this option is included when creating subsequent indices the *index.path* must be the same as for the first index. It is suggested that the pathname should be based on the data file name for ease of recognition.

Index subfiles can be moved using the operating system level qmidx program.

The **MAKE.INDEX** command requires exclusive access to the file during the build phase.

Data Encryption

Alternate key indices may be applied to files that use record level data encryption but developers should be aware that the index itself is not encrypted and hence weakens the security of the indexed

fields.

Files using field level encryption cannot have indices on encrypted fields. Also, indices constructed from calculated values such as I-types that use encrypted fields will fail if the record is updated by a user that does not have access to the relevant encryption key.

Example

```
MAKE.INDEX ORDERS DATE
```

The above command creates and builds an index on the DATE field of the ORDERS file.

See also:
BUILD.INDEX, CREATE.INDEX, DELETE.INDEX, LIST.INDEX, MAKE.INDEX

4.104 MAP

The **MAP** command produces a map of the system catalogue.

Format

MAP {**ALL**} {**LPTR** {*n*}} {**FILE** {*file.name*}}

where

ALL indicates that system entries are to be included in the map.

LPTR specifies that the output is to be sent to a print unit. The print unit number, *n*, defaults to 0 if omitted.

FILE specifies that the output is to be sent to a file. If *file.name* is omitted, the $MAP file is used by default.

The **MAP** command produces a combined list of the contents of the global and private catalogues. Without the **FILE** keyword, the map shows the name of each catalogued item with its date and time of compilation and its size, separating the object code and cross-reference tables. Items from the global catalogue have an asterisk in the leftmost column of the report. The report ends with a line giving the total size of all reported items.

The file produced with the **FILE** keyword can be listed using the query processor.

The private catalogue is normally a subdirectory, cat, under the account directory but can be moved by creating an X-type VOC entry named $PRIVATE.CATALOGUE in which field 2 contains the pathname of the alternative private catalogue directory. This only takes effect when QM is re-entered or on use of the **LOGTO** command. This feature is particularly useful where two or more accounts are to share a common private catalogue.

Example

```
MAP ALL LPTR
```

The above command prints a map of the catalogue, including system items.

See also:
BASIC, **CATALOGUE**, **DELETE.CATALOGUE**

4.105 MED

The **MED** command creates or modifies a menu definition.

Format

MED {*file.name* {*menu.name*}}

where

file.name	identifies the file holding the menu.
menu.name	is the name of the menu record to be processed. Menu names are case sensitive.

If the file or menu names are omitted from the command line, **MED** prompts for these. When prompting for menu names, **MED** will edit the given menu and then prompt for a further name. This is repeated until a null menu name is entered.

Menus are normally stored in the VOC file but can be stored in any file of the application designer's choice if an R-type (remote) VOC record is used to point to the menu record in the other file.

If the menu does not exist, **MED** prompts for confirmation that it is to be created.

The display of a typical menu might appear as shown below:

```
Title :ORDER PROCESSING SYSTEM : MAIN MENU
Subr  :OPS.MENU.VALIDATE
Prompt:
Exits :
Stops :
--------------------------------------------------------------
Text 1:Customer Maintenance
Action:CUST.MENU
Help  :Enter customer maintenance menu
Access:CUST
Hide  :
--------------------------------------------------------------
Text 2:Order Entry
Action:RUN BP ORDER.ENTRY
Help  :Runs the order entry system
Access:ORDERS
Hide  :
--------------------------------------------------------------
Text 3:Invoice Management
Action:INV.MENU
Help  :Enter invoice management menu
Access:INVOICES
Hide  :

VOC ORDERS                                             F1=Help
Access control subroutine key for this option
```

MED uses a subset of the SED full screen editor default key bindings to allow the user to move around within the display and enter or modify text. These are:

Ctrl-A	Home	Move to start of line
Ctrl-B	Cursor left	Move left one character
Ctrl-D	Del char	Delete character
Ctrl-E	End	Move to end of line
Ctrl-F	Cursor right	Move right one character
Ctrl-G		Cancel
Ctrl-K		Kill line
Ctrl-L		Refresh screen
Ctrl-N	Cursor down	Move down one line
Ctrl-O	Insert	Toggle overlay mode
Ctrl-P	Cursor up	Move up one line
Ctrl-V	Page down	Move down one page
Ctrl-X C	Ctrl-X Ctrl-C	Exit
Ctrl-X S	Ctrl-X Ctrl-S	Save
Ctrl-Y	Esc-Y	Paste
Esc-V	Page up	Move up one page
Esc-<	Ctrl-Home	Move to top
Esc->	Ctrl-End	Move to bottom
Backspace		Backspace
F1		Help
F4		Show menu

The leftmost few characters of each line display a line type key. The remainder of the line is editable and the line on which the cursor is positioned will pan if required to allow text data wider than the display device.

The bottom line of the screen displays a single line help prompt at all times. Pressing F1 will display a help page appropriate to the line on which the cursor is positioned. Pressing F1 again while this help text is displayed will display help on the key bindings.

The first section of the menu data displayed by **MED** contains information that relates to the entire menu:

The menu title line

The access control subroutine name

The prompt text

Exit codes

Stop codes

The remainder of the displayed data is a set of sections corresponding to the menu options in the order in which they will appear on the menu. Each section contains:

The option text

The action sentence. Terminate with a semicolon for an automatic "Press return to continue" prompt

Help text for the option

The access subroutine key

A flag indicating whether the option is to be hidden if it is unavailable

The separator line between each section has some special features. Pressing the return key while on this line inserts a new menu option entry under the line. Use of the kill line function (Ctrl-K) on this line deletes the menu option under the line, placing it in the kill buffer. Repeated use of the kill line function places all of the deleted menu options in the kill buffer.

When the kill buffer contains one or more complete menu options, use of the paste function (Ctrl-Y) inserts the kill buffer content under the current option. Use of kill and paste can be used to move options within the menu.

When on a text line, the kill line function deletes all text after the cursor, placing it in the kill buffer. The paste function can be used to paste this text into another line.

See VOC M-type records for more details of menu definitions.

4.106 MERGE.LIST

The **MERGE.LIST** command creates a new active select list by merging two other lists according to one of three relational operators.

Format

MERGE.LIST *list1 rel.op list2* {**TO** *tgt.list*} {**COUNT.SUP**}

where

list1, *list2*	identify the select lists to be merged. These must be select list numbers in the range 0 to 10. They may not reference the same list.
rel.op	is the relational operator and is one of
	INTERSECTION Create a new list containing only those record keys that appear in both *list1* and *list2*. The keyword may be abbreviated to **INTERSECT**.
	UNION Create a new list containing all record keys from both *list1* and *list2*. Keys appearing in both lists appear only once in the resultant list.
	DIFFERENCE Create a new list containing all record keys from *list1* except those that are also in *list2*. The keyword may be abbreviated to **DIFF**.
tgt.list	is the number of the select list (0 to 10) to receive the result. If omitted, select list zero is used. It is valid for *tgt.list* to reference one of the source lists.
COUNT.SUP	indicates that display of the record count in the merged list is to be suppressed.

The **MERGE.LIST** command allows construction of one select list from two others. Use of **MERGE.LIST** can be significantly faster than a full select of the file to create the new list.

If either source list has already been partially processed before the **MERGE.LIST** command is executed, only the remaining unprocessed items are used. The resultant list will replace any already active *tgt.list*. The source lists are cleared after the new list has been set up. The ordering of *tgt.list* is undefined.

@SYSTEM.RETURN.CODE is set to the number of items in the new list or a negative error code.

Example

```
GET.LIST FRANCE.CUSTOMERS TO 1
```

```
27 records selected.
GET.LIST GERMANY.CUSTOMERS TO 2
31 records selected.
MERGE.LIST 1 UNION 2 TO 3
58 records selected.
```

This example restores two saved select lists, one holding keys for customers in France, the other for customers in Germany and merges these to form select list 3 as a list of customers in either of these countries.

See also:
LIST.DIFF, **LIST.INTER**, **LIST.UNION**

4.107 MESSAGE

The **MESSAGE** command sends a message to selected other users. This command is not available on the PDA version of QM.

Format

MESSAGE *user* {**IMMEDIATE**} {*message.text*}

MESSAGE OFF

MESSAGE ON

where

user	identifies the user(s) to receive the message. This may be a user number, a case insensitive user name, or the keyword **ALL**. Messages cannot be sent to phantom or QMClient processes.
IMMEDIATE	causes immediate display of the message as described below.
message.text	is the text of the message to be sent. If omitted from the command line, the user is prompted to enter the text. With the **IMMEDIATE** keyword, messages that are wider than the screen are truncated on terminals that support immediate message display.

Where a specific user number is given, the **MESSAGE** command checks that this user is logged in and is not a phantom process. The **ALL** keyword sends the message to all non-phantom users (except the user sending the message).

Messages are normally displayed when the user next arrives at the command prompt. If the **IMMEDIATE** keyword is used and the destination process is using a terminal that supports screen save and restore (QMConsole on Windows, QMTerm, AccuTerm), the message is displayed immediately and the screen is restored when the user acknowledges the message.

The **MESSAGE OFF** command disables receipt of messages. Messages sent while message reception is disabled are not queued for later display and will never be seen. Use of the **MESSAGE** command with a user number will report an error if the target user has message reception disabled.

The **MESSAGE ON** command enables receipt of messages. This is the default state.

@SYSTEM.RETURN.CODE is set to zero for success or to a negative error code.

4.108 MODIFY

The **MODIFY** command enters the QM record modification processor.

Format

MODIFY {**DICT**} *file.name* { *field list* } { *id.list* }

where

DICT indicates that the dictionary portion of the file is to be modified.

file.name is the name of the file to be modified.

field.list is the list of field(s) to be modified. Each entry must correspond to a D-type dictionary entry. These name may alternatively be a PH (phrase) type entry which will be expanded and all fields referenced by the phrase will be modified. If no fields are specified on the command line, **MODIFY** looks for a phrase named @MODIFY and, if found, uses this as the source of field names. If no @MODIFY phrase exists, **MODIFY** will use the @ phrase or, if this also does not exist, a default list of fields is constructed from the dictionary.

Items appearing on the command line or in the @MODIFY or @ phrase which are not D-type dictionary entries or phrases are ignored.

Field names may be followed by "**VERIFY** *filename*". In this case, **MODIFY** will check that data entered into the named field is a record id in the named file.

id.list is the list of records to be modified. An item is assumed to be a record id if it is not a field name defined in either the dictionary or the VOC, or if it is enclosed in quotes. If no *id.list* is specified, **MODIFY** uses the default select list or, if that is inactive, prompts for record ids.

The **MODIFY** command provides a data editor which uses the dictionary associated with a file to determine the format in which data is displayed or entered and to provide prompts in terms which relate to the data. It is useful for making changes to existing records or entering new data. **MODIFY** is particularly suited to entry of dictionary records where the prompts remove the need to remember the meaning of each field.

MODIFY prompts for a record id or uses the next item from *id.list* or the default select list. Entry of a question mark (?) at the id prompt will display a pick list of record ids.

If the record already exists, a list of modifiable fields is displayed. This list contains one entry for each single valued field followed by an entry for each multi-valued field or associated set of fields.

The prompt displayed with the list allows the following responses:

item no Entry of an item number from the list selects that field or association for modification. Data may be entered or modified in a panning input area at the bottom of the screen. The edit keys available are:

Ctrl-A or Home	Position cursor at the start of the data
Ctrl-E or End	Position cursor at the start of the data
Ctrl-B or Left	Move the cursor left one character
Ctrl-F or Right	Move the cursor right one character
Ctrl-D or Del	Delete the character under the cursor
Backspace	Delete the character to the left of the cursor
Ctrl-K	Delete all characters from the cursor position onwards
Ctrl-O or Ins	Toggle overlay / insertion mode
Ctrl-Q	Quote character. The next character is inserted without interpretation as a command. If the character is V, S or T, a value, subvalue or text mark is inserted.
Return	Accept the entered data
Ctrl-X	Abort entry, returning to the field list
F1	Display help screen

Non-printing characters can be inserted using the Ctrl-Q prefix shown above or by typing **^***nnn* where *nnn* is the ASCII character number of the character to be inserted.

As fields are modified, their values are inserted into the displayed list of fields.

FI Writes the modified record to the file and prompts for a new record id. If the record was a dictionary I-type or C-type, **MODIFY** will compile it.

Q Quits from the record, discarding any changes and prompts for a new record id.

N Displays the next page of fields available for modification.

P Displays the previous page of fields available for modification.

? Displays a brief expansion of the available options.

Selecting a multi-valued field or an association enters a separate display screen showing one line for each value in the field(s).

The prompt displayed with the list allows the following responses:

line no Entry of a line number from the list selects that value set for modification. Data may be entered or modified for each field in the association in turn in a panning input area at the bottom of the screen. The edit keys available are as above.

D*n* Deletes the value set at line *n*.

I*n* Inserts a new value set at line *n*.

E Extends the values, repeatedly accepting new data until either a null entry is made

in the first field of the association or the exit key (Ctrl-X) is used.

N Displays the next page of values available for modification.

P Displays the previous page of values available for modification.

? Displays a brief expansion of the available options.

Where the record does not already exist, **MODIFY** prompts for data for each field in turn and then allows changes as for an existing record.

When editing a dictionary, **MODIFY** automatically chooses the editable fields based on the record type.

4.109 NLS

The **NLS** command sets or reports national language support settings.

Format

NLS	Report all settings
NLS { **DEFAULT** }	Set defaults
NLS { *key* }	Report setting for given parameter
NLS { *key value* }	Set value for given parameter

where

key	identifies the parameter to be set or reported.
value	is the new value for the parameter.

The **NLS** command sets or reports national language parameter values. The available parameters and their default values are:

Parameter	**Default**	**Notes**
CURRENCY	$	Maximum 8 characters
THOUSANDS	,	Thousands separator character
DECIMAL	.	Decimal separator character

4.110 NSELECT

The **NSELECT** command refines a select list by removing items that are in a named file.

Format

NSELECT { **DICT** } *file* { **FROM** *from.list* } { **TO** *to.list* }

where

DICT indicates that the dictionary portion of the file is to be used.

file identifies the file to be processed.

from.list is the select list to be used as the source of record ids to be checked against *file*. If omitted, the default list (list 0) is used.

to.list is the select list to be receive the modified list. If omitted, the default list (list 0) is used.

The **NSELECT** command refines the source select list by removing from it any items that correspond to record ids present in the named file.

Example

```
SELECT VOC
NSELECT NEWVOC
LIST VOC
```

The above sequence of commands builds a list of all records in the VOC file, removes from this list all items present in NEWVOC and then lists the remaining VOC records. The effect is to show those VOC records added since the account was created.

4.111 OPTION

The **OPTION** command sets, clears or displays configurable options.

To ease application portability, options that are not meaningful on a particular QM platform are ignored.

Format

OPTION {*option.name* {**ON** | **OFF** | **DISPLAY** | **LPTR** {*unit*}} }
OPTION ALL OFF

The **OPTION** command, normally only used in the LOGIN or MASTER.LOGIN paragraphs, sets options that determine how the system behaves for that user session.

The **ON** keyword is used to set an option and is the default action if no keyword is present. The **OFF** keyword is used to clear an option. The **DISPLAY** keyword is used to display the current setting of an option.

The **OPTION** command with no qualifying information displays the settings of all options. The **LPTR** keyword directs this report to the specified print unit, printer zero if *unit* is omitted.

The **OPTION ALL OFF** syntax turns off all options. It is useful in LOGIN paragraphs to ensure that all options are off before turning on those that are required in applications that may use **LOGTO** to move between accounts.

Option settings are not automatically inherited by phantom processes.

The available options are:

AMPM.UPCASE	Causes the am/pm suffix displayed by some time conversions to appear in uppercase instead of the default lowercase.
ASSOC.UNASSOC.MV	Treats all multivalued fields for which no association is defined in the dictionary as being associated together. This provides close compatibility with Pick style systems but may lead to unintentional association of unrelated fields.
CHAIN.KEEP.COMMON	Retains the unnamed common block and command processor level on use of **CHAIN**.
CRDB.UPCASE	Causes the cr/db suffix displayed by some decimal conversions to appear in uppercase instead of the default lowercase.
DEBUG.REBIND.KEYS	Causes the QMBasic debugger to rebind the function keys on entry, replacing any user defined bindings with those specified in the terminfo entry for the current terminal type.
DIV.ZERO.WARNING	Attempts to divide by zero in QMBasic programs should report a warning rather than a fatal error. The division will return a zero result. This option should only be used during application development as it may cause faulty applications to

	appear to work correctly.
DUMP.ON.ERROR	Causes generation of a process dump file at a process abort such as a run time fatal error.
ED.NO.QUERY.FD	Suppresses the confirmation prompt in the ED editor when using the FD command or its synonym DELETE.
INHERIT	Phantom processes will inherit the option settings of the parent process. Use of an OPTION command in the MASTER.LOGIN or LOGIN paragraphs of the phantom process may modify these settings.
LOCK.BEEP	Emits a beep at the terminal once per second while waiting for a record or file lock.
NO.DATE.WRAPPING	Suppresses rolling of dates with overlarge day numbers into the following month on input conversion.
NO.SEL.LIST.QUERY	Suppresses display of the confirmation prompt in commands that take an optional select list of records to process. This is equivalent to use of the NO.QUERY option to those commands.
NO.USER.ABORTS	Suppresses all options that allow a user to generate an abort event. These are: the "Press return to continue" prompt, the pagination prompt when using the **SCROLL** keyword of the query processor, and the break key options.
NON.NUMERIC.WARNING	QMBasic programs attempting to use a non-numeric value where a number is required should use zero and report a warning rather than a fatal error. The operation will return a zero result. This option should only be used during application development as it may cause faulty applications to appear to work correctly.
PICK.BREAKPOINT	Causes the query processor to recognise Pick style syntax for the **BREAK.ON** and **BREAK.SUP** keywords where the optional text qualifier follows the field name rather than appearing before it.
PICK.BREAKPOINT.U	Causes the query processor to handle the U breakpoint option differently. See the **BREAK.ON** and **BREAK.SUP** keywords for further details.
PICK.EXPLODE	When using **BY.EXP**, if an associated field has only one value, do not explode this field.
PICK.IMPLIED.EQ	Causes the query processor to handle a selection clause that has no operator between the field name and a literal value enclosed in double quotes as though there was an EQ operator.
PICK.GRAND.TOTAL	Causes the query processor to display the text of the **GRAND.TOTAL** keyword on the same line as the total values.
PICK.NULL	Causes the ML and MR conversion codes and format expressions that use options applicable to numeric data to return a null string for null data instead of zero.
PICK.WILDCARD	Causes the query processor to recognise Pick style wildcards

	in equality tests as an alternative to the **LIKE** operator.
PROC.A	Causes the Proc A(*n*,*m*) command not to terminate copying data at the end of the field.
QUALIFIED.DISPLAY	Causes the query processor to recognise Pick style qualified display clauses.
QUERY.NO.CASE	Causes the query processor to perform selection operations and sorting in a case insensitive manner.
QUERY.PRIORITY.AND	Causes the **AND** operator to take priority over the **OR** operator in query processor commands. This does not affect the behaviour of these operators in QMBasic programs.
RUN.NO.PAGE	Causes the **RUN** and **DEBUG** commands to start the program with screen pagination disabled. This is equivalent to use of the NO.PAGE option. This option also affects user catalogued programs.
SELECT.KEEP.CASE	Causes QM to preserve the case of record ids when building a select list from a directory file on an operating system that uses case insensitive file names. This currently only affects Windows systems.
SHOW.STACK.ON.ERROR	Displays the call stack at a fatal program error, showing the program name, line number (where available), and object code address.
SPACE.MCT	Modifies the behaviour of the MCT conversion code such that only the first character and letters immediately after a space are converted to uppercase.
SUPPRESS.ABORT.MSG	Suppresses display of program location diagnostic information when a QMBasic **ABORT** statement is executed.
UNASS.WARNING	Unassigned variables in QMBasic programs should report a warning rather than a fatal error. This option should only be used during application development as it may cause faulty applications to appear to work correctly.
WITH.IMPLIES.OR	In a query containing multiple **WITH** clauses, there is an implied **OR** rather than the default implied **AND** between these clauses.

Special short form options:

PICK	This option sets **ASSOC.UNASSOC.MV**, **PICK.BREAKPOINT**, **PICK.BREAKPOINT.U**, **PICK.EXPLODE**, **PICK.GRAND.TOTAL**, **PICK.NULL**, **PICK.WILDCARD**, **QUALIFIED.DISPLAY** and **WITH.IMPLIES.OR** options. It cannot be used with **ON**, **OFF** or **DISPLAY**. Note that this option brings QM closer to the Pick database model but does not provide complete compatibility.
QMBASIC.WARNINGS	This option sets **DIV.ZERO.WARNING**, **NON.NUMERIC.WARNING** and **UNASS.WARNING** options. It cannot be used with **ON**, **OFF** or **DISPLAY**.

4.112 PASSWORD

The **PASSWORD** command changes the password for a QM user on Windows 98/ME.

User management is not applicable to the PDA version of QM.

Format

PASSWORD {*username*}

The **PASSWORD** command prompts for the existing password of the user and then prompts twice for the new password. Terminal echo is suppressed during password entry.

The *username* argument may only be used by users with administrator rights and allows changes to the password of a user other than that executing the command.

See also:
ADMIN.USER, **CREATE.USER**, **DELETE.USER**, **LIST.USERS**, **SECURITY**

4.113 PAUSE

The **PAUSE** command displays a "Press return to continue" prompt.

Format

PAUSE

The **PAUSE** command, intended for use in paragraphs, pauses processing and displays a prompt for user input before continuing. By default, this prompt offers two special responses; A to abort and Q to quit. If the NO.USER.ABORTS mode of the **OPTION** command is active, the A option is not offered.

4.114 PDEBUG

The **PDEBUG** command runs the phantom debugger. This command is not available on the PDA version of QM.

Format

PDEBUG {*command*}

where

command is the command to be executed by the phantom process.

The **PDEBUG** command allows debugging of a QMBasic program in a phantom or QMClient process using the same debugger interface as for foreground processes.

The **PDEBUG** command waits for a phantom or QMClient process running in the same account and as the same user name to attempt to enter the debugger. At that point, the process executing the **PDEBUG** command will enter the QMBasic debugger and can use this in the usual way except that it is not possible to view the application screen because a phantom process is not associated with a terminal device.

The phantom process to be debugged may be started separately or by use of the *command* option to the **PDEBUG** command.

4.115 PDUMP

The **PDUMP** command generates a process dump file for a named QM process.

Format

PDUMP *userno*

where

userno is the QM user number of the process to dump.

The **PDUMP** command forces generation of a process dump file for the user identified by *userno*.

Because use of the **PDUMP** command can weaken system security by allowing a user to see data inside another user's program, the PDUMP configuration parameter may be used select a mode where only system administrators can dump processes running under other user names. For alternative security rules, add a security subroutine to the relevant VOC entry.

4.116 PHANTOM

The **PHANTOM** command starts execution of a verb, sentence or paragraph as a background process. This command is not available on the PDA version of QM.

Format

PHANTOM *command*

A new background process is started to execute the *command* which must be a valid verb, sentence or paragraph. The process from which the **PHANTOM** command was performed continues without waiting for *command* to be completed. A message is displayed indicating the user number associated with the phantom. The user number is also returned in @SYSTEM.RETURN.CODE. If the phantom process cannot be started, @SYSTEM.RETURN.CODE holds the negative error code.

When the background process terminates a message is queued for display immediately before the next command prompt. This message is

```
Phantom n : Normal termination.
```

where *n* is the user number if the process completed successfully or

```
Phantom n : Abnormal termination.
```

if the process aborted.

The phantom process will automatically create a COMO file named PH*n_date_time* exactly as though it had commenced with the command

COMO ON PH*n_date_time*

Output that would normally be directed to the display is suppressed except for recording in the COMO file. The COMO file may be switched off or redirected as desired.

Any attempt to read data from the keyboard will cause the process to abort. **DATA** statements may be used in the phantom to supply input that would normally be read from the keyboard.

Phantom processes may not be started within a transaction.

All QM processes, including phantoms, execute the VOC LOGIN paragraph, if it exists. To exit from the LOGIN paragraph for a phantom process, insert a line

```
IF @TTY = 'phantom' THEN STOP
```

at the relevant point in the paragraph. See @TTY for more details.

Example

```
PHANTOM BASIC BP INVOICE
```

This command starts a phantom process to compile the QMBasic program in record INVOICE of the BP file.

4.117 PRINTER

The **PRINTER** command provides control for print units.

Format

PRINTER {*print.unit*} *action*

The *print.unit* argument identifies the print unit on which the action is to occur and must be in the range -1 to 255. If omitted, print unit zero is used.

The *action* may be any of the following. Multiple actions may be specified in a single **PRINTER** command and will be performed in the order in which they occur on the command line.

AT *printer.name*	Output is directed to the named printer
BOTTOM.MARGIN *n*	Sets the bottom margin size.
CLOSE	The print unit is closed.
FILE *filename recordname*	Selects the destination for printed output.
LEFT.MARGIN *n*	Sets the left margin size.
LINES *n*	Sets the number of lines per page.
KEEP.OPEN	Keeps the printer open to merge successive printer output.
QUERY	Reports the current settings
RESET	Resets to the default parameter values.
TOP.MARGIN *n*	Sets the top margin size.
WIDTH *n*	Sets the number of characters per line.

The **PRINTER** command sets or reports the settings of printer control parameters. The action of each keyword is described in detail below.

PRINTER *print.unit* **AT** *printer.name*
Subsequent output is directed to the named printer. The *printer.name* must be a printer defined in Windows.

PRINTER *print.unit* **BOTTOM.MARGIN** *n*
Sets the bottom margin size. On reaching the foot of the page, *n* blank lines will be output to reach the start of the next page. This value defaults to 0 and is reset on closing a print unit.

PRINTER *print.unit* **CLOSE**

The print unit is closed. This action overrides any previous use of the **KEEP.OPEN** option. If this print unit was directed to a spool file, the data will be printed. Any heading and footing text or file name associated with the printer is discarded and further use of this print unit by a program or command will start a new file.

PRINTER *print.unit* **FILE** *filename recordname*
Selects the destination for printed output. Output to print units 1 to 255 is normally directed to a hold file. This command associates a record of a directory file with the print unit. The record is not created until the first output is directed to the print unit.

PRINTER *print.unit* **KEEP.OPEN**
Allows merging of successive printer output into a single print job. Any request from a program to close the print unit clears the heading and footing but leaves the print job open to receive further output. The print unit is finally closed, and the job printed, by using the **CLOSE** option to this command. On Windows systems it may be important that the Print Manager option to start printing while a print job is being created is disabled as this could result in the printer being assigned to an incomplete job.

PRINTER *print.unit* **LEFT.MARGIN** *n*
Sets the left margin size. Each line will be indented by *n* spaces. This value defaults to 0 and is reset on closing a print unit.

PRINTER *print.unit* **LINES** *n*
Sets the number of lines per page. No validation of the value of *n* is performed. The effect of specifying a number of lines per page greater than that of the physical device on which the data is subsequently printed is undefined. This value defaults to 66 and is reset on closing a print unit.

PRINTER *print.unit* **QUERY**
Reports the current settings of the width, lines per page, top margin, bottom margin and left margin

PRINTER *print.unit* **RESET**
Resets to the default values for width, lines per page, top margin, bottom margin and left margin. This function does not affect any file association.

PRINTER *print.unit* **TOP.MARGIN** *n*
Sets the top margin size. Each page of output will commence with *n* blank lines. This value defaults to 0 and is reset on closing a print unit.

PRINTER *print.unit* **WIDTH** *n*
Sets the number of characters per line. No validation of the value of *n* is performed. The effect of specifying a width greater than that of the physical device on which the data is subsequently printed is undefined. This value defaults to 80 and is reset on closing a print unit.

See also:
SETPTR

4.118 PSTAT

The **PSTAT** command displays the status of one or all QM processes. This command is not available on the PDA version of QM.

Format

PSTAT { **USER** *userno* } { **LEVEL** *level* }

where

userno is the QM user number of the process to report.

level is the reporting level.

The **PSTAT** command displays diagnostic status information about the process with user number *userno* or, if the **USER** option is omitted, all QM processes.

For each process reported, **PSTAT** shows the account name, the last command executed and the current execution point (program name, line number and execution address).

The *level* parameter specifies extended report features and is formed by adding together the following components:

1 Report each program and subroutine in the call stack. If not included, only the currently active program is reported.

2 Report internal subroutine calls within each reported program and subroutine. If not included, only external subroutine calls are reported.

Examples

```
PSTAT USER 2 LEVEL 3
User Detail
    2 Account: SALES
      Command: RUN INVOICES
      !SCREEN 953 (14E6)
              750 (118E)
              450 (08F3)
              323 (061B)
      D:\LBS\QM\BP.OUT\INVOICES 105 (01BE)
      Command processor
      D:\LBS\QM\BP.OUT\PROC 104 (05B8)
      Command processor
```

In this example, the most recent command executed by user 2 was RUN INVOICES. It is currently executing the !SCREEN subroutine at line 953, address 14E6. Because the LEVEL parameter includes level 2, internal subroutine calls are also shown. The !SCREEN subroutine was called from The INVOICES program at line 105 (address 01BE). This program was started from the command processor which was itself started from line 104 of program PROC which was itself started from the command processor.

The same process could be reported in less detail using other values of the LEVEL option as shown below:

Level 2 (Internal subroutine stack but exclude external calls)

```
PSTAT USER 2 LEVEL 2
User Detail
   2 Command: RUN INVOICES
     !SCREEN 953 (14E6)
             750 (118E)
             450 (08F3)
             323 (061B)
```

Level 1 (External subroutine stack but exclude internal calls)

```
PSTAT USER 2 LEVEL 1
User Detail
   2 Command: RUN INVOICES
     !SCREEN 953 (14E6)
     D:\LBS\QM\BP.OUT\INVOICES 105 (01BE)
     Command processor
     D:\LBS\QM\BP.OUT\PROC 104 (05B8)
     Command processor
```

Level 0 (Current location only)

```
PSTAT USER 2
User Detail
   2 Command: RUN INVOICES
     !SCREEN 953 (14E6)
```

4.119 PTERM

The **PTERM** command sets or displays terminal characteristics.

Format

PTERM BINARY { **ON** | **OFF** }

PTERM BREAK { **ON** | **OFF** }

PTERM BREAK { *n* | **^***c* }

PTERM CASE { **INVERT** | **NOINVERT** }

PTERM NEWLINE { **CR** | **LF** | **CRLF** }

PTERM PROMPT "*string1***"** { "*string2*" }

PTERM RESET *string*

PTERM RETURN { **CR** | **LF** }

PTERM DISPLAY

PTERM LPTR

Multiple options from the above may be included in a single command.

The **PTERM BINARY ON** or **OFF** command determines whether terminal input/output is processed by QM to handle special character transformation rules appropriate to a telnet connection. When binary mode is enabled, all data is passed in.out without any modification.

The **PTERM BREAK ON** or **OFF** command determines whether use of the break key is considered to be a break or a data character. If set on, the break key will interrupt processing. If set off, the break key is treated as a normal data character. The setting of this mode does not affect interpretation of the telnet break command.

The **PTERM BREAK** *n* or **^***c* command sets the character to be used as the break key. The first form takes the character number (1 - 31); the second form takes the printable character associated with the control key (A - Z, [, \,], ^, _). The default break character is ctrl-C (character 3). Note that some terminal emulators send a telnet negotiation parameter instead of the break character itself and may require changes to the emulator configuration to use an alternative character.

The **PTERM CASE** command determines whether the case of alphabetic characters is inverted on entry at the keyboard. Running with case inversion enabled may be more natural as, for historic reasons, the QM command set is all in upper case. In QMBasic programs, case inversion affects **INPUT** statements, the **KEYCODE()** and **KEYINC()** functions but not the **KEYIN()** function.

The **PTERM NEWLINE** command determines whether QM sends CR, LF or a CR/LF pair as the newline sequence on terminal output. The default mode is **CRLF**.

The **PTERM PROMPT** command changes the command prompt from the default colon to *string1*. The optional *string2* changes the alternative prompt displayed when the default select list is active. The prompt strings must be quoted and may be from 1 to 10 characters in length.

The **PTERM RESET** command sets a control string to be sent to the terminal device on return to the command prompt. This can be used, for example, to ensure that the terminal reverts to a chosen foreground/background colour scheme regardless of how the application left it set. The *string* may include use of the QMBasic style @() function to insert device dependent control codes or any of the following special codes:

\B	Backspace
\E	Escape
\F	Form feed
\N	Newline
\R	Carriage return
\T	Tab
\^	^
\\	\
^*x*	Ctrl-*x*

The **PTERM RETURN** command determines whether **KEYIN()** and related QMBasic functions return 10 (LF) or 13 (CR) when the return key is pressed. The actual effect of this mode setting is to replace incoming carriage returns with the given character unless the session is operating over a binary mode telnet connection. The default mode is **CR**.

The **PTERM DISPLAY** command reports the current settings of the terminal. **PTERM LPTR** directs the same report to the default printer.

4.120 QSELECT

The **QSELECT** command constructs a select list from the content of selected records.

Format

QSELECT {**DICT**} *file.name* {*id...* | * | **FROM** *list*} {**TO** *list*} {**SAVING** *field*}

where

id...	is a list of records to be processed.
*	specifies that all records are to be processed.
FROM *list*	specifies a select list of records to be processed.
TO *list*	specifies the list to be created. If omitted, the default list (list 0) is created.
SAVING *field*	identifies the field from which items are to be taken. If omitted, all fields in the record are processed. The *field* item may be a field number or a field name.

The **QSELECT** command reads selected records from the given file and constructs a select list from the content of the named field or all fields. Multivalued fields are expanded to give a separate list entry for each value or subvalue.

If the default select list is active and there are no record ids or **FROM** clause on the command line, this list is used to control processing.

4.121 QUIT

The **QUIT** command terminates the current QM session. The synonym **OFF** can be used.

Format

QUIT

The **QUIT** command terminates the QM session. If the account has the command stack recording option active, the current command stack is written to the VOC.

The ON.EXIT paragraph, if present, is executed before final return to the operating system.

4.122 RELEASE

The **RELEASE** command releases record or file locks..

Format

RELEASE *filename id...*

RELEASE FILELOCK *filename*

In the first form, **RELEASE** releases locks on the specified record id(s) in the named file. The second form releases the file lock on the named file.

RELEASE can only release locks held by the process in which the command is issued. System administrators can use the **UNLOCK** command to release locks held by other users.

Locks are released automatically when a file is closed. Applications can store file variables in a named common block so that the files remains open when the program terminates. In this case, locks left in place when the program ends will not be released automatically.

4.123 REPORT.SRC

The **REPORT.SRC** command turns on or off display of the @SYSTEM.RETURN.CODE variable on return to the command prompt. It is particularly useful when testing applications.

Format

REPORT.SRC OFF	To turn off display of @SYSTEM.RETURN.CODE
REPORT.SRC ON	To turn on display of @SYSTEM.RETURN.CODE
REPORT.SRC	To toggle display of @SYSTEM.RETURN.CODE

When reporting is enabled, the value of @SYSTEM.RETURN.CODE is displayed on return to the command prompt.

4.124 REPORT.STYLE

The **REPORT.STYLE** command sets the default query processor report style.

Format

REPORT.STYLE *name*	To set the default report style
REPORT.STYLE	To display the current setting
REPORT.STYLE OFF	To disable the default report style

The query processor can highlight selected components of a report using colour on a displayed report or font weights on a report directed to a PCL printer. The **REPORT.STYLE** command sets the default style to be used for all reports unless overridden by an alternative setting using **SETPTR**, the QMBasic **SETPU** statement, or the **STYLE** option to the query processor.

See the query processor **STYLE** option for full details of report styles.

4.125 RESET.MASTER.KEY

The **RESET.MASTER.KEY** command resets the encryption master key. This command can only be executed by users with administrator rights in the QMSYS account.

Format

RESET.MASTER.KEY

The command prompts for the key string.

The **RESET.MASTER.KEY** command is intended for use after moving the encryption key vault from another system or after application of a new licence.

The key string entered must be the same as when the key vault was created. The master key cannot be changed unless the key vault is cleared and rebuilt.

See also:
Data encryption, **CREATE.FILE**, **CREATE.KEY**, **DELETE.KEY**, **ENCRYPT.FILE**, **GRANT.KEY**, **LIST.KEYS**, **REVOKE.KEY**, **SET.ENCRYPTION.KEY.NAME**

4.126 RESTORE.ACCOUNTS

The **RESTORE.ACCOUNTS** command restores all accounts from a Pick style FILE.SAVE tape.

Format

RESTORE.ACCOUNTS *target* {*options*}

where

target	is the parent directory under which the restored accounts are to be placed. If omitted, the pathname specified in the $ACCOUNT.ROOT.DIR VOC entry is used or, if this record does not exist, the user is prompted for the directory pathname.
options	is any combination of the following:

BINARY	Suppresses translation of field marks to newlines when restoring directory files. Use this option when restoring binary data.
DET.SUP	Suppresses display of the name of each file as it is restored.
NO.CASE	Causes new files to be created with case insensitive record ids. Existing files are not reconfigured.
NO.INDEX	Do not create alternate key indices.
NO.OBJECT	Omits restore of object code. This is particularly useful when migrating to QM from other environments.
POSITIONED	Assumes that the tape is already positioned at the start of the data to be restored.

The **RESTORE.ACCOUNTS** command processes a Pick style FILE.SAVE tape or pseudo tape and restores data from it into a QM system. It can also restore from a tape containing multiple ACCOUNT.SAVEs.

The tape to be restored must first be opened to the process using the **SET.DEVICE** command.

All accounts found on the tape are restored unless there is already an account of the same name or the target account directory already exists. In these cases, the account is skipped.

For more details of the tape processing applied during restore, see the **ACCOUNT.RESTORE** command.

See also:
ACCOUNT.RESTORE, ACCOUNT.SAVE, FILE.SAVE, FIND.ACCOUNT, SEL.RESTORE, SET.DEVICE, T.ATT, T.DUMP, T.LOAD, T.xxx

4.127 REVOKE.KEY

The **REVOKE.KEY** command removes access to a specific data encryption key. This command can only be executed by users with administrator rights in the QMSYS account.

Format

REVOKE.KEY *keyname* {**GROUP**} *name ...*

where

keyname is the name of the encryption key. This is case insensitive

name ... is a list if usernames for users to be denied access. If prefixed by the **GROUP** keyword, this is a list of user groups. On Windows systems, user and group names are treated as case insensitive.

The **REVOKE.KEY** command removes access to an encryption key to one or more users or user groups. The user will be asked to enter the master key unless it has already been entered during this session.

No error occurs if the user or group specified did not have access to the key.

Example

```
REVOKE.KEY CARDNO jsmith bjones
```

The above command removes access to the encryption key named CARDNO for users jsmith and bjones.

See also:
Data encryption, **CREATE.FILE**, **CREATE.KEY**, **DELETE.KEY**, **ENCRYPT.FILE**, **GRANT.KEY**, **LIST.KEYS**, **RESET.MASTER.KEY**, **SET.ENCRYPTION.KEY.NAME**

4.128 RUN

The **RUN** command initiates execution of a compiled QMBasic program. It can also be used to execute VOC style items that are stored in alternative files.

Format

RUN {*file.name*} *record.name* {**LPTR**} {**NO.PAGE**}

where

file.name	is the name of the directory file holding the program to be run. If omitted, this defaults to BP. The .OUT suffix for the compiler output file is supplied automatically when using the command to execute a QMBasic program.
record.name	is the name of the compiled program.
LPTR	causes output to logical print unit 0 to be directed to the printer. This is identical in effect to a **PRINTER ON** statement being performed within the program.
NO.PAGE	suppresses pagination of output to the terminal.

The rules regarding location of the item to be executed are:

1. If only one name is provided, BP is assumed as the file name.
2. If a file with the .OUT suffix added to the name is defined in the VOC and can be opened, *record.name* is assumed to be the name of a compiled QMBasic program.
3. If the file is not defined in the VOC or cannot be opened for any reason, *record.name* is assumed to be the name of a VOC style item (sentence, paragraph, menu, etc) in the named file without the .OUT suffix.
4. If the item identified by the above steps cannot be found, an error is reported.

4.129 SAVE.LIST

The **SAVE.LIST** command is used to save an active select list for future use.

Format

SAVE.LIST *list.name* {**FROM** *list.no*}

where

list.name	is the name of the record to be created in $SAVEDLISTS to hold the saved select list.
list.no	identifies the select list (0 to 10) to be saved. If omitted, select list zero is used.

The **SAVE.LIST** command copies an active select list to the $SAVEDLISTS file. This file will be created if it does not already exist.

If the active list has already been partially processed, only the remaining items are saved. The active select list is cleared after it has been saved.

@SYSTEM.RETURN.CODE is set to the number of items in the saved list. In the event of an error, the value is a negative error code.

Example

```
SAVE.LIST INVENTORY FROM 3
Saved list 'INVENTORY' in $SAVEDLISTS.
```

This example saves active select list 3 as INVENTORY.

See also:
COPY.LIST, **DELETE.LIST**, **EDIT.LIST**, **GET.LIST**

4.130 SAVE.STACK

The **SAVE.STACK** command saves the current command stack.

Format

SAVE.STACK {*stack.name*}

where

stack.name is the name to be given to the saved command stack. A prompt is issued if this name is omitted.

The **SAVE.STACK** command copies the current command stack to the $SAVEDLISTS file as a record named *stack.name*. The file will be created if it does not already exist. Any existing record of the same name will be overwritten.

Example

```
SAVE.STACK <<@LOGNAME>>
Command stack 'jsmith' saved in $SAVEDLISTS
```

This command saves the current command stack to a record with id as the user's login name in the **$SAVEDLISTS** file.

See also:
CLEAR.STACK, **GET.STACK**

4.131 SCRB

The **SCRB** command runs the screen builder to create or modify a screen definition for use by the QMBasic **!SCREEN()** subroutine.

Format

SCRB {*screen.file*} {*screen.name*}

where

screen.file	is the name of the file holding the screen definition.
screen.name	is the screen definition record name. If neither a *screen.file* nor a *screen.name* is given, **SCRB** will check for an active select list before prompting for a screen name.

The QMBasic **!SCREEN()** subroutine uses screen definitions which are created and maintained using **SCRB**. The name of the account's default screen definition file is stored in field 2 of an X-type VOC record named $SCRB.FILE and will be used if no file name is given in the **SCRB** command line. If this record does not exist, **SCRB** uses the $SCREENS file which is common to all accounts. The $SCREENS file may also contain screen definitions which are part of the QM product. These have a dollar sign in their name and should not be modified or removed.

A screen consists of a number of steps, each of which may have a fixed text display, output of data from a data record, input of data into a data record. Data may be converted or formatted on output and input. Steps that include data input may perform validation within the screen driver subroutine and may also have user defined help and error messages. Programs can undertake all aspects of managing the flow from one step to another themselves, pass this task to the screen driver using a variety of conditional flow control options or use a mixture of the two modes.

The screen builder can automatically generate an include record identifying the screen steps by name for use in programs that use the screen. This include record will be placed in a nominated file with the same name as the screen with a .SCR suffix.

On entry to **SCRB**, the user is invited to enter a screen name unless this has been provided on the command line. **SCRB** will look for this in the form entered and, if not found, in uppercase. If neither exists, a new screen is created.

The user can then select from the following options

D	Delete the screen definition
F	File the screen definition
H	Amend the screen header line
I	Select the file to store the generated include record
L	List the screen steps
P	Paint the screen
LPTR	Print the screen definition

S*n* Show / edit step *n*

X Exit without filing

Amending the Screen Header Line

Selecting the **H** option allows entry/modification of the screen header line. It is useful to include the screen name in the header, perhaps at the left margin. All the normal input editing keys are available. Pressing the return key will end the header update.

Listing Screen Steps

The **L** option displays a list of screen steps. The information displayed is the step number and the fixed text (if any) associated with the step. If the step has no fixed text, the display shows <<*step* name>>. The escape key can be used to terminate the list before the last page is displayed.

Painting the Screen

The **P** option paints an image of the screen, showing the fixed text associated with steps except those that are tagged as not to be included in a full screen paint. A prompt is issued allowing selection of a step number to be executed. This allows easy debugging of the screen from within the screen builder. Entering **X** at the action prompt exits from paint mode.

Printing the Screen

The **LPTR** option send the screen definition to the printer. Details of each step are printed followed by a representation of the screen as it would be appear after the screen paint action of the **!SCREEN()** subroutine.

Show / Edit a Screen Step

The **S***n* option displays the definition of screen step *n*. A further prompt allows selection of the action to be taken

C*n* Copy step *n* over the currently displayed step

C*scrn***,***n* Copy step *n* of screen *scrn* over the currently displayed step

D Delete this step

I Insert a new step before this step

M*n* Move currently displayed step to become step *n*

N Advance to the next step

P Move to the previous step

R Return to the top level screen

S*n* Move to step *n*

n Edit step definition starting at item *n*

The items that make up a screen step are described below.

Name
Steps may optionally be given names. These must be unique within the screen definition and are used in generating an include record of step names for use in QMBasic programs. The include record tokens are formed by adding a prefix of SS. to the step name.

Type
The step type determines the way in which the screen driver will handle the step. The type may be any of the following:

D A display step. Any data item referenced by the step will be displayed but no input is permitted.

I An input step. The data is displayed as for a display step but input may also be performed.

N A control step. Any data item referenced by the step is not displayed but conditional flow control elements may still be included.

G*n* A step group to be repeated *n* times. The display step field described below contains a list of steps to be repeated. The repeat will terminate if the next step determination of any repeated step evaluates to anything other than the default. Step groups cannot be nested.

The step type may also include the following qualifying codes:

B Sounds the terminal "bell".

C Clears the text and data of this step after the step is completed. Usually used with the **X** display mode options described later, this feature is particularly useful for clearing temporary prompt fields from the screen.

H Causes the screen header to be displayed as part of this step.

R*n* This step is to be repeated *n* times. The repeat will terminate if the next step evaluates to anything other than the default. Repeated steps may not appear inside step groups.

X Excludes this step from the initial screen painting process. This should normally be included on the elements of a repeating group (not a repeated step).

Clear
The clear item contains **Y** if the screen is to be cleared prior to displaying this step.

Display step (multi-valued)
This field lists steps by name or number which are to be displayed prior to displaying this step. For repeating step group definitions it holds the steps to be repeated as described above.

A list may be entered in a multi-valued screen definition field by pressing F2.

Text
Text row

Text col
Text mode
The text item contains a fixed text string which will be displayed on the screen at the position given by the text row and text col values using the text mode display style. The mode may contain any combination of **H** to display in half intensity, **R** to set reverse video (interchange foreground and background colours) and **X** (omit from full screen paint).

Field
Value
Subvalue
These items determine the position of the data item to be displayed or input. The field may be specified as a numeric position or as a filename and field name separated by a space. In the latter case, the screen builder will look up the actual field position in the dictionary of the specified file when the screen definition is being entered. Later changes to the dictionary will not cause the screen definition to change. The value and subvalue fields may be left blank where the entire field or value is to be displayed.

A value of zero for the field uses an internal temporary variable. This is of particular use in confirmation prompts, for example, where the data input is used to determine flow through the screen steps but is not part of the record being amended.

For a repeated step or the elements of a repeating group, the field, value or subvalue may be specified as '1+', for example, which will cause the screen to use successive items starting at the given position.

Prompt char
This item may be used to specify a character to appear immediately to the left of the data field. It will be ignored if the data is displayed at the left margin.

Fill char
The fill character is used to pad out short data items on the display. It is not entered into the stored data.

Data row
Data col
Data mode
These items operate in the same way as their equivalents for the text area.

For a repeated step or the elements of a repeating group, the row may be specified as *y+i* where *y* is the line on which the first item is to appear and *i* indicates the number of lines by which the position is to advance for successive elements. The value of *i* defaults to 1.

Output len
The output length item specifies the length of the data item on the display. If the actual data is longer than this, the display is truncated.

Output conv (multi-valued)
This item holds the conversion to be performed on the data prior to display. The same conversion will be applied to redisplay input values when the step is completed. The conversion may be multi-valued to perform successive conversions. Output conversions are:

F*fmt*	Apply **FMT()** using *fmt* as the format specifier.
I*file***,***rec*	Execute the I-type named *rec* in the dictionary of *file*. against the data

record.

S*name*	Execute catalogued subroutine *name*, passing in the field value as argument 2 and replacing it with the valued returned through argument 1.
T*file***,***fld***,***code*	Apply **TRANS()** using the data item as the record id to access field *fld* of *file*. The code determines the action if the record is not found. **C** returns the record id, **X** returns a null string.
<*f*,*v*,*s*>	Extract the given field, value or subvalue.
Other	All other codes are passed to **OCONV()**.

Justify
This item contains **L** for left justification or **R** for right justification.

End mark
This item may be used to specify a character to appear immediately to the right of the data field. It will be ignored if the data field extends to the right margin.

Input len
The input length item specifies the permissible length of the data. If this value exceeds the output length, the field is panned to allow entry of long data. Many of the screen definition items are themselves panned in this way by **SCRB**.

Required
This item indicates whether the field may be left blank. It may contain:

Y	The field may not be left blank.
N	The field may be left blank.
F	For a repeated step or element of a repeating group, the field must not be blank for the first iteration of the repeat but may be blank for subsequent iterations.
<*f*>*cond*	The field is required if field <*n*> (or <*f*,*v*> or <*f*,*v*,*s*>) meets the supplied condition. The condition code is as described for the next step determinations described below.

Input val 1 (multi-valued)
The first input validation is performed on the input data prior to input conversion. This item may be multi-valued to perform multiple validations. The data is deemed acceptable if any of the validation criteria are satisfied. Validation codes are:

m	Numeric value *m*. This is a numeric comparison, leading zeros will be ignored.
m-*n*	A numeric value in the range *m* to *n*.
=*x*	String equality with *x*. *x* may be a null string.
D	A valid date.

F*filename* A record named as the input data exists in *filename*.

F*filename***,***n* Similar to the simple **F** validation but, if the record is found, the input data is replaced by the contents of field *n* of the record.

M*template* The input data matches the specified *template*.

R*file***,***rec***,***fld***,***case***,***subst*
Record *rec* is read from *file*. Field *fld* of this record is scanned for a match with the input data. If *case* is **X**, this scan is case insensitive. If *subst* is specified, the input data is replaced with the content of the corresponding value of field *subst* of the record. Field *fld* may be broken down into subvalues to specify alternative strings all of which are replaced by the value (not subvalue) in *subst*.

@*subrname* Calls the named user supplied validation subroutine. This subroutine takes three arguments; the return status (1 if ok, 0 if error), the data record being processed and the input data field to be validated.

X*xxx* Inverts the condition *xxx*. For example, XFINDEX would check that there is no record named as the input data in file INDEX.

Input conv (multi-valued)
This item holds the conversion to be performed on the input data. The conversion may be multi-valued to perform successive conversions. Input conversions are:

F*fmt* Apply **FMT()** using *fmt* as the format specifier.

N*n* If the data is numeric, extend it to be right justified in *n* digits.

S*name* Execute catalogued subroutine *name*, passing in the field value as argument 2 and replacing it with the valued returned through argument 1.

T*file***,***fld***,***code* Apply **TRANS()** using the data item as the record id to access field *fld* of *file*. The code determines the action if the record is not found. **C** returns the record id, **X** returns a null string.

<*f*,*v*,*s*> Extract the given field, value or subvalue.

Other All other codes are passed to **ICONV()**.

Input val 2 (multi-valued)
The second input validation is performed on the input data after input conversion. This item may be multi-valued to perform multiple validations. The data is deemed acceptable if any of the validation criteria are satisfied. Validation codes are as for the first input validation.

Back step
The back step item determines whether the backtab key is allowed and may contain **Y**, **N** or blank which is taken as **N**. If backtab is allowed, the screen driver will perform the action internally if it has a step history. If there is no step history, the screen driver returns to the calling program with a status indicating that the backstep key was used. The back step will correctly back-track through a repeated step or repeating group.

Next step
The next step item defines the action to be taken after the step is completed. It may be multi-valued with conditional elements. A null action simply increments the step number. All next step action lists effectively end with a null element which would be executed if all previous elements were conditional and not satisfied.

An action item comprises three parts; a *field reference*, a *condition* and an *action*. The *action* is preceded by a colon.

The *field reference* identifies the field within the screen data which is to be used in the following *condition*. This may be specified as <*field*>, <*field*,*value*> or <*field*,*value*,*subvalue*>. If omitted entirely (as is usual), the data from the current step is used. If a *field reference* is included, the *condition* must also be present.

The *condition* compares the selected data with a fixed string or numeric value. The generic form of this is **EQ'***string***'**, **EQ***number* or **EQ<***f*,*v*,*s***>**. The operator may be any of **EQ**, **NE**, **LT**, **GT**, **LE** or **GE**. If the *condition* is omitted, the *action* is performed unconditionally.

The *action* may be null to advance to the next step, a step number, a step name or **X** to exit to the calling program. Within a repeated step or a repeating group any non-null *action* terminates the repeat.

Example: `EQ'':X` would exit if the field is empty.

Help msg
The help message item defines a message to be displayed if the F1 key is pressed. The message may be split over multiple lines by using the F2 multi-value entry feature of **SCRB**.

Error msg
The error message item defines a message to be displayed if input validation fails in a similar manner to the help message.

Exit key
The exit key item defines the action to be taken if the escape key is pressed. The format and processing of this item is as for the next step item except that a null value causes an error message indicating that the exit key is not allowed.

F2 action
The F2 key is used for extended pick-list based help. If this item is blank, F2 is treated the same as other function keys as described below. There are three formats to this item:

filename, *selection/sort clauses*, *field names*
This format causes the screen driver to select records from the specified file using the selection and sort clauses (as for the query processor). A pick list is displayed based on the specified field names (which are space separated and may include I-types). The first field in this list is used as the returned value from the selection. The pick list short cut system described below uses the *field name* by default. An alternative field may be used by prefixing its name with a & character. The short cut will only work correctly if the list is sorted in ascending order by the short cut field.

#filename,*record.name*,*sort.field*,*field.list*
This format builds a pick list from given file, record, field. The *sort.field* and *field.list* reference fields in the named record by number. Dictionary names cannot be used in this action.

The data is sorted based on the value in the *sort.field*. The *sort.field* number may be followed by **R** to perform a right justified sort. The *field.list* is a space separated list of fields to be displayed. The *sort.field* must be explicitly referenced if it is to be displayed. The first field in *field.list* contains the value to be returned by the selection process.

@*subr*
@*subr*(*arglist*)
Calls a user written subroutine *subr* to generate the list of items to display. This subroutine returns the data to be displayed via its first argument, one field per pick list line each containing a value mark delimited set of data values. The second argument should return the pick list column number (from one) of the column to be used by the short cut system described below. Up to four additional arguments may be passed into the subroutine from *arglist* which contains literal values separated by commas. No string delimiters are required.

The pick list is displayed as a rolling window. The cursor up/down, page up/down, home and end keys may be used to explore this window. Keys corresponding to printable characters cause a short cut jump to a page displaying items starting at the first that commences with the entered character. The return key will place the data displayed in the first column of the selected item into the screen field. The escape key will exit from the pick list processing without entering data into the screen field.

Func keys
The screen driver may accept or reject function keys. Entering **Y** in this item causes the screen driver to return function keys to the calling program. Entering **N** or leaving it blank causes an error message if function keys are used.

Key val
This field may contain the name of a validation subroutine that will be called after each input keystroke in the field. The subroutine name is followed by a comma and the error message to be displayed if validation fails.

The subroutine takes three arguments; the returned status (1 if ok, 0 if error), the data record being processed and the input data for the field (not just the last keystroke).

Special keys

The screen driver uses the following keys for special purposes. The control key bindings shown after some entries are provided for compatibility with other parts of QM.

F1	Help
F2	Pick list help
F3	Delete the contents of the current field
F4	Restore the contents of the current field after incorrect entry
Return	Execute the next step action
Tab	Treated identically to the return key
Ctrl-P	Execute the back step action
Exit	Execute the exit key action (Ctrl-X)
Home	Mode to start of field (Ctrl-A)
End	Move to end of field (Ctrl-E)
Cursor left	Move left one character (Ctrl-B)
Cursor right	Move right one character (Ctrl-F)
Delete	Delete character under the cursor (Ctrl-D)

Ctrl-K	Delete all to right of the cursor
Backspace	Delete character before cursor
Insert	Toggle overlay mode
Page up	Scroll up in pick list display (Esc-V)
Page down	Scroll down in pick list display (Ctrl-V)

Within **SCRB** itself, the F2 key is used to enter multi-valued items such as validation criteria. Input prompts for successive items appear at the bottom of the screen until a null value is entered.

4.132 SECURITY

The **SECURITY** command enables, disables or reports the state of QM's internal security system.

User management is not applicable to the PDA version of QM.

Format

SECURITY ON	Enable security
SECURITY OFF	Disable security
SECURITY	Report the current security setting

The **SECURITY** command determines how users connecting directly to QM over a network are handled. Users of QMConsole sessions, including users who have made a standard telnet connection and entered QM from an operating system command prompt, are not affected by this command.

On Windows 98/ME, network users will be required to enter a valid username and password if security is enabled. This username is private to the QM environment and is created using the **CREATE.USER** or **ADMIN.USER** commands. If security is not enabled, network users can connect directly to QM with no authentication.

On later versions of Windows, network users will always be required to enter a valid username and password known to Windows. Furthermore, if security is enabled, this username must also be in QM's own register of usernames. It is inserted into the register using the **CREATE.USER** or **ADMIN.USER** commands. If security is not enabled, any user with a valid Windows username will be able to make a direct network connection to QM.

On other platforms, network users will always be required to enter a valid username and password known to the operating system. Furthermore, if security is enabled, this username must also be in QM's own register of usernames. It is inserted into the register using the **CREATE.USER** or **ADMIN.USER** commands. If security is not enabled, any user with a valid operating system username will be able to make a direct network connection to QM.

Use of the **SECURITY** command is restricted to QMConsole users with administrator rights. If security is disabled, all users are considered as administrators.

See also:
ADMIN.USER, **CREATE.USER**, **DELETE.USER**, **LIST.USERS**, **PASSWORD**

4.133 SED

The **SED** command is a screen based editor, particularly useful for editing QMBasic source programs where many lines (fields) can be seen at once.

Format

SED {{**DICT**} *file.name* {*record.id* ...}}

where

DICT	indicates that records from the dictionary portion of the file are to be edited.
file.name	is the name of the file holding the record(s) to be edited.
record.id	is the name of the record to be edited. Multiple record names may be specified.

If no *file.name* is specified, **SED** will prompt for this name. The response may include a prefix of **DICT** to select the dictionary portion of the file.

If no *record.id* is specified and the default select list is active, this list is used to identify the records to be edited. If no *record.id* is specified and the default select list is not active, **SED** prompts for the *record.id*.

An asterisk (*) either on the command line or as the first *record.id* entered in response to the prompt will cause **SED** to select all records of the file and edit each in turn.

A question mark (**?**) as the first *record.id* entered in response to the prompt (not on the command line) causes direct entry in explore mode, displaying a list of records in the file. The **?** character may be followed by a single space and a **selection template** as described under the **list records** function to produce a restricted list of records.

The editor maintains an update lock on the record(s) being edited.

When editing an I-type dictionary item, **SED** removes the compiled code thus forcing recompilation when the modified I-type is first referenced.

SED Topics

Records, Buffers and Windows

Standard key bindings

Cursor movement functions

Data insertion

Copying, deleting and restoring data

Working with multivalued data

Functions that operate on a block of data

Changing text

[Macros]
[File Handling]
[Repeating functions]
[Miscellaneous functions]
[Commands]
[Setting up default modes]
[Source control]
[Dynamic key bindings]
[Extension programming]

SED - Records, buffers and windows

A record to be edited is held in a **buffer**. Buffers may also hold records being created but not yet written to disk or other data such as lists of records in a file. **SED** allows use of up to 20 buffers.

The editor displays a **window** in which a number of lines of the record being edited can be seen at any one time. Where a line is wider than the display, the entire window pans from side to side to maintain the cursor within the display area.

The bottom two lines of the screen display status information. The upper status line shows the file and record names of the data being edited. If the data has been changed and hence does not match what is stored in the file, an asterisk is displayed at the start of this line.

The lower status line displays several status fields. From left to right these show
the number of lines in the record
the current cursor position (line and column, both numbered from one)
the status of macro collection
the state of insertion overlay mode
the state of indentation mode
the search mode
the count for repeated functions and operations with a numeric prefix

The lower status line is also used by some editor functions to request qualifying information. A limited set of editing functions can be used within this prompt area. These are **forward char**, **back char**, **start line**, **end line**, **delete char**, **backspace**, **kill line** and **insert kill buffer**. The **kill line** function used in this area deletes all characters after the cursor without affecting the kill buffer. The **insert kill buffer** function will insert the first line from the kill buffer at the current cursor position.

The display may optionally include line numbering. See the **LNUM** command for further details.

SED - Standard key bindings

SED commands in the default key bindings consist of keystrokes which are

Control shift + key

ESCape followed by another key

Ctrl-X followed by another key

Ctrl-X followed by control shift + key

The table below summarises the standard editor function key bindings but these can be changed. All other keystrokes except for unused control shift codes cause the character to be inserted into the record text at the current cursor position.

	Ctrl-	Esc-	Ctrl-X -	Ctrl-X Ctrl-
A	Start line			
B	Back char	Back word	Goto buffer	*List buffers
C	Repeat	Capital init	*Quit	*Quit
D	Delete char	Delete word	*List records	Dive
E	End line	Run extension	*Execute macro	
F	Forward char	Forward word		*Find record
G	Cancel	Goto line		
H	Backspace			
I	Tab	Align text	Import	
J	Newline			
K	Kill line		Delete buffer	
L	Refresh	Lowercase		Lowercase region
M	Newline		CompRun	
N	Down line	Next buffer		Nudge down
O	Overlay		Toggle window	
P	Up line	Previous buffer		Nudge up
Q	Quote char	Quote char	Query replace	
R	Reverse search	Reverse search	Replace	
S	Forward search	Forward search	Save record	Save record
T	Toggle chars			
U	Repeat	Uppercase	Up to parent	Uppercase region
V	Forward screen	Back screen		
W	Delete region	Copy region	*Write record	*Write record

X	Ctrl-X prefix	*Command	*Export	Swap mark
Y	Insert kill buffer	Insert kill buffer		
Z	Up line			Nudge up
1			Unsplit window	
2			Split window	
(			*Start macro	
)			*End macro	
=			*Expand char	
.		Set mark		
<		Top		
>		Bottom		
Bkspc	Backspace	Back del word		
Del	Delete char			
Space		Close spaces		

Functions marked with an asterisk cannot be included in a macro and cannot be repeated using the **repeat** or **repeat count** functions.

Some functions are available using alternative key sequences. Such alternatives are shown in the descriptions.

Most functions can be repeated multiple times by use of the repeat count prefix. Unless otherwise specified, the repeat count defaults to one if not explicitly set. Some functions use the repeat counter for different purposes.

When learning SED, the Quick Reference Chart summarises the more important commands.

SED - Standard key bindings quick reference

Simple Cursor Movements

```
            Ctrl-P (previous)
              ^
              |
              |
              |
Ctrl-B  <---- . ----> Ctrl-F
Ctrl-E
(backwards)   |       (forwards)
(end)
              |
              |
              v
            Ctrl-N (next)
```

"All the way" movements

```
             Esc-<
               ^
               |
               |
               |
Ctrl-A  <----  .  ---->
               |

               |
               |
               v
             Esc->
```

Delete char	Ctrl-D	
Backspace	Backspace key	
Delete line	Ctrl-K	Alternates between deleting text and newline
Forward one screen	Ctrl-V	
Backward one screen	Esc-V	

Other Important Keys

Cancel	Ctrl-G	Terminates partly entered codes
Save changes	Ctrl-X S	
Close editor	Ctrl-X C	

Searching and Replacing

Forward search	Esc-S	Prompts for search string, defaulting to last
Reverse search	Esc-R	Prompts for search string, defaulting to last
Replace	Ctrl-X R	Prompts for search string and replacement
Query replace	Ctrl-X Q	Like Replace but queries each change

Other Movements

Forward word	Esc-F
Backward word	Esc-B

Cut and Paste

Set mark	Esc-.	Marks current cursor position
Copy region	Esc-W	Saves a copy of the text between the cursor and the mark
Delete region	Ctrl-W	Deletes the text between the cursor and the mark, saving it
Paste	Ctrl-Y	Inserts text saved by Esc-W, Ctrl-W or Ctrl-K

SED - Cursor movement functions

Start line (Ctrl-A)
Moves the cursor to the start of the current line (column 1).

End line (Ctrl-E)
Moves the cursor to the position following the last character in the current line.

Top (Esc-<)
Moves to the start of line 1.

Bottom (Esc- >)
Moves to the start of the line immediately after the last line in the record.

Down line (Ctrl-N)
Moves the cursor vertically down one line. If this position is beyond the end of the data in the new line, the cursor is displayed immediately to the right of the final character. The editor remembers the column position from which the cursor was moved so that a further vertical movement will continue to place the cursor at the lesser of its original column position and the end of the current line.

Up line (Ctrl-P or Ctrl-Z)
Moves the cursor vertically up one line. The same process is used for determining the column position as for the **down line** operation described above.

Forward char (Ctrl-F)
Moves the cursor right. Moving beyond the end of a line positions the cursor at the start of the following line.

Back char (Ctrl-B)
Moves the cursor left. Moving beyond the start of a line positions the cursor at the end of the previous line.

Forward word (Esc-F)
Moves the cursor to the first character after the next word. A word is defined as a continuous sequence of letters or digits.

Back word (Esc-B)
Moves the cursor to the first character of the previous word. A word is defined as a continuous sequence of letters or digits.

Forward screen (Ctrl-V)
Moves the cursor down by one screen or to the end of the buffer.

Back screen (Esc-V)
Moves the cursor up by one screen or to the start of the buffer.

Goto line (Esc-G)
Moves the cursor to the line number specified by the repeat counter. If no count has been entered, a prompt for the line number is issued.

Tab (Tab or Ctrl-I)
Advances the cursor to the next horizontal tabulation position (columns 11, 21, 31, etc. by

default. See the **TABS** command). If this is beyond the end of the data in the current line, spaces are inserted to extend the line to the required position. The tab function does not insert a tab character. Use the **quote character** prefix to do this.

Forward search (Ctrl-S or Esc-S)

The **forward search** function prompts for a search string and advances to the next occurrence of this string within the record. The prompt defaults to the same string as the previous search function (if any). Searches may be performed in any of four modes:

Case sensitive: Data will only be found if it matches the search string exactly. This is the default search mode.

Case insensitive: The case of both the search string and the data is ignored.

Word: Data is only considered to match where it is a whole word. A word is a sequence of letters preceded and followed by a line break or a character other than a letter. Searches performed in this mode are case insensitive.

Basic word: Similar to word search mode but the characters valid in the "word" are extended to cover acceptable syntax for a Basic program variable name.

The default search mode may changed during initialisation or by commands entered at the SED command prompt. Use of the **up line** and **down line** functions whilst entering the search string can also be used to change the mode except when collecting functions for a macro.

When a search is included in a macro, the prompt for the search string only occurs when collecting the macro. Subsequent executions use the same search string. Multiple search functions in a macro may have different search strings.

Reverse search (Ctrl-R or Esc-R)

The **reverse search** function prompts for a search string and moves backwards to the previous occurrence of this string within the record. The prompt defaults to the same string as the previous search function (if any). Search modes are as described above.

Nudge down (Ctrl-X Ctrl-N)

This function moves the displayed window down the record by one line. The cursor remains in the same position within the data unless it is on the top line of the screen in which case it will move down by one line.

Nudge up (Ctrl-X Ctrl-P or Ctrl-X Ctrl-Z)

This function moves the displayed window up the record by one line. The cursor remains in the same position within the data unless it is on the last line of the screen in which case it will move up by one line.

Align text (Esc-tab)

This function aligns the data on the current line to align text with the preceding line.

SED - Data insertion

Data is inserted at the current cursor position. If overlay mode is set the new data overwrites any existing data at this position, otherwise it is inserted before the character under the cursor. Overlay mode may be toggled using the **overlay** function (Ctrl-O) or the **OVERLAY** command.

The return key inserts a newline. If indent mode is active (see the **INDENT** command), the cursor is indented to line up with the previous line.

Any character other than a field mark or item mark may be inserted. The **quote character** function (Ctrl-Q or Esc-Q) allows insertion of non-printing characters. It may be used in four ways:

Followed by a number of up to three digits, it inserts the character with that decimal ASCII sequence.

Followed by V, S or T, it inserts a value mark, subvalue mark or text mark respectively.

Followed by K, it waits for a key to be pressed and then inserts the key binding code required for this key as described under Dynamic Key Bindings.

Followed by any other character, usually a non-printing character, it will insert that character.

SED - Copying, deleting and restoring data

Delete char (Ctrl-D)
The character at the current cursor position is deleted unless the cursor is positioned at the end of the line in which case the following line is appended to the current line.

Backspace (Backspace or Ctrl-H)
The **backspace** function removes the character to the left of the cursor position unless the cursor is already at the start of the line in which case the current line is appended to the previous line.

Kill line (Ctrl-K)
The **kill line** function behaves in one of two ways depending on the cursor position.

If there is data at or beyond the cursor position on the current line, the line is truncated at the cursor position.

If the cursor is beyond the last data character on the current line, the line break is removed, bringing data up from the next line.

The data removed by consecutive uses of the **kill line** function is placed in the **kill buffer** (see Functions that Operate on a Block of Data). Any other function will cause a later use of the **kill line** function to reset the kill buffer.

The **kill line** function may also be used in an explore buffer to delete the record named on the current line.

Delete word (Esc-D)
Text is deleted from the current cursor position to the end of the next word.

Back del word (Esc-Backspace)
Text is deleted backwards from the current cursor position to the start of the previous word.

SED - Working with multivalued data

When in a normal data window, some edit functions normally associated with file handling actions have special usage and allow entry to and exit from value edit mode.

Value edit mode takes the contents of a multivalued field and displays each value as a separate line in much the same way as the **EV** command of the **ED** line editor. While value edit mode is active, the original parent buffer becomes read only.

Used with a dictionary I-type entry, this mode breaks compound I-types into separate lines to simplify editing.

Up to parent (Ctrl-X U)
Used in a value edit buffer, this function returns to the parent buffer, saving any changes into the main buffer.

Dive (Ctrl-X Ctrl-D)
When not positioned on a $INCLUDE statement, this function enters edit value mode.

Delete buffer (Ctrl-X K)
When in a value edit buffer, this function returns to the parent buffer, discarding any changes.

SED - Functions that operate of a block of data

The editor maintains reference to two positions within the record; the cursor position and the **mark**.

Set mark (Esc-.)
The mark is set at the current cursor position.

Swap mark (Ctrl-X Ctrl-X)
The **swap mark** function interchanges the positions of the cursor and the mark. It has no effect if the mark has not been set.

Copy region (Esc-W)
The text within the region bounded by the mark and the current cursor position (which may be either way around) is copied to the **kill buffer**.

Delete region (Ctrl-W)
The text within the region bounded by the mark and the current cursor position (which may be either way around) is copied to the **kill buffer** and deleted from the record.

Insert kill buffer (Ctrl-Y or Esc-Y)
The contents of the kill buffer are inserted at the current cursor position. The kill buffer retains a copy of this text thus allowing multiple insertions.

Lowercase region (Ctrl-X Ctrl-L)
All words in the region between the mark and the cursor are converted to lowercase.

Uppercase region (Ctrl-X Ctrl-U)
All words in the region between the mark and the cursor are converted to uppercase.

SED - Changing text

Replace (Ctrl-X R)

The **replace** function prompts for a search string and a replacement string. All occurrences of the search string from the current cursor position to the end of the record are replaced by the replacement string. Search modes are applied as described for the **forward search** function.

When a **replace** is included in a macro, the prompt for the search and replacement strings only occurs when collecting the macro. Subsequent executions use the same strings. Multiple **replace** functions in a macro may have different strings.

Query replace (Ctrl-X Q)

This function is like the **replace** function except that a prompt is issued for each possible replacement. Entering a space causes replacement to occur, the return key causes no replacement and Ctrl-G causes the function to be aborted. Search modes are applied as described for the **forward search** function.

Capital init (Esc-C)

This function locates the next word in the record and converts it so that the first letter is in uppercase and the remainder is in lowercase.

Lowercase (Esc-L)

This function locates the next word in the record and converts it to lowercase.

Uppercase (Esc-U)

This function locates the next word in the record and converts it to uppercase.

Toggle chars (Ctrl-T)

The character at the cursor position and the preceding character are interchanged. This function has no effect if the cursor is at the start of the line or beyond the end of the line.

Close spaces (Esc-space)

All spaces surrounding the current cursor position are replaced by a single space.

SED - Macros

The editor allows multiple command sequences to be collected as a macro for subsequent re-execution.

The functions marked with an asterisk in the table at the start of this description cannot be included within a macro and will be rejected during collection of a macro.

Start macro (Ctrl-X open bracket)
Subsequent keystrokes are collected to form the macro. Each function is executed as it is collected.

End macro (Ctrl-X close bracket)
Terminates collection of a macro.

Execute macro (Ctrl-X E)
Causes execution of the macro. The repeat counter may be used to execute the macro multiple times.

Use of the **repeat** function after an **execute macro** function will repeat the macro. If the repeat count is set for the **repeat** function, the macro is executed that number of times. Otherwise the repeat count applied to the previous execution of the macro is used.

SED - File handling

Save record (Ctrl-X S or Ctrl-X Ctrl-S)
The current record is saved, overwriting the previous version (if any).

Write record (Ctrl-X W or Ctrl-X Ctrl-W)
A prompt is issued for the file and record names under which the data is to be saved. The file name may be prefixed by DICT to indicate that the dictionary portion is required.

After saving the data, the selected file and record names become current. A later use of the **save record** function would replace this record not the record that was specified when editing began.

The update lock is transferred to the new record by this function.

Import (Ctrl-X I)
A prompt is issued for the file and record names for the data to be imported. The data is then inserted at the current cursor position.

Export (Ctrl-X X)
The **export** function saves the contents of the region between the cursor and the mark to a file. A prompt is issued for the file and record names under which the data is to be saved. The file name may be prefixed by DICT to indicate that the dictionary portion is required.

Find record (Ctrl-X Ctrl-F)
The editor can handle multiple records simultaneously. The **find record** function prompts for file and record names and reads the record for editing. The file name defaults to that of the record in the current buffer. If the named record does not exist, a prompt is issued to confirm that it is to be created. Multiple records are of particular use when copying data between records.

The **find record** function will accept the record name on the same response line as the file name as an alternative to entering the file and record names in response to separate prompts. This is achieved by separating the file and record names by a single space. **SED** still attempts to open a file with a name corresponding to the complete prompt response first to allow for the unlikely situation of a file name which includes a space.

The **find record** function maintains a stack of the last 10 files referenced by this command. The **up line** and **down line** functions can be used to restore previous file names from the stack when the file name prompt is displayed.

List buffers (Ctrl-X Ctrl-B)
The **list buffers** function displays a list of all currently defined buffers, showing the buffer number, and its corresponding file and record names. It is of use when multiple records have been read. The colon normally following the buffer number is replaced by an asterisk if the buffer has been modified or a hyphen if it is a read-only buffer.

A marker is displayed to the left of the buffer number of the current buffer. This marker can be moved up and down using the **up line** and **down line** functions. Pressing **return** selects the marked buffer. The **cancel** function will revert to the previous buffer.

Next buffer (Esc-N)
When multiple records are in use, this function selects the next buffer as the current buffer for display and editing.

Previous buffer (Esc-P)
When multiple records are in use, this function selects the previous buffer as the current buffer for display and editing.

Goto buffer (Ctrl-X B)
This function selects the buffer identified by the repeat counter value.

Delete buffer (Ctrl-X K)
The current buffer is deleted, freeing it for use by other records. A confirmation prompt is displayed if the buffer has been modified.

List records (Ctrl-X D)
Displays a list of the records in a file allowing the user to explore the content of the file. The editor prompts for the file name which defaults to that of the record in the current buffer.

The file name may be followed by a **selection template** separated from the file name by a single space. If this template begins with the word **LIKE** or **WITH** the entire template is taken as a selection clause for the internally executed SELECT command. If the template does not begin with either of these words, it is assumed to be a pattern for matching with the SELECT statement LIKE clause. Thus a template of

```
PRT...
```

is equivalent to

```
WITH @ID LIKE PRT...
```

Single or double quotes may be used as required to ensure correct parsing of the template. Multiple conditions may be included exactly as in a SELECT statement. A template not starting with **LIKE** or **WITH** may not include both single and double quotes.

The list of records is displayed in a buffer which is tagged with a pseudo-record name of --Explore--. If an explore list already exists for this file, the list is rebuilt by this function, thus showing any changes to the file content.

The normal editor functions may be used to move around this buffer but it cannot be updated. The **return** key or the **dive** function (Ctrl-X Ctrl-D) will cause the editor to read and display the record identified by the line of the explore list on which the cursor lies. If this record is already loaded into a buffer, the existing buffer is selected.

The **kill line** function executed in an explore buffer deletes the record named on the current line. A confirmation prompt is issued before the record is deleted. If this record is currently loaded into a buffer, the buffer is also deleted. A second confirmation prompt is issued to confirm this action.

Up to parent (Ctrl-X U)
Moves 'up' from the displayed record to an explore list for the file holding the record. If the explore list already exists, the list is not rebuilt by this function.

Used in an explore buffer, this function moves up to a display of all files in the VOC. Diving into a file from this list shows a list of records in the file. It does not dive into the VOC record itself.

Used in a value edit buffer, this function returns to the parent buffer, saving any changes into the main buffer.

Dive (Ctrl-X Ctrl-D)

When positioned on a $INCLUDE statement of a **QMBasic** program, this function loads the associated include record into a new buffer.

When not positioned on a $INCLUDE statement, this function enters edit value mode.

SED - Repeating functions

A function may be repeated multiple times by use of the **repeat count** prefix. This is performed by use of the ESCape key followed by the number of times the command is to be repeated. The repeat count is displayed on the status line. Functions for which a repeat count is irrelevant ignore it.

Functions within macro definitions may be repeated in this way and the execution of the macro itself may also be repeated.

The **repeat** function (Ctrl-C or Ctrl-U) repeats the previously executed function. The **repeat count** prefix can also be used with this function.

SED - Miscellaneous functions

Cancel (Ctrl-G)
The **cancel** function aborts partially entered commands such as searches or repeat counts.

Refresh (Ctrl-L)
The refresh function rebuilds the screen display if it should be corrupted in any way. The current line is placed at the centre of the screen if possible. Alternatively, the repeat counter may be used to specify the screen line number on which the current line is to be placed.

Expand character (Ctrl-X =)
Certain control characters (e.g. tab, form feed) are represented on the screen by question marks. The **expand character** function displays the character sequence number for the character at the cursor position. It also shows the cursor position in terms of field, value and subvalue which is useful when editing data files.

Split window (Ctrl-X 2)
The **split window** function divides the screen into two separate windows. These initially hold two views of the same buffer but can be used to show different buffers.

Unsplit window (Ctrl-X 1)
The **unsplit window** function returns to single window mode from a split window view.

Toggle window (Ctrl-X O)
The **toggle window** function moves between the two windows of a split window display.

Quit (Ctrl-X Ctrl-C or Ctrl-X C)
The **quit** function terminates an editing session. If any records have been modified but not written back to disk, **SED** will prompt for confirmation that this action is intended.

Where a select list is in use, **SED** will move to the next item from this list.

Where only a file name was specified on the command line, **SED** will prompt for a further record name.

Run extension (Esc-E)
The **run extension** function prompts for an extension program name and executes that extension.

CompRun (Ctrl-X M)
The **CompRun** function compiles the QMBasic program in the current window and, if the compilation is successful, runs the program.

Command (Esc-X)
The **command** function is used to alter various long term states of the editor and to perform other actions.

Click here for a list of commands.

SED - Commands

The **command** function is used to alter various long term states of the editor and to perform other actions. After entering the **command** function (Esc-X), a prompt for the command name is issued. The following commands are available:

BASIC Saves the current record and runs the Basic compiler. This command is similar to COMPILE (described below) but it inserts marker lines into the source program where error or warning messages have been produced by the compiler.

BWORD Sets Basic Word mode for **search** and **replace** functions as described for the **forward search** function.

CASE_OFF Sets Case Insensitive mode for **search** and **replace** functions.

CASE_ON Sets Case Sensitive mode for **search** and **replace** functions.

COMPILE Saves the current record and runs the Basic compiler. For compatibility with SED on other platforms, if this record includes a line
*$CATALOG *catname*
the compiled program will be catalogued automatically after successful compilation. The actual cataloguing command issued is
CATALOG *filename catname recordname*
It is thus possible to perform either private or global cataloguing. The same action can be performed on **QM** using the $CATALOG compiler directive.

EXPAND.TABS Expands tab characters in the record being edited to align data on the columns determined by the current setting of the tab interval. The default tab columns are 11, 21, 31, etc.

FORMAT Applies standard format rules to the layout of a QMBasic program.

FUNDAMENTAL Reverts to the default (fundamental mode) key bindings.

INDENT Toggles indent mode.

KEYS Displays the name of the active key binding record.

LNUM The **LNUM** command controls display of line numbering. Used alone, it toggles the current state of numbering on the displayed buffer. It may also be used with the following qualifiers:

OFF	Turn off line numbering in the current buffer.
ON	Turn on line numbering in the current buffer.
ALL	Turn on line numbering in all buffers.
OFF ALL	Turn off line numbering in all buffers.
ON ALL	Synonym for **ALL**.

LOAD.KEYS Loads a named key binding record.

OVERLAY Toggles overlay mode. The **OVERLAY** function (Ctrl-O) has the same effect.

QUIT Ends editing of the current record in a similar way to the **quit** key sequence but also aborts any select list.

RELEASE Releases the update lock on the current record.

RUN Entering RUN with no qualifying details runs the program in the current buffer (which must have been compiled).

SAVE.KEYS Saves the key bindings as described later.

SPOOL Spools the contents of the current buffer to print unit zero.

The **SPOOL** command has optional qualifiers which may be used together if required. **LNUM** adds a line number prefix to each line printed. **REGION** prints only the lines between the mark and the cursor (which may be in either order). **AT** followed by a printer name selects the destination printer.

TABS Sets the tab interval to be used by the **tab** function and the **EXPAND.TABS** command. The value given after **TABS** must be in the range 1 to 99.

WORD Sets Word mode for **search** and **replace** commands.

XEQ {*cmnd*} Executes **QM** command *cmnd.* The **XEQ** command prefix is only required where *cmnd* is also an internal **SED** command. All commands not recognised by **SED** are passed to the command processor for execution.

The **command** function maintains a stack of the last 100 commands executed. The **up line** and **down line** functions can be used to restore commands from the stack when the command prompt is displayed.

SED - Setting up default modes

On entry, **SED** looks for a record named &SED.OPTIONS& in the VOC file. This record may be used to set up default configuration data.

Field 1 of the record should contain X, the record type code.

Field 2 may contain the following keywords separated by spaces:

BWORD	Turn on Basic word search mode.
CASE_OFF	Turn off search case sensitivity.
CASE_ON	Turn on search case sensitivity.
INDENT	Turn on indentation mode.
LNUM	Line numbering is to be on in all windows by default.
OVERLAY	Turn on overlay mode.
TABS *n*	Sets the default tab interval to *n* columns.
WORD	Turn on word search mode.

Fields 3 and 4 may contain the name of a key binding record.

Field 5 may be used to modify the default tab interval used by the **tab** function and by the **EXPAND.TABS** command. The value in this field must be between 1 and 99.

The record should contain no other data. Other fields may be used by later revisions of **SED**.

SED - Source control

SED includes a mechanism that may be used to implement a source control system or other special processing when updated records are written to disk.

Whenever a write is attempted using the **save record** or **write record** functions, SED checks for a catalogued subroutine named SOURCE.CONTROL. If this is present, it is called to validate whether data may be written to the file. The subroutine is defined as:

```
SUBROUTINE  SOURCE.CONTROL(dict.flag, file.name,
                           record.name, rec, caller,
                           write.allowed, updated)
```

where

dict.flag is "DICT" if attempting to write to a dictionary, a null string otherwise.

file.name is the name of the file to be written.

record.name is the name of the record to be written.

rec is the record data.

caller is 1 to indicate a call from SED, 2 for a call from ED.

write.allowed should be returned by the subroutine as true (1) if the write may be performed, false (0) if not. This argument is 1 on calling the subroutine.

updated should be set true if the subroutine has made any changes to the data in *rec* . This argument is 0 on calling the subroutine.

The source control subroutine may be used in any way you wish. Typical uses are simple validation of whether the record may be written or addition of edit history information prior to writing the data. In the latter case, where changes are made to the data passed via the *rec* argument, the *updated* flag should be set true so that SED rebuilds its working copy of the data on return.

The following simple example appends a history entry to the end of any record edited in BP or a file with a name ending .BP but ignores dictionaries.

```
SUBROUTINE  SOURCE.CONTROL(DICT.FLAG, FILE.NAME,
                           RECORD.NAME, REC,
                           FULL.SCREEN, WRITE.ALLOWED,
                           UPDATED)

   IF LEN(DICT.FLAG) THEN RETURN  ;* No interest in dictionary
   IF FILE.NAME # 'BP' AND FILE.NAME[3] # '.BP' THEN RETURN

   DISPLAY @(-1):
   DISPLAY SPACE(27) : "SOURCE CONTROL INFORMATION" : @(-4)
   DISPLAY "Change description:"
   PROMPT ""
   HDR = ""
   TAG = OCONV(DATE(), "D2EL")
   LOOP
```

```
      DISPLAY @(67) : "<" : @(0) :
      INPUT S, 66_
   WHILE LEN(S)
      HDR<-1> = "* " : TAG : "  " : S[1, 66]
      TAG = SPACE(9)
   REPEAT

   REC<-1> = HDR
   UPDATED = @TRUE
   RETURN
END
```

SED - Dynamic key bindings

The key bindings used in the function descriptions in this manual are the defaults used by **SED**, known as the **fundamental mode** bindings. The dynamic key binding system allows these to be changed if desired.

On entry, **SED** looks for a file named &SED.BINDINGS&. In most cases where this exists, it would be set up as a remote file pointer to a single file shared by all accounts. This file contains records defining named sets of key bindings.

SED works through a sequence of steps in locating the binding record to be used. This sequence, described below, is designed to allow almost any user or terminal specific precedence rules to be created.

Try the (optional) name in field 3 of the &SED.OPTIONS& VOC record.

Try a name constructed from *loginname-termtype* where both the login name and the terminal type are mapped to upper case.

Try USER.*loginname* where the login name is mapped to upper case.

Try *termtype* where the terminal type is mapped to upper case.

Try the (optional) name in field 4 of the &SED.OPTIONS& VOC record.

Try DEFAULT.

Revert to the fundamental mode bindings.

If there is no &SED.BINDINGS& file, SED uses the fundamental mode key bindings.

Key bindings can be changed at run time by use of the **LOAD.KEYS** command. This takes the name of a key binding record as its argument and the bindings defined in that record will be loaded.

Fundamental mode can be restored by use of the **FUNDAMENTAL** command.

The **SAVE.KEYS** command saves the current key bindings into a record named in the command argument (e.g. SAVE.KEYS DEFAULT to generate the DEFAULT bindings record).

Key binding records consist of a series of lines (fields), each of which defines one or more bindings for the function associated with that line separated by value marks. Control characters are represented by @A, @B, etc. for Ctrl-A, Ctrl-B, etc. Thus escape is @[. The @ character can be included in a binding as @@. All characters before the first @ are ignored thus allowing comments to be included. The **SAVE.KEYS** command inserts the function name as a comment in each binding.

One way to create new bindings is to use **SAVE.KEYS** to create a template which is then edited to make any desired modifications. The **quote char** function followed by **K** inserts the key binding expansion of the next key pressed and can be used while editing a key binding record. This function simply inserts the characters sent by the next key pressed. It does not validate the modified binding record for duplicate or ambiguous key sequences.

Used in this way, **quote char** waits for the first character to arrive and then sleeps for one second. It then inserts the codes for all characters waiting to be processed. This ensures that the entire sequence sent by, for example, a function key is processed. You should wait until the character sequence appears on the screen before typing any further characters.

SED - Extension Programming

The extension programming feature allows users to add new functions to the editor. These may range from simple insertion or modification of text with a single keystroke to complex programs that manipulate the data to achieve tasks that are specific to your own editor usage.

Extensions may be stored in any QM file. Ideally, this should be a dynamic hashed file and SED uses &SED.EXTENSIONS& by default. The editor looks for and executes an extension named START.UP on loading the first data record. Extension names must be upper case and consist only of letters, digits, periods (.) and dollar signs.

Extensions must be compiled before use. This is performed using SED's **COMPILE** command which recognises extension programs as distinct from QMBasic programs. The compiled version is stored in the same file as the source but with a suffix of -EXT added to the record name.

An extension is executed by the SED **run extension** function which is normally bound as Esc-E. Extensions may also be bound directly to user defined key sequences or made available via the **command** function. Typically this would be performed by the optional START.UP extension.

All those Brackets...

The extension programming language is based on the LISP language. This yields programs with very simple, though somewhat strange looking, structure.

Extension programs come in two types; **procedures** perform some operation whereas **functions** also return a value. The outermost structure of a procedure is

```
PROC
(
  ...operations...
)
```

and for a function it is

```
FUNC
(
  ...operations...
)
```

where *...operations...* is a sequence of steps that makes up the program.

A function returns a value using the **return** operation at any point in its execution. There is an implicit return of a zero value at the end of the function text.

Each of these operations is also a procedure or a function in that they perform some operation on the editing environment and/or they return information that can be used by other operations.

Each complete operation and any data items on which it works are enclosed in a further layer of brackets. Since the language allows functions to be nested to a high degree, a typical program at first appears to contain a large number of brackets. By applying some thought to the layout of the program, the actual structure can be made very clear to the reader. The language has no built-in format rules except that no token (individual word, constant, variable name, etc.) can span lines.

For example, a simple program to provide the equivalent of the STAMP command of ED could be written as:

```
PROC
(
 (goto.col 1)
 (insert '*Last updated by ' @who ' (' @logname ')'
         ' at ' (oconv @time 'MTS')
         ' on ' (oconv @date 'D4/'))
 (newline 1)
)
```

The screen is not updated during execution of an extension program except by functions that are documented as doing so. This allows the extension program to perform complex data movements without the screen continually tracking the internal workings of the extension. The screen is updated when the extension terminates.

For detailed information follow the links below:

Variables, constants and functions

Standard variables and functions

Argument passing

Local procedures and functions

An example of a complex extension

SED Extensions - Variables, constants and functions

All extension program source text is case insensitive except for literal strings.

Local Variables

These are names commencing with a letter and containing only letters, digits, periods (.) and dollar signs. A procedure or function can use at most 250 local variables. Local variables are private to the procedure or function and the same name used in another procedure refers to a different local variable.

Global Variables

These are names commencing with a dollar sign and containing only letters, digits, periods (.) and dollar signs. Global variables are common to all extensions and retain their values until the user leaves SED.

Global variables beginning with two dollar signs are reserved. Current usage of these names is:

$$EXTENSION.FILES	Contains a space separated list of the files to be searched for extension programs. By default, this variable contains &SED.EXTENSIONS& but it may be modified at any time by user written extension programs. File names are used left to right. Once an extension program has been loaded on first use, it remains

loaded unless it is specifically unloaded by use of **unload** or by recompilation by the user who has it loaded.

Constants

Numeric constants are written as a sequence of digits, optionally prefixed by a sign or including a decimal point. A numeric constant with an absolute value of less than one must be written with a leading zero (e.g. 0.5).

A string constant may be enclosed in either single or double quotes. It may contain any character except the mark characters (which are available using the tokens shown below) and ASCII character 0 (nul).

The logical values are represented as 0 for false and 1 for true. In general, use of any value other than zero is treated as true by operations that expect logical values as their arguments.

Key Tokens

The **get.key** function returns a code that relates to an internal function number. Each function has a corresponding symbolic name. These all begin with a period (.) and are the same as the comment inserted at the start of each line of a key binding record with spaces replaced by period. The names are:

.newline	.start.line	.end.line	.back.char
.fwd.char	.up.line	.down.line	.top
.bottom	.page.up	.page.down	.del.char
.backspace	.kill.line	.save.record	.quit
.overlay	.tab	.goto.line	.toggle.chars
.fwd.search	.replace	.query.replace	.swap.mark
.execute.macro	.nudge.down	.nudge.up	.set.mark
.delete.region	.copy.region	.insert.killed	.forward.word
.delete.word	.import	.reverse.srch	.lowercase
.uppercase	.capital.init	.back.word	.del.back.word
.close.spaces	.next.buffer	.prev.buffer	.goto.buffer
.delete.buffer	.up.to.list	.repeat	.refresh
.quote.char	.list.buffers	.find.record	.write.record
.start.macro	.end.macro	.expand.char	.list.records
.export	.command	.cancel	.run
.insert	.align.text		

System Variables

Extension programs may examine the current state of many editor features by use of system variables. These all begin with a percent sign (%) and are read only (i.e. they cannot be used in a set function).

The following system variables may also be referenced in extensions:

@IM	@FM	@VM	@SM
@TM	@LOGNAME	@CRTHIGH	@CRTWIDE
@DATE	@TIME	@PATH	@SENTENCE
@WHO	@TTY	@USERNO	

Comments

A comment is introduced by an asterisk (*) and extends to the end of the line.

Erroneous Programs

Extension programs may test whether the buffer being processed is read only. Attempts to change such a buffer are ignored. No error is displayed.

Variables are type variant in the same way as for QMBasic programs and they follow the same rules. In most cases, attempts to use a non-numeric value where a number is required result in use of a default.

SED Extensions - Standard variables and functions

Variables are type variant in the same way as for QMBasic programs and they follow the same rules. In most cases, attempts to use a non-numeric value where a number is required result in use of a default.

Buffer Information

%file	Returns file name for current buffer. This is prefixed by “DICT “ if the buffer is from the dictionary part of the file.
%id	Returns the record id for the current buffer. For an explore buffer or a file list buffer it returns a pseudo id value.
%buffer.type	Returns a type code for the current buffer: 1 : data buffer 2 : explore buffer 3 : file list buffer
%read.only	Returns a logical value indicating whether the current buffer is read only.
(set.read.only *n*)	Sets the read only status of the current buffer. If *n* is non-zero, the buffer is marked as read only, otherwise modifications are allowed. This function is of particular use with scratch buffers. It is ignored for buffers containing explore record lists or file lists.
%changed	Returns a logical value indicating whether the current buffer is marked as having been changed since it was last saved.
(set.changed *n*)	Sets the status of the buffer changed flag. If *n* is zero, the buffer is marked as unchanged, otherwise it is marked as changed. Use this operation with care as it can result in data not being saved on leaving the editor. It is of particular use with scratch buffers.
%overlay	Returns a logical value indicating whether the current buffer is operating in overlay mode.

(set.overlay *n*)	Sets the overlay status of the current buffer. If *n* is zero, overlay is turned off, otherwise it is turned on.
%buffer.no	Returns the current buffer number.
(prev.buffer *n*)	Select the buffer with buffer number *n* less than the current one. This operation cycles to the highest numbered buffer if necessary.
(next.buffer *n*)	Select the buffer with buffer number *n* greater than the current one. This operation cycles to the lowest numbered buffer if necessary.
(goto.buffer *n*)	Select buffer number *n*.
(delete.buffer)	Deletes the current buffer. Unlike the SED **delete.buffer** keyboard function, this operation allows deletion of modified buffers without any confirmation checks.
%current.line	Returns text of current line.
%current.char	Returns character under cursor.
%line.len	Returns length of current line.
%line	Returns current line number.
%col	Returns current column number.
%lines	Returns number of lines in current record.
%mark.line	Returns the line number of the mark position, zero if no mark set.
%mark.col	Returns the column number of the mark position, zero if no mark set.
%scroll	Returns current scroll position. This is the line number of the data displayed on the first line of the screen.
(set.scroll *n*)	Sets the current scroll position to *n*. The value of *n* must be greater than zero and must not be greater than the number of lines in the current buffer. The next screen update (**paint** or implicit from some other function) will move the scroll position if the current line is not in the displayed region of the buffer.
%pan	Returns the current pan position. This is the column number (from one) of the leftmost displayed column of the current buffer.
(set.pan *n*)	Set the current pan position to *n*. The value of *n* must be greater than zero. The next screen update (**paint** or implicit from some other function) will move the pan position if the current cursor position is not in the displayed region of the buffer.
%tab.interval	Returns the current setting of the tab interval.
(set.tab.interval *n*)	Sets the tab interval to *n*. The value of *n* must be in the range 1 to 99.
%width	Returns the width of the screen display.
%height	Returns the number of lines on the screen display excluding the two editor status lines.
%kill.buffer	Returns the content of the kill buffer.
(make.buffer *name*)	Makes a new scratch buffer named *name*. Scratch buffers may be used for internal purposes of the extension program or as the place to create data which will later be written to disk. Use of %file with a scratch buffer returns a null string. %id returns *name*. This function returns true if successful, false if not. If a scratch buffer of the given *name* already exists, it makes that buffer current and returns true.
(find.buffer file *rec*)	Returns the internal number of the buffer holding data from the given *file* and *rec*ord. Use of a null string as *file* allows location of a scratch buffer. This function returns zero if no such buffer exists.

(find.record file *rec*)	Reads record *rec* from *file* into a newly created buffer. If the record is already loaded, it simply switches to that buffer. This function returns true if successful, false if not.
(save.record)	Saves the current buffer. It has no effect on a scratch buffer or if the current buffer is read only. The normal source control actions are performed if this editor feature is in use.
(write.record *file rec*)	Writes the current buffer to record *rec* in *file*. This operation may result in the current buffer being renamed. The normal source control actions are performed if this editor feature is in use. The **write.record** operation is ignored if the target record is locked by another user.

Moving the Cursor, Insertion and Deletion

(top)	Move to the start of line 1.
(bottom)	Move to after the final line of the buffer.
(start.line)	Move to the start of the current line.
(home)	Synonym for **start.line**.
(end.line)	Move to the end of the current line.
(end)	Synonym for **end.line**.
(back.char *n*)	Move cursor left *n* columns.
(left *n*)	Synonym for **back.char**.
(fwd.char *n*)	Move cursor right *n* columns.
(right *n*)	Synonym for **fwd.char**.
(up.line *n*)	Move cursor up *n* lines.
(up *n*)	Synonym for **up.line**.
(down.line *n*)	Move cursor down *n* lines.
(down *n*)	Synonym for **down.line**.
(page.up *n*)	Move cursor up by *n* display pages.
(page.down *n*)	Move cursor down by *n* display pages.
(fsearch *mode str*)	Search forwards for string *str*. The *mode* indicates the style of search: 0 : Use the current search mode setting 1 : Case sensitive 2 : Case insensitive 3 : Word search, case insensitive This function returns a logical value indicating whether the search was successful. An unsuccessful search does not move the current position.
(rsearch *mode str*)	Search backwards for string *str*. The *mode* indicates the style of search: 0 : Use the current search mode setting 1 : Case sensitive 2 : Case insensitive 3 : Word search, case insensitive This function returns a logical value indicating whether the search was successful. An unsuccessful search does not move the current position.
(del.char *n*)	Delete *n* characters.
(backspace *n*)	Backspace *n* characters.
(insert *s*)	Insert string *s* at current cursor position. Any field marks in the text are treated as newlines. The **insert** function can take more than one argument,

	each of which is inserted in turn.
(newline *rpt*)	Insert *rpt* newlines at the current cursor position.
(tab *rpt*)	Advances the cursor to the next tab position as determined by the current setting of the tab interval. Additional spaces are appended to the current line if necessary. The *rpt* argument specifies how by many tab positions the cursor is to be advanced.
(goto.line *a*)	Go to column 1 of line *a*.
(goto.col *a*)	Go to column *a* of current line. The line is extended if necessary by adding trailing spaces.
(set.mark)	Set the mark at the current cursor position.
(swap.mark)	Interchange the cursor and mark positions. Has no effect if there is no mark position defined.
(retype *s*)	Replace the current line by string *s*.
(set.case *mode rpt*)	Changes the case of the next *rpt* words in the current buffer. The *mode* argument is: 0 : Set lower case 1 : Set upper case 2 : Set capital initial casing
(toggle.chars)	Interchanges the character at the cursor position with that in the preceding column.
(fwd.word *n*)	Moves the cursor forward by *n* words.
(back.word *n*)	Moves the cursor backward by *n* words.
(del.word *n*)	Deletes *n* words from the current cursor position.
(del.back.word *n*)	Deletes *n* words backwards from the current cursor position.
(copy.region)	Copies the region between the mark and the cursor, which may be in either order, to the kill buffer.
(delete.region)	Copies the region between the mark and the cursor, which may be in either order, to the kill buffer and deletes the text from the buffer.
(close.spaces)	Closes multiple spaces around the current cursor position to be just one space.

Arithmetic, String and Logical Functions

(add *a b*)	Returns *a* + *b*.
(sub *a b*)	Returns *a* – *b*.
(mul *a b*)	Returns *a* * *b*.
(div *a b*)	Returns *a* / *b*.
(rem *a b*)	Returns the remainder of dividing *a* by *b*.
(int *a*)	Returns the integer portion of value *a* by truncating any fractional part.
(eq *a b*)	Test *a* equal to *b*.
(ne *a b*)	Test *a* not equal to *b*.
(lt *a b*)	Test *a* less than *b*.
(gt *a b*)	Test *a* greater than *b*.
(le *a b*)	Test *a* less than or equal to *b*.
(ge *a b*)	Test *a* greater than or equal to *b*.

(and *a b*)	Forms logical relationship *a* and *b*. The **and** function can take more than two arguments, each of which is and'ed in turn.
(or *a b*)	Forms logical relationship *a* or *b*. The **or** function can take more than two arguments, each of which is or'ed in turn.
(not *a*)	Returns logical inverse of *a*.
(max *a b*)	Returns the maximum of *a* and *b*. If either value is not numeric, this function returns the item that appears last in collating sequence order.
(min *a b*)	Returns the minimum of *a* and *b*. If either value is not numeric, this function returns the item that appears first in collating sequence order.
(len *s*)	Returns the length of string *s*.
(char *n*)	Returns the character with ASCII character value *n*.
(seq *c*)	Returns the ASCII character sequence number of the first character of *c*.
(cat *a b*)	Returns concatenation of strings *a* and *b*. The **cat** function can take more than two arguments, each of which is concatenated in turn.
(substr s *a b*)	Returns a substring from *s* starting at character *a*, *b* characters long.
(pad *s n*)	Pad string *s* with spaces to be *n* characters long. If string *s* is already at least *n* characters long, this function returns the original string.
(trim *s*)	Returns string *s* with all leading and trailing spaces removed and all multiple embedded spaces replaced by a single space.
(trimb *s*)	Returns string *s* with all trailing spaces removed.
(trimf *s*)	Returns string *s* with all leading spaces removed.
(upcase *s*)	Returns string *s* converted to upper case.
(downcase *s*)	Returns string *s* converted to lower case.
(extract *str f v s*)	Returns field *f*, value *v*, subvalue *s* of string *str*. Specify *v* and *s* as zero to extract field *f*, *s* as zero to extract field *f*, value *v*.
(rep *str f v s new*)	Returns a string formed from *str* with field *f*, value *v*, subvalue *s* replaced by *new*. Specify *v* and *s* as zero to replace field *f*, *s* as zero to replace field *f* , value *v*.
(ins *str f v s new*)	Returns a string formed from *str* with new inserted before field *f*, value *v*, subvalue *s*. Specify *v* and *s* as zero to insert before field *f*, *s* as zero to insert before field *f*, value *v*.
(del *str f v s*)	Returns a string formed from *str* with field *f*, value *v*, subvalue *s* deleted. Specify *v* and *s* as zero to delete field *f*, *s* as zero to delete field *f*, value *v*.
(field *str d n count*)	Returns a portion of *str* starting at the *n*'th substring delimited by *d* and extending for *count* such substrings.

User Input and Screen Display

(prompt *prmpt dflt*)	Displays *prmpt* prompt text on the upper status line and invites input. *Dflt* is the default input if the return key is pressed without entering any response.
(get.char)	Waits for and returns the character sent by the next key pressed by the user. This function does not position the cursor. Precede it with **paint** if the cursor should be refreshed at the current position.
%key.ready	Returns a logical value indicating whether there is data waiting from a user key depression.

(get.key)	Waits for user input of a bound key and returns the internal code for this key. These codes are shown under the heading **key tokens** above. If the key is a data character, the key type code is **.insert** and the associated data character can be retrieved using %key.char. See also %prefix.count and %prefix.set.
%key.char	Returns the character from the last **get.key** if it was an insert action. For other actions, it returns a null string.
%prefix.count	Returns the prefix count for the last use of get.key. Returns 1 if no prefix count was entered. On Initial entry to a procedure started from the keyboard, this function returns any prefix count associated with the keyboard action.
%prefix.set	Returns a logical value indicating whether a prefix count was entered for the last use of get.key.
(status.msg *str*)	Displays message *str* on the upper status line. The displayed text may be cleared by using the **status.msg** operation with a null *str*.
(paint *mode*)	Refreshes the screen display and positions the cursor. The *mode* argument is: 0 : Updates screen for any changes 1 : Clears the screen and repaints all displayed data Repainting of the screen terminates on detection of type-ahead.
(beep)	Sounds the terminal bell.
(wait.input)	Wait for the user to press a key. The actual key pressed remains available for subsequent processing.

Miscellaneous File Handling

(exists *file rec*)	Returns a logical value indicating whether record *rec* exists in *file*.
(read *file rec*)	Returns record *rec* from *file*. If the record cannot be read, this function returns a null string.
(write *file rec str*)	Writes *str* to record *rec* of *file*. If the file cannot be opened, this function has no effect
(delete *rec*)	Deletes *rec* from *file*. If the file cannot be opened, this function has no effect

Conditional Execution and Loops

(if *a proc1* else *proc2*)	Executes procedure *proc1* if logical item *a* is true, *proc2* if it is false. The **else** component is optional. Both *proc1* and *proc2* may be one or more procedures.
(switch *val* case *a proc1* case *b proc2* ... else *proc*)	Executes one of several procedures depending on the value of *val*. Items *a*, *b* and *c* (etc.) are values which are compared with *val*. The **else** component is optional and is executed only if none of the preceding conditions is met.
(loop *proc*)	Executes *proc* repeatedly. *proc* may be one or more procedures. A loop is

	terminated by use of **exit**.
(exit)	Exits from the innermost active **loop**.
(return)	Returns from the current PROC.
(return *n*)	Returns *n* as the value of the current FUNC.
(stop)	Terminates extension program and returns to SED edit mode.
(quit *n*)	Terminates current edit. If *n* is zero, SED continues processing a select list (equivalent to the **quit** editor function). For non-zero values of *n*, SED terminates the entire sequence (equivalent to the QUIT command).

Setting Variables

(set *var val*)	Set local or global variable *var* to *val*.

Extension Control

(unload)	Unloads all extensions on exit from outermost extension program.
(bind.command *ext name*)	Binds extension procedure *ext* as command *name*. The extension name is automatically converted to upper case.
(bind.key *ext keyseq*)	Binds extension procedure *ext* as key sequence *keyseq*. The extension name is automatically converted to upper case. This function returns a logical value indicating whether it was successful.
%key.bindings	Returns a dynamic array, each field of which corresponds to a bindable internal function and consists of one or more values which hold the actual character sequence. Note that this character sequence is the actual characters, not the encoded form used in the key bindings records to avoid use of control characters. The field number of any particular key can be identified using the key tokens described earlier.
(xeq *cmnd*)	Executes *cmnd* as though it were entered using the editor **command** function. Commands which are themselves bound to extensions cannot be executed in this way. SED checks for extensions bound as command names before internal commands. It is therefore possible to replace a built-in command. Furthermore, since extensions cannot execute extension commands, the extension can be used to provide a prelude to a built-in command.
%macro.state	Returns state of editor macro system: 0 : Not collecting or executing 1 : Collecting macro 2 : Executing macro

Basic Functions (Operations that mimic QMBasic programming functions)

(alpha *str*)	Equivalent to ALPHA(*str*) Returns a logical value indicating whether *str* is an entirely alphabetic string.
(convert *old new str*)	Equivalent to CONVERT(*old*, *new*, *str*) For each character in *old*, this function replaces all occurrences of that character in *str* by the character in the corresponding position in *new*. If *new* is shorter than *old*, characters in *old* for which there is no replacement in *new* are deleted from the returned version of *str*.
(count *str substr*)	Equivalent to COUNT(*str*, *substr*)

	Returns a count of the number of occurrences of *substr* in *str*.
(dcount *str delim*)	Equivalent to DCOUNT(*str*, *delim*) Returns a count of the number of substrings in *str* delimited by *delim*. The delimiter must be a single character.
(matches *str pattern*)	Equivalent to *str* MATCHES *pattern* Tests whether *str* matches the given *pattern*.
(matchfield *str pattern n*)	
	Equivalent to MATCHFIELD(*str*, *pattern*, *n*) Returns the *n*'th component of *str* when matched against *pattern*.
(iconv *str conv*)	Equivalent to ICONV(*str*, *conv*) Returns the result of applying input conversion *conv* to *str*.
(index *str substr occc*)	Equivalent to INDEX(*str*, *substr*, *occ*) Returns the character position (from one) of the *occ*'th occurrence of *susbtr* in *str*. This function returns zero if the specified occurrence is not found.
(num *str*)	Equivalent to NUM(*str*) Returns a logical value indicating whether *str* can be interpreted as a number.
(oconv *str conv*)	Equivalent to OCONV(*str*, *conv*) Returns the result of applying output conversion *conv* to *str*.

Keyboard Functions Not Available as Extension Functions

The following editor keyboard functions are not available directly as extension operations. They can all be achieved by use of other operations.

Editor Function	**Equivalent Extension Coding**
export	(write *file rec* %kill.buffer)
import	(insert (read *file rec*))
insert killed	(insert %kill.buffer)

SED Extensions - Argument Passing

Any user written PROC or FUNC may take arguments. The actual number the compiler expects to pass is determined by the first reference to that PROC or FUNC and is checked at run time against the number that are expected by the called item.

To declare arguments in a PROC, it is written as

```
   PROC
   ARGS arg1, arg2, arg3...
   (
...operations...
   )
```

The *arg1*, *arg2*, etc. items are local variables into which the argument values are to be transfered when the procedure is called.

SED Extensions - An example of a complex extension

The following extension implements a “walk” function. This function allows you to define a rectangular block of text and use the cursor keys to “walk” it left, right, up or down. As the text block “runs over” other text, this reappear on the opposite side of the block being moved. The walk function is very useful in rearranging tabular data.

To use this extension, first position the cursor at the top left of the block. Execute the extension and move the cursor to the bottom right of the block by using the up, down, left and right functions then press the return key. Further use of the up, down, left and right functions will move the defined block until the return key is pressed once more.

```
PROC
(
 (if %read.only
    (status.msg 'Read only buffer')
    (beep)
    (wait.input)
    (return)
 )

 * Step 1 - Get block coordinates

 (set top %line)
 (set left %col)

 (status.msg 'Set block limits')
 (loop
    (switch (get.key)
       case .up.line
          (set ct %prefix.count)
          (loop
             (if (le %line top) (exit))

             (retype (trimb %current.line))      * Remove
trailing spaces
             (up.line 1)
             (if (lt %line.len %col)             * Must extend
line
                (retype (pad %current.line %col))
             )

             (set ct (sub ct 1))
             (if (eq ct 0) (exit))
          )

       case .down.line
          (set ct %prefix.count)
          (loop
             (if (gt %line %lines) (exit))

             (down.line 1)
             (if (lt %line.len %col)             * Must extend
line
                (retype (pad %current.line %col))
             )
```

```
            (set ct (sub ct 1))
            (if (eq ct 0) (exit))
         )

      case .fwd.char
         (set x (add %col %prefix.count))
         (if (gt x %line.len) (retype (pad %current.line x)))
         (goto.col x)

      case .back.char
         (set x (sub %col %prefix.count))
         (if (le x left) (set x left))
         (goto.col x)

      case .newline
         (set height (add (sub %line top) 1))
         (set width (add (sub %col left) 1))
         (exit)

      case .cancel
         (status.msg '')
         (stop)

      else
         (beep)
   )
)

* Step 2 - Move the block


(goto.line top)
(goto.col left)

(status.msg 'Move block')
(loop
   (switch (get.key)
      case .up.line  * Move block up
         (set rpt %prefix.count)
         (loop
            (set lw (sub left 1))       * Width of bit to left
of block
            (set right (add left width)) * Col of bit to right
of block
            (set rc (sub right 1))       * Righmost column of
block

            (if (le %line 1) (exit))

            (up.line 1)
            (if (lt %line.len rc)            * Must extend line
               (retype (pad %current.line rc))
            )
            (set wrapped.bit (substr %current.line left width))

            (set ct height)
            (loop
```

```
                 (down.line 1)
                 (set moving.bit (substr %current.line left
width))
                 (up.line 1)
                 (retype (cat (substr %current.line 1 lw)
moving.bit
                              (substr %current.line right
999999)))

                 (down.line 1)
                 (set ct (sub ct 1))
                 (if (eq ct 0) (exit))
              )

              (retype (trimb (cat (substr %current.line 1 lw)
wrapped.bit
                                  (substr %current.line right
999999))))
              (set top (sub top 1))
              (goto.line top)
              (goto.col left)

              (set rpt (sub rpt 1))
              (if (eq rpt 0) (exit))
           )

        case .down.line  * Move block down
           (set rpt %prefix.count)
           (loop
              (set lw (sub left 1))       * Width of bit to left
of block
              (set right (add left width)) * Col of bit to right
of block
              (set rc (sub right 1))       * Righmost column of
block

              (if (gt (add %line height) %lines) (exit))

              (down.line height)
              (if (lt %line.len rc)        * Must extend line
                 (retype (pad %current.line rc))
              )
              (set wrapped.bit (substr %current.line left width))

              (set ct height)
              (loop
                 (up.line 1)
                 (set moving.bit (substr %current.line left
width))
                 (down.line 1)
                 (retype (cat (substr %current.line 1 lw)
moving.bit
                              (substr %current.line right
999999)))

                 (up.line 1)
                 (set ct (sub ct 1))
                 (if (eq ct 0) (exit))
```

```
            )

            (retype (trimb (cat (substr %current.line 1 lw)
wrapped.bit
                              (substr %current.line right
999999))))
            (set top (add top 1))
            (goto.line top)
            (goto.col left)

            (set rpt (sub rpt 1))
            (if (eq rpt 0) (exit))
         )

      case .fwd.char   * Move block to the right
         (set rpt %prefix.count)
         (loop
            (set lw (sub left 1))       * Width of bit to left
of block
            (set right (add left width)) * Col of bit to right
of block

            (set x (add right 1))
            (set ct height)
            (loop
               (if (lt %line.len right)            * Must
extend line
                  (retype (pad %current.line right))
               )
               (set wrapped.bit (substr %current.line right 1))
               (set moving.bit (substr %current.line left
width))
               (retype (cat (substr %current.line 1 lw)
wrapped.bit
                            moving.bit
                            (substr %current.line x 999999)))

               (down.line 1)
               (set ct (sub ct 1))
               (if (eq ct 0) (exit))
            )
            (set left (add left 1))
            (goto.line top)
            (goto.col left)
            (set rpt (sub rpt 1))
            (if (eq rpt 0) (exit))
         )

      case .back.char
         (set rpt %prefix.count)
         (loop
            (set lw (sub left 1))       * Width of bit to left
of block
            (set right (add left width)) * Col of bit to right
of block
            (set rc (sub right 1))       * Righmost column of
block
```

```
            (if (le left 1) (exit))

            (set x (sub lw 1))
            (set ct height)
            (loop
               (if (lt %line.len rc)            * Must extend
line
                  (retype (pad %current.line rc))
               )
               (set wrapped.bit (substr %current.line lw 1))
               (set moving.bit (substr %current.line left
width))
               (retype (cat (substr %current.line 1 x)
moving.bit
                             wrapped.bit
                            (substr %current.line right
999999)))

               (down.line 1)
               (set ct (sub ct 1))
               (if (eq ct 0) (exit))
            )
            (set left (sub left 1))
            (goto.line top)
            (goto.col left)

            (set rpt (sub rpt 1))
            (if (eq rpt 0) (exit))
         )

      case .newline
         (exit)

      case .cancel
         (status.msg '')
         (stop)

      else
         (beep)
   )
 )

 * Step 3 - Tidy up by trimming trailing spaces from lines in
block

 (status.msg '')
 (set ct height)
 (loop
    (retype (trimb %current.line))
    (down.line 1)
    (set ct (sub ct 1))
    (if (eq ct 0) (exit))
 )
 (goto.line top)
 (goto.col left)
)
```

SED Extensions - Local procedures and functions

A single extension source record may contain local procedures and functions that are only accessible to the other components of that extension. These must follow the main procedure or function are take the form

```
LPROC name
ARGS arg1, arg2, arg3...
(
   ...operations...
)
```

or

```
LFUNC name
ARGS arg1, arg2, arg3...
(
   ...operations...
)
```

There is no concept of local variable scope. Variable names used within local PROCs and FUNCs refer to the same set of variables as in the main PROC or FUNC. In particular, note that the argument variables simply provide an easy way to transfer information into the local PROC or FUNC. The two alternatives below are exact equivalents.

```
PROC
(
     ...
 (MYPROC 12 A)
     ...
)

LPROC MYPROC
ARGS X, Y
(
     ...
)


PROC
(
      ...
 (SET X 12)
 (SET Y A)
 (MYPROC)
      ...
)

LPROC MYPROC
(

)...
```

Although local procedures may recurse (that is call themselves) it is likely that the lack of scoped variables makes this of limited use.

4.134 SEL.RESTORE

The **SEL.RESTORE** command restores a single file from a Pick style ACCOUNT.SAVE or FILE.SAVE tape.

Format

SEL.RESTORE {**DICT**} *target.file.name* {*item.list*} {*options*}

where

target.filet.name	is the name of the file into which data is to be restored.
item.list	is a list of records to be restored. The default select list may be used instead.s
options	is any combination of the following:

BINARY	Suppresses translation of field marks to newlines when restoring directory files. Use this option when restoring binary data.
DET.SUP	Suppresses display of the name of each file as it is restored.
NO.CASE	Causes new files to be created with case insensitive record ids. Existing files are not reconfigured.
NO.INDEX	Do not create alternate key indices.
NO.OBJECT	Omits restore of object code. This is particularly useful when migrating to QM from other environments.
POSITIONED	Assumes that the tape is already positioned at the start of the data to be restored.

Unless the POSITIONED option is used, the **SEL.RESTORE** command prompts for the name of the account and the file within that account. It then restores the data for this file from the tape into the specified target file. which must already exist.

The tape to be restored must first be opened to the process using the **SET.DEVICE** command.

See also:
ACCOUNT.RESTORE, **ACCOUNT.SAVE**, **FILE.SAVE**, **FIND.ACCOUNT**, **RESTORE.ACCOUNTS**, **SET.DEVICE**, **T.ATT**, **T.DUMP**, **T.LOAD**, **T.xxx**

4.135 SET

The **SET** command sets a value into an @-variable.

Format

SET *variable* *value*

SET *variable* **EVAL** *expression*

where

variable	is the name of the variable to be set. The leading @ character is optional. The name may be up to 32 characters and is case insensitive.
value	is the value to be stored. This may not include the mark characters.
expression	is an arithmetic expression to be evaluated.

The **SET** command sets a value into a user defined @-variable. The values of system defined variables @SYSTEM.RETURN.CODE, @USER0 to @USER4 and @USER.RETURN.CODE c an also be set.

In the second form, the *expression* may include the four arithmetic operators +, -, * and /. These operators must be surrounded by spaces. Any @-variables in the expression will be expanded.

Examples

```
SET USER.RETURN.CODE 1
```

The above command sets the @USER.RETURN.CODE variable to 1.

```
PA
SET CT 5
LOOP
   DISPLAY <<@CT>>
   SET CT EVAL @CT - 1
   IF @CT = 0 THEN STOP
REPEAT
```

This paragraph executes the loop five times, displaying the decreasing values stored in @CT on each cycle.

See also:
LIST.VARS and the QMBasic !ATVAR() and !SETVAR() subroutines.

4.136 SET.DATE

The **SET.DATE** command adjusts the date used for all internal processing.

Format

SET.DATE *date*

where

date is the new date to be used.

The **SET.DATE** command alters the internal date value affecting all application access to the date via the QMBasic **DATE()** function or the **@DATE** variable. It is useful when, for example, repeating month end processing after an error has been detected.

4.137 SET.DEVICE

The **SET.DEVICE** command opens a tape or pseudo-tape for processing by QM. The synonym **T.ATT** may be used.

Format

SET.DEVICE *device.name*

where

device.name	is the pathname of the device to be opened. This must be enclosed in quotes if it commences with a backslash on Windows.

The **SET.DEVICE** command assigns a tape device or a file representing a pseudo-tape to the current QM process. The device can then be used by other tape processing commands such as **ACCOUNT.SAVE**, **ACCOUNT.RESTORE**, **T.DUMP**, **T.LOAD** and the **T.xxx** tape utility commands.

Note: QM does not support Pick style use of floppy disks as tape devices.

SET.DEVICE attempts to detect the format of the image being attached. A code signifying the format is then stored internally for future use by the other tape processing utilities.

Note that access to real tape devices (as opposed to pseudo-tapes) may offer limited functionality. In particular, the Pick compatible tape transfer tools require the ability to process file mark blocks, a feature which may not be provided by the underlying operating system device driver. Use of pseudo-tapes is strongly recommended.

The formats currently supported are:

AS	PICK style ACCOUNT-SAVE image (also the QM **ACCOUNT.SAVE** format)
FS	PICK style FILE-SAVE image.
ULTFS	Ultimate style FILE-SAVE image.
JBS	jBASE ACCOUNT-SAVE image.

The AS type can be either a single ACCOUNT-SAVE or several ACCOUNT-SAVEs on the same tape. These multiple saves are created by successive ACCOUNT-SAVE commands issued without rewinding the tape between saves. If multiple accounts exist, this format is handled like the FS type by the tape utilities and **RESTORE.ACCOUNTS**, **FIND.ACCOUNT** and **SEL.RESTORE** operations may all be used.

The ULTFS format is a FILE-SAVE format in which several accounts are expected.

The JBS format is essentially the same as the individual files that comprise the ULTFS set. These files have a single label followed immediately by the account data and are treated like individual AS types.

See also:
ACCOUNT.RESTORE, **ACCOUNT.SAVE**, **FILE.SAVE**, **FIND.ACCOUNT**, **RESTORE.ACCOUNTS**, **SEL.RESTORE**, **T.DUMP**, **T.LOAD**, **T.xxx**

4.138 SET.ENCRYPTION.KEY.NAME

The **SET.ENCRYPTION.KEY.NAME** command updates a data file to reference a new name for an encryption key.

Format

SET.ENCRYPTION.KEY.NAME *filename field*, *keyname* ...

SET.ENCRYPTION.KEY.NAME *filename keyname*

where

filename is the name of the encrypted file to be updated.

field is the name or field number of the field to be amended.

keyname is the name of the encryption key to be used. This is case insensitive.

The **SET.ENCRYPTION.KEY.NAME** command is intended for use where an encrypted file is moved to a system on which the original encryption key name is already in use but with a different key value. It updates the encryption key information stored in the file but does not make any changes to the data records.

The first form of the **SET.ENCRYPTION.KEY.NAME** command updates the encryption key for one or more fields within a file that uses field level encryption.

The second form of the **SET.ENCRYPTION.KEY.NAME** command updates the encryption key for record level encryption.

Examples

```
SET.ENCRYPTION.KEY.NAME  CUSTOMERS  CCARD,CARDNO
```

The above command sets the encryption key for the CCARD field of the CUSTOMERS file to be CARDNO.

```
SET.ENCRYPTION.KEY.NAME  CUSTOMERS  CKEY
```

The above command sets the record level encryption key for encrypts the CUSTOMERS file to be CKEY.

See also:
Data encryption, **CREATE.FILE**, **CREATE.KEY**, **DELETE.KEY**, **GRANT.KEY**, **LIST.KEYS**, **RESET.MASTER.KEY**, **REVOKE.KEY**

4.139 SET.EXIT.STATUS

The **SET.EXIT.STATUS** command sets the final exit status returned by QM to the operating system. This command is not available on the PDA version of QM.

Format

SET.EXIT.STATUS *value*

where

value is the numeric exit status value to be set.

By default, QM returns an exit status of zero to the operating system on termination. The **SET.EXIT.STATUS** command allows an application to return an alternative exit status value to indicate, for example, success or failure. Note that error conditions detected during startup of a QM session return an exit status of 1.

See also the QMBasic **SET.EXIT.STATUS** statement.

4.140 SET.FILE

The **SET.FILE** command adds a Q-pointer to the VOC to reference a remote file.

Format

SET.FILE {*account* { *filename* { *pointer*} } }

where

account	is the name of the account holding the file to be referenced. This name must exist in the ACCOUNTS file of the QMSYS account.
filename	is the name of the file in the remote account. This must correspond to an F-type VOC entry in that account. The **SET.FILE** verb cannot be used to create Q-pointer chains as this technique is not recommended.
pointer	is the name to be given to the Q-pointer created in the local account.

The **SET.FILE** command prompts for information not provided on the command line. The *pointer* defaults to QFILE.

The **SET.FILE** command creates a Q-pointer in the local account to reference the named file in the remote account. Q-pointers should be used in preference to multiple F-type records pointing to the same file as they simplify maintenance and give a sense of ownership of the file to the account containing the F-type entry.

4.141 SET.QUEUE

The **SET.QUEUE** command creates a relationship between a Pick style form queue number and the corresponding **SETPTR** print unit options.

Format

SET.QUEUE *queue* {, *width*, *depth*, *top.margin*, *bottom.margin*, *mode* {, *options* }}

SET.QUEUE DISPLAY {**LPTR** {*unit*}}

where

queue	is the form queue number in the range 0 to 999.
width	is the page width in characters, excluding any left margin.
depth	is the total page length in lines, including the top and bottom margins. A value of zero implies no pagination of the output data.
top.margin	is the number of lines to be left blank at the top of the page.
bottom.margin	is the number of lines to be left blank at the bottom of the page.
mode	is the print unit mode.
options	qualify the output destination. There should be a comma between each option.

If only *queue* is given, the current settings of the form queue are reported.

The **SET.QUEUE** command creates or modifies an entry in the $FORMS file to relate a Pick style form queue number to the corresponding **SETPTR** options. This form queue number can then be used in the **SP.ASSIGN** command. See **SETPTR** for details of the command options.

The **SET.QUEUE DISPLAY** command displays a report of the settings of all defined form queues. The optional **LPTR** keyword directs this report to a printer.

Examples

```
SET.QUEUE 0,80,66,3,3,1,AT laser
```

Directs form queue 0 output to a printer named "laser" with a page shape of 80 columns by 66 lines and a 3 line top and bottom margin.

```
SET.QUEUE 4,80,66,0,0,3,AS SALES_REPORT,BRIEF
```

Directs form queue 4 output to a record named "SALES_REPORT" in the $HOLD file.

See also:
SETPTR, **SP.ASSIGN**

4.142 SET.TRIGGER

The **SET.TRIGGER** command sets, removes or displays the trigger function associated with a dynamic file.

Format

SET.TRIGGER *file.name* *function.name* {*modes*}	Set trigger function
SET.TRIGGER *file.name* ""	Remove trigger function
SET.TRIGGER *file.name*	Report trigger function

where

file.name is the file to be processed.

function.name is the name of the catalogued trigger function.

modes is any combination of the following tokens indicating when the trigger will be executed.

PRE.WRITE	Before a write operation
PRE.DELETE	Before a delete operation
PRE.CLEAR	Before a clear file operation
POST.WRITE	After a write operation
POST.DELETE	After a delete operation
POST.CLEAR	After a clear file operation
READ	After a read operation

If no *modes* are specified, the default is **PRE.WRITE** and **PRE.DELETE**.

The first form of the **SET.TRIGGER** command sets the name of the trigger function to be associated with the named file. Any existing trigger function is replaced by this action.

The second form of the **SET.TRIGGER** command removes the trigger function for the named file.

The third form of the **SET.TRIGGER** command displays the name and modes of the trigger function for the named file.

4.143 SETPORT

The **SETPORT** command sets communications parameters of a serial port. This command is not available on the PDA version of QM.

Format

SETPORT *port* {**BAUD** *rate*} {**BITS** *bits.per.byte*} {**PARITY** *parity*} {**STOP.BITS** *stop*} {**BRIEF**}

where

port	is the name of the port to be accessed (e.g. COM1 on Windows or /dev/cua0 on Linux).
rate	is the baud rate for the port.
bits.per.byte	is the number of bits per byte (5 to 8).
parity	is the parity mode (**NONE**, **ODD** or **EVEN**).
stop	is the number of stop bits (1 or 2).
BRIEF	Suppresses the normal confirmation prompt

If only *port* is given, the current settings of the port are reported.

On some systems, it may be necessary to change the permissions on the device driver to make it accessible to users.

Example

```
SET.PORT COM1 BAUD 9600 BITS 7 PARITY ODD STOP.BITS 1
```

4.144 SETPTR

The **SETPTR** command sets print unit characteristics.

Format

SETPTR *unit* {**,** *width***,** *depth***,** *top.margin***,** *bottom.margin***,** *mode* {**,** *options* }}

SETPTR DISPLAY {**LPTR** {*printer*}}

SETPTR *unit***, DISPLAY**

where

unit	is the print unit number in the range 0 to 255 or the keyword **DEFAULT**.
width	is the page width in characters, excluding any left margin.
depth	is the total page length in lines, including the top and bottom margins. A value of zero implies no pagination of the output data.
top.margin	is the number of lines to be left blank at the top of the page.
bottom.margin	is the number of lines to be left blank at the bottom of the page.
mode	is the print unit mode: 1 Output is sent to a printer. 3 Output is directed to a hold file. 4 Output is directed to stderr (standard error). 5 Output is directed to the terminal auxiliary port. 6 Output is written to a file and also printed.
options	qualify the destination as described below. There should be a comma between each option.

If only *unit* is given, the current settings of the print unit are reported.

Use of the **DEFAULT** keyword in place of a unit number records the default values to be used when a new print unit is accessed without prior use of **SETPTR** to define its settings. Note that this operation does not affect the default printer, print unit 0, which is configured with standard default settings on entry to QM. These can be changed with a **SETPTR** command specifying unit 0.

The third form of **SETPTR** with a unit number and the **DISPLAY** keyword shows the current settings in a form that can be captured by a program and later used to restore the settings by executing a **SETPTR** command with the captured value appended.

The *options* available are:

AS { **NEXT** } { *id* } Specifies the hold file record name in modes 3 and 6. At least one of the optional components must be present.

id is the name of the record to be created in the $HOLD file. If

omitted, a default name of P*unit* is used.

The optional **NEXT** keyword causes QM to attach a four digit cyclic sequence number to the end of the name so that successive output is stored separately. Note that this sequence number is shared across all printer output directed to the $HOLD file by all processes. Thus two successive jobs from one process may have non-adjacent sequence numbers.

AS PATHNAME *path* Specifies a destination pathname for output in modes 3 and 6.

AT *printer.name* Specifies the printer name in modes 1 and 6. This name must be enclosed in quotes if it contains spaces or backslashes. The name is case sensitive except on Windows.

BANNER *text* Set the text to appear on a banner page.

BRIEF Suppresses the normal confirmation prompt before setting the printer characteristics. This is typically used in **SETPTR** commands from paragraphs or QMBasic programs.

COPIES *n* Specifies the number of copies to be printed.

GDI Specifies that the GDI mode API calls are to be used to initiate printing.

KEEP.OPEN Keeps the printer open to merge successive printer output. Use the **PRINTER CLOSE** command to terminate the print job.

LANDSCAPE When used without the PCL option, this option is passed to the underlying print driver to request landscape format printing where this is supported. On non-Windows platforms, this is equivalent to use of OPTIONS "landscape".

LEFT.MARGIN *n* Inserts a margin of *n* spaces to the left of the printed data.

NEWLINE *mode* Determines the newline sequence used by the QMBasic **PRINT** statement. This may be CR, LF or CRLF. The default is LF.

NFMT Specifies that no page formatting is to be applied to the output data. The entire output is treated as a single page with no further inserted form feeds or top and bottom margins.

NODEFAULT Omitted options normally take their default values. Use of this keyword leaves the option at its current value.

OPTIONS *xxx* Passes the given option(s) to the underlying operating system print spooler (e.g. OPTIONS "landscape" on non-Windows systems).

OVERLAY *subr* Identifies a catalogued subroutine that will be executed at the start of each page of output. This subroutine takes a single argument which is the print unit number and can be used to send printer control codes for a graphical page overlay, if required. It should not perform any other printer output. This option is ignored for Windows GDI mode printing.

PCL Specifies that this printer supports PCL. This option cannot be used with GDI mode Windows printers.

PORTRAIT Where supported by the underlying print driver, this keyword specifies that the output is to be printed in portrait format.

PREFIX *path* Sends the contents of the named file to the printer at the start of each

	job. This can be used to send printer specific commands for features that are not available through other **SETPTR** options. This option is ignored for Windows GDI mode printing.
RAW	Specifies that the non-GDI mode API calls are to be used to initiate printing.
SPOOLER *name*	Specifies and alternative spooler to be used on non-Windows systems. If not specified, the spooler selected by the **SPOOLER** configuration parameter is used or, if this is not set, the standard lp spooler is used. The *name* can include other spooler options if required but must be quoted if it includes spaces or other reserved characters. The actual command executed to print the job will be *name* with options appropriate to lp added as follows:

-n *copies*	If **COPIES** is greater than 1.
-d *prt.name*	To set the printer name if **AT** is used.
-t *banner*	Banner text if **BANNER** is used.
-o "*options*"	Text from **OPTIONS** if used.
-o "landscape"	If **LANDSCAPE** is used.

The **SPOOLER** option can be used to access another standard operating system spooler package or to direct output to a user written shell script or program to perform custom processing.

STYLE *name*	Specifies the name of a query processor report style to be used for all reports directed to this print unit unless overridden by the **STYLE** option in the query command.

The following additional options are available. Although the values set will be saved and can be accessed by application software, they only affect printing when used with the **PCL** option. In many cases, the list of acceptable parameter values can be extended by modifying the SYSCOM $PCLDATA record.

CPI *n*	Specifies the number of characters per inch. The value may be non-integer.
DUPLEX	Selects duplex (double sided) printing, binding on the long edge.
DUPLEX SHORT	Selects duplex (double sided) printing, binding on the short edge.
LANDSCAPE	Prints the page in landscape format.
LPI *n*	Specifies the number of lines per inch. The value must be 1, 2, 3, 4, 6, 8, 12, 16, 24 or 48.
PAPER.SIZE *xx*	Specifies the paper size. Valid size names are A4, LETTER, LEGAL, LEDGER, A3, MONARCH, COM_10, DL, C5, B5.
SYMBOL.SET *xx*	Specifies the character set. Valid values of *xx* are ROMAN8 (the default), LATIN1, ASCII, PC8.
WEIGHT *xx*	Specifies the font weight. Valid values of *xx* are ULTRA-THIN, EXTRA-THIN, THIN, EXTRA-LIGHT, LIGHT, DEMI-LIGHT, SEMI-LIGHT, MEDIUM, SEMI-BOLD, DEMI-BOLD, BOLD, EXTRA-BOLD, BLACK, EXTRA-BLACK, ULTRA-BLACK

though specific printers might not support all values.

Note: The quality of PCL implementations varies widely and these options may not give the expected results on some printers. In particular, setting some font metrics may cause inconsistent character placement. It is the application developer's responsibility to ensure that the printed results are acceptable.

On Windows systems, two styles of interface with the underlying Print Manager are supported. The GDI mode uses the Windows Graphical Device Interface API calls. Non-GDI mode uses an alternative set of API calls. For most purposes, the non-GDI mode is likely to be preferable.

The GDI parameter to SETPTR sets GDI mode and the RAW parameter sets non-GDI mode. The default is normally non-GDI but this can be modified by setting the GDI configuration parameter to 1.

Use of mode 4 (stderr) allows an application developer to direct output to the standard error file handle. It is the user's responsibility to ensure that this points to an appropriate destination as the default settings may cause the screen display to be overwritten. Headings, footings and other pagination related features are ignored for printers in mode 4.

The **SETPTR DISPLAY** command displays a report of the settings of all print unit. The optional **LPTR** keyword directs this report to a printer.

Examples

```
SETPTR 0,80,66,3,3,1,AT laser,BRIEF
```
Directs print unit 0 output to a printer named "laser" with a page shape of 80 columns by 66 lines and a 3 line top and bottom margin. The BRIEF option suppresses the normal confirmation prompt.

```
SETPTR 0,80,66,0,0,3,AS SALES_REPORT,BRIEF
```
Directs print unit 0 output to a record named "SALES_REPORT" in the $HOLD file. The BRIEF option suppresses the normal confirmation prompt.

```
SETPTR 0,,,,,3
```
Directs print unit 0 output to the default $HOLD file record (P0), leaving all page shape parameters unchanged.

See also:
PRINTER, **SET.QUEUE**, **SP.ASSIGN**

4.145 SH

The **SH** command executes a shell (operating system) command. This command is not available on the PDA version of QM.

Format

SH *command*

!*command*

SH (Not Windows)

where

command is the shell command to be executed.

The **SH** command executes the given operating system *command*. No checks are performed on the command to be executed so care needs to be taken not to do anything that would interfere with correct operation of QM.

The **!** synonym is provided for compatibility with other systems. This form does not need a space between the **!** and the *command*.

Use of **SH** without a *command* starts an interactive shell. Use the shell exit command to return to QM. Interactive shells are not currently available on Windows.

Example

```
SH DIR
```

This command lists the current directory on a Windows system.

4.146 SLEEP

The **SLEEP** command suspends execution of further commands until a given number of seconds have elapsed or until a specified time of day.

Format

SLEEP *time*

where

time	is either a number of seconds or a time of day in any format accepted by the MT input time conversion.

If *time* is a positive integer value, the process is suspended for that number of seconds.

If *time* is a time of day such as 8:27PM or 22:00:30, the process is suspended until that time. Unlike the QMBasic **SLEEP** statement, the **SLEEP** command allows for sleeping past midnight. A **SLEEP** to 12:00 executed at 13:00 would sleep for 23 hours.

If *time* is omitted, the process is suspended for one second.

The **SLEEP** command reports an error if the value of *time* is not a positive integer and cannot be converted to a time of day.

4.147 SP.ASSIGN

The **SP.ASSIGN** command uses a form queue number to set the destination and other options for printer output.

Format

SP.ASSIGN *options*

where *options* are chosen from:

n	is the number of copies to print.
F*qno*	specifies the form queue number in the range 0 to 999.
H	directs output to the hold file.
O	keeps the print unit open until the **PRINTER CLOSE** command is used.
Q*qno*	Same as **F***qno*.
R*unit*	uses the specified print unit, zero if omitted.
S	Suppresses printing.

The **SP.ASSIGN** command references the $FORMS file (set up using **SET.QUEUE**) to relate Pick style form queue numbers to the corresponding **SETPTR** options. The options to **SP.ASSIGN** can be used to override the settings in the form queue definition.

The **F***qno* or **Q***qno* options specify the form queue to be used. This defaults to zero if omitted.

The queue number is used to read the corresponding print unit details from the $FORMS file. The remaining options can be used to override settings in the $FORMS entry.

Use of both the **H** and **S** options selects mode 3 printing, directing output to the hold file. When the **H** option is used without the **S** option, print mode 6 is selected causing the output to be written to a file and also printed.

SP.ASSIGN sets the characteristics of print unit zero, the default printer, unless the **R***unit* option is given.

Note: **SP.ASSIGN** is provided to ease migration of applications from Pick style environments. It is strongly recommended that new applications should make direct use of **SETPTR**.

Examples

```
SP.ASSIGN F3
```

This command uses the definition of form queue 3 to process output sent to the default printer (print

unit 0).

```
SP.ASSIGN HSF3
```
This command uses the definition of form queue 3 but forces use of print mode 3 to send the data to a file.

```
SP.ASSIGN HF3
```
This is similar to the previous example except that the data is saved to a file and also printed.

```
SP.ASSIGN 2R4F6
```
This command uses the definition of form queue 6 to process output sent to print unit 4 but forces the number of copies to be 2.

See also:
SETPTR, SET.QUEUE

4.148 SP.OPEN, SP.CLOSE

The **SP.OPEN** command sets the "keep open" flag on the default printer, merging multiple print requests into a single print job. The **SP.CLOSE** command resets this option.

Format

SP.OPEN
SP.CLOSE

The **SP.OPEN** command is equivalent to use of the O option of the **SP.ASSIGN** command or the KEEP.OPEN option of the **SETPTR** command.

When this mode is set, output directed to the default printer (print unit 0) from successive commands or programs is merged into a single print job. The job is terminated and queued for printing by use of **SP.CLOSE** or **PRINTER CLOSE**.

Example

```
SP.OPEN
LIST CUSTOMERS,NORTH LPTR
LIST CUSTOMERS,SOUTH LPTR
SP.CLOSE
```

The above sequence of commands lists records from two elements of the CUSTOMERS multifile as a single print job.

See also:
SETPTR, **SP.ASSIGN**

4.149 SP.VIEW

The **SP.VIEW** command views and, optionally, prints records from $HOLD or other files.

Format

SP.VIEW {*file*} {*item*} { **LPTR** *n* }

where

file	is the file to be processed. If omitted, $HOLD is used.
item	is the record id of the record to be processed. If omitted, a pick list of records is displayed.
LPTR *n*	specifies the default print unit to be used. If omitted, print unit 0 is used.

If only one name is specified on the command line, it is assumed to be the *file* name if a corresponding VOC F or Q-type record exists and there is no record of that name in $HOLD.

The **SP.VIEW** command allows users to view and print records. If no *item* is specified, a pick list of records in *file* is displayed. The cursor keys, page up, page down, home and end keys can be used to move around within this list. Equivalent actions can be performed using the letter keys or the **SED** style control keys.

Cursor up	U	Ctrl-Z	Move up one line
Cursor down	D	Ctrl-N	Move down one line
Page up	P	Ctrl-V	Move to previous page
Page down	N	Esc-V	Move to next page
Home	T	Esc-<	Move to top of list
End	B	Esc->	Move to bottom of list
	Q		Quit from program. Requires use of return key to confirm
Return			Dive into selected item

After an item has been selected, either as described above or by specifying the *item* name on the command line, the text of the given record is displayed. The cursor keys, page up, page down, home and end keys can be used to move around within the data. Equivalent actions can be performed using the letter keys or the **SED** style control keys.

Cursor up	U	Esc-Z	Move to previous page
Cursor down	D	Ctrl-N	Move to next page
Cursor right	R	Ctrl-F	Pan right
Cursor left	L	Ctrl-B	Pan left
Page up	P	Ctrl-V	Move to previous page

Page down	N	Esc-V	Move to next page
Home	T	Esc-<	Move to top of record
End	B	Esc->	Move to bottom of record
	Q		Quit from record. Requires use of return key to confirm
Return	S		Spool item

The S option prompts for the print unit (defaulting to that in the **LPTR** option, if used), asks whether line numbering is to be used and then prints the item.

4.150 SPOOL

The **SPOOL** command sends specified records to the printer.

Format

SPOOL *file record(s)* { **LINES** *m n* } { **LNUM** }{ **LPTR** *n* }

where

file	is the file holding the record(s) to be printed.
record(s)	is a list of records to be printed. If no record ids are specified, **SPOOL** will use the default select list to identify the records to be printed.
LINES *m n*	specifies that only line *m* to *n* of the record(s) are to be printed. The value of *m* must be greater than 0 and the value of *n* must be greater than *m*.
LNUM	specifies that line numbers are to be printed.
LPTR *n*	specifies the print unit to be used. If omitted, print unit 0 is used.

The **SPOOL** command sends the specified records to print unit 0. The actual destination is determined by use of either **PRINTER** or **SETPTR**.

Use of the **LNUM** keyword prefixes each line by its line number, a colon and a single space. The line number is printed as a minimum of four digits but expands if the record has more than 9999 lines.

Example

```
SPOOL INVOICES 01249 01250
```

The above command would print records 01249 and 01250 from the INVOICES file. The **SPOOL** command does no formatting of the data except to replace field marks by newlines.

4.151 STATUS

The **STATUS** command displays a list of active phantom processes. This command is not available on the PDA version of QM.

Format

STATUS

A list of phantom processes is displayed in the form

```
User  Started               Command
   2  10:30:28 18 May 1994  BASIC BP ACC
```

If there are no phantom processes, the **STATUS** command displays

There are no phantom processes

4.152 STOP

The **STOP** command terminates the currently active paragraph.

Format

STOP

The **STOP** command is intended as a means of exiting from the middle of a paragraph. The active paragraph is discarded, control returning to the paragraph, menu, etc from which the paragraph was started or, if none, to the command prompt.

The value of @SYSTEM.RETURN.CODE is not affected by the **STOP** command.

See also:
ABORT

4.153 T.DUMP

The **T.DUMP** command saves data to a Pick style T-DUMP tape.

Format

T.DUMP {**DICT**} *filename* {*id...*} {**BINARY**} {**COUNT.SUP**} {**DET.SUP**} {**FROM** *listno*}

where

filename	is the name of the file to be saved.
id...	is a list of record ids to be saved.
BINARY	suppresses conversion of newlines to field marks in directory files. Use this mode when saving binary data.
COUNT.SUP	suppresses display of the count of records saved.
DET.SUP	suppresses display of the detailed list of records saved.
FROM *listno*	uses the specified select list to identify the records to be saved.

The **T.LOAD** command processes the named file to produce a Pick style T-DUMP tape

The tape or pseudo-tape to be created must first be assigned to the process using the SET.DEVICE command.

By default, the entire content of the named file is saved. If the default select list is active or the **FROM** option is used to identify an active select list, that list is used to determine the records to be saved. Alternatively, a list of ids may be given on the command line.

See also:
ACCOUNT.RESTORE, ACCOUNT.SAVE, FILE.SAVE, FIND.ACCOUNT, RESTORE.ACCOUNTS, SEL.RESTORE, SET.DEVICE, T.ATT, T.LOAD, T.xxx

4.154 T.LOAD

The **T.LOAD** command restores a Pick style T-DUMP tape.

Format

T.LOAD {**DICT**} *filename* {*item.list*} {**BINARY**} {**COUNT.SUP**} {**OVERWRITING**}

where

filename	is the name of the file to receive the restored data.
item.list	is the list of items to be restored. The default select list may be used instead.
BINARY	suppresses translation of field marks to newlines in directory files. Use this mode when restoring binary data.
COUNT.SUP	suppresses display of the count of records restored.
OVERWRITING	causes existing records to be replaced.

The **T.LOAD** command processes a Pick style T-DUMP pseudo tape and restores data from it into the named QM file.

The tape or pseudo-tape to be read must first be assigned to the process using the **SET.DEVICE** command.

See also:
ACCOUNT.RESTORE, **ACCOUNT.SAVE**, **FILE.SAVE**, **FIND.ACCOUNT**, **RESTORE.ACCOUNTS**, **SEL.RESTORE**, **SET.DEVICE**, **T.ATT**, **T.DUMP**, **T.xxx**

4.155 T.DET, T.EOD, T.FWD, T.RDLBL, T.READ, T.REW, T.STAT, T.WEOF

The **T.xxx** utility commands perform various functions to a tape device.

Format

T.DET	Detach device
T.EOD	Position to end of data
T.FWD	Skip forwards one file
T.RDLBL	Read tape label
T.READ	Read tape
T.REW	Rewind tape
T.STAT	Report device status
T.WEOF	Write end of file marker

The tape or pseudo-tape to be processed must first be assigned using the **SET.DEVICE** command.

See also:
ACCOUNT.RESTORE, **ACCOUNT.SAVE**, **FILE.SAVE**, **FIND.ACCOUNT**, **RESTORE.ACCOUNTS**, **SEL.RESTORE**, **SET.DEVICE**, **T.ATT**, **T.DUMP**, **T.LOAD**

4.156 TERM

The **TERM** command specifies the terminal display dimensions.

Format

TERM

TERM { *columns* } { **,** *lines* } {*term.type*}

TERM COLOUR { *bgc*} { **,** *fgc*}

TERM DEFAULT

TERM DISPLAY

where

columns	is the width of the display device.
lines	is the depth (number of lines) of the display device.
bgc	is the required background colour
fgc	is the required foreground colour

The **TERM** command with no qualifying information reports the display device settings. It shows the page width and depth together with the terminal type (as in the @TERM.TYPE variable).

The command may include either or both of the *columns* and *lines* values to specify the characteristics of the display device. If used for a console session or a QMTerm connection with values of *columns* and *lines* less than 256, the command will also set the device window to the given shape.

The *columns* value must be in the range 20 to 32767. The *lines* value must be in the range 10 to 32767.

The *term.type* option selects the terminal device type. The name given must correspond to an entry in the terminfo library or may be QMTERM (case independent) for the QMTerm emulator.

The **COLOUR** (or **COLOR**) option can be used to set the background and foreground colours. The colour names are case insensitive and chosen from BLACK, BLUE, GREEN, CYAN, RED, MAGENTA, BROWN, WHITE, GREY, BRIGHT BLUE, BRIGHT GREEN, BRIGHT CYAN, BRIGHT RED, BRIGHT MAGENTA, YELLOW, BRIGHT WHITE. The American spelling GRAY can be used in place of GREY and the two word names can be written with either a space or a dot between the words.

Note that some terminal emulators only apply the background colour to characters output by the application, not to the entire window. Thus clearing the screen, for example, may lead to unexpected results.

The **TERM DEFAULT** command resets the device to 80 x 24.

The **TERM DISPLAY** command displays a list of input key codes and output control sequences for the currently selected terminal type.

Example

```
TERM 120,32
```

The above command sets the terminal to be 120 columns wide by 32 lines. A subsequent **TERM** command with no qualifying information would report

```
Page width: 120
Page depth: 32
Device    : QMTERM
```

4.157 TIME

The **TIME** command displays the current date and time.

Format

TIME

TIME INTERNAL

The command takes no arguments. The date and time is reported in the form

```
14:30:00  12 May 1993
```

The **TIME INTERNAL** form displays the current time in internal form (seconds since midnight).

See **DATE** for an alternative format date and time report.

@SYSTEM.RETURN.CODE is not affected by this command.

4.158 UNLOCK

The **UNLOCK** command, available only in the QMSYS account, releases task, record or file locks set by any process.

Format

UNLOCK { **USER** *user.no* } { **FILE** *file.no* } { **ALL** | *record.ids...* }

UNLOCK { **USER** *user.no* } { **FILE** *file.no* } **FILELOCK**

UNLOCK TASKLOCK *lock.no...*

In the first form, **UNLOCK** releases record ids set by user *user.no* on file *file.no*. At least one of these options must be present. The values of *user.no* and *file.no* can be found from the output of the LIST.READU command. The **UNLOCK** requires either a list of record ids or the **ALL** keyword to determine which records to unlock.

In the second form, the file lock set by the specified user on the given file is released. Again, at least one of the **USER** and **FILE** options must be specified.

The third form allows task locks owned by other users to be released. Any number of locks may be released in a single command.

The **UNLOCK** command should be used with great care. Locks are taken by application software to protect critical operations. Releasing a lock can cause data integrity problems.

Example

```
LIST.READU
File  Path
  17  D:\SALES\INVENTORY
File User Type Id
  17     4  RU  18464
  17     4  RU  21968
UNLOCK USER 4 18464
```

In this example, LIST.READU is used to check which locks are outstanding and the **UNLOCK** command is used to release a specific record lock.

4.159 UPDATE.ACCOUNT

The **UPDATE.ACCOUNT** command copies all system VOC entries from NEWVOC, setting the correct locations for system files.

Format

UPDATE.ACCOUNT

The **UPDATE.ACCOUNT** command copies all NEWVOC items to the VOC file of the current account. It is useful after an upgrade or if the VOC has been damaged. Unlike a simple **COPY** from NEWVOC to the VOC, **UPDATE.ACCOUNT** checks for changes that may have a detrimental effect.

Executing this command in the QMSYS account when logged in as a user with administrator rights prompts to ask whether all registered accounts are to be updated. This can be useful after an upgrade on a system with many accounts.

See also:
CREATE.ACCOUNT, **DELETE.ACCOUNT**

4.160 UPDATE.LICENCE

The **UPDATE.LICENCE** command, available only in the QMSYS account, applies new licence details.

Format

UPDATE.LICENCE

The **UPDATE.LICENCE** command prompts for the licence information supplied with the product or at an upgrade.

Care should be taken to enter the information exactly as it appears on the licence information sheet. When relicensing an existing system, the old licence data is displayed allowing amendment of only the fields that have changed.

The screen layout for the PDA version is different and omits the user limit field.

Example

```
LICENCE DETAILS
---------------------------------------------------------

Licence number      [1961491396]      System id WLHX-YRTZ
Max users           [50  ]
Expiry date         [31 Dec 2000]
Authorisation code  [YKSAJ-KKRFW-CNDKD-LRRTW-CJRTD]
Security number     [65859     ]
Site text [Manor Developments Limited             ]


Use Return, Tab or Cursor keys to move between fields.
Use Ctrl-X to abort licence data entry.

---------------------------------------------------------

Enter 10 digit licence number
```

4.161 UPDATE.RECORD

UPDATE.RECORD simplifies amendment of database files. In **batch mode**, it allows the same update to be made to multiple records in a file with just one command, possibly changing the content of more than one field. In **visual mode**, it displays a full screen image of fields from the data record in their external (converted) form, allowing modifications to be entered as the cursor is moved around the displayed data.

Format

UPDATE.RECORD {**DICT**} *file* {**USING** {**DICT**} *dict*}

FROM *listno*
ALL
id { *id* ...}
INQUIRING {*prompt*}

Batch mode:
field,*value* {**CONV** "*spec*"} { *field*,*value* ...}
DELETING *field*
{**COUNT.SUP**}
{**VERIFY.SUP**}
{**EXCLUSIVE**}
{**WAIT**} or {**NO.WAIT**}
{**CREATING**}
{**OVERWRITING**}
{**REPORTING**}
{**LPTR** {*n*}}
{**NO.PAGE**}

Visual mode:
{**ID.SUP**}
{**COL.SUP**}

Identifying the file to be processed:

{**DICT**} *file*	specifies the file to be updated. The optional **DICT** keyword indicates that the dictionary portion of the file is to be updated.
USING {**DICT**} *dict*	specifies that *dict* is to be used as the dictionary for *file*. The optional **DICT** keyword uses the dictionary portion of *dict*.

Selection of the records to be updated:

FROM *listno*	specifies that select list *listno* (0 to 10) is to be used as the list of records to process.
ALL	specifies that all records in *file* are to be updated. **UPDATE.RECORD** will use select list 0 internally to generate

	the list of records to be processed.
id { *id* ...}	is a list of specific record ids to process. Record ids should be enclosed in single or double quotes if they contain spaces or commas or match command keywords.
INQUIRING {*prompt*}	causes **UPDATE.RECORD** to prompt for the id of each record to be processed. The *prompt* string is optional and must be enclosed in single or double quotes if it contains spaces or commas. If omitted, a default of "Record id" is used. Inquiry mode is the default in visual mode if no record ids are specified and the **ALL** and **FROM** keywords are not used.

Only one of these selection styles can be used in a single command. If none of the above record selection criteria is given and the default select list is active, that list is used.

Specifying the updates to be made in batch mode:

field	identifies the field to be updated. The value given may be a numeric field position or the name of an A, D or S-type item from the dictionary.
value	identifies the new value to be placed in *field*. This may be a number, a quoted string, the name of a field or I-type from the dictionary or the keyword **EVAL** followed by an I-type expression in either single or double quotes.
CONV "*spec*"	Allows use of alternative conversion codes.
DELETING *field*	Deletes the specified *field* from the data record, moving all subsequent fields back by one position.

Options controlling the action of **UPDATE.RECORD** in batch mode:

COUNT.SUP	suppresses the normal report of the number of records processed.
VERIFY.SUP	suppresses the confirmation prior to an update using a select list or the **ALL** keyword.
EXCLUSIVE	causes **UPDATE.RECORD** to lock the entire file during the update to ensure exclusive access. If the file cannot be locked, **UPDATE.RECORD** will display a message and terminate unless the **WAIT** keyword is also given, in which case it will wait until it can obtain exclusive access.
WAIT	can be used with the **EXCLUSIVE** keyword as described above. It can also be used alone to specify that **UPDATE.RECORD** should wait whenever it encounters a locked record.
NO.WAIT	turns off **WAIT**. It is not normally required as this is the default. **UPDATE.RECORD** honours the last **WAIT** or **NO.WAIT** on the

command line.

CREATING causes **UPDATE.RECORD** to create records that are not found in the file.

OVERWRITING allows overwriting of existing records when changing the record id.

REPORTING produces a detailed report of each update.

LPTR {*n*} directs the commentary from **UPDATE.RECORD** to the specified print unit. Print unit 0 is used if *n* is omitted.

NO.PAGE suppresses pagination of output to the display.

The sequence of the command components must be file specification, record ids, fields and values, options.

Options controlling the action of **UPDATE.RECORD** in visual mode:

ID.SUP suppresses display of the field names.

COL.SUP suppresses display of the display names (column headings in a query report).

UPDATE.RECORD batch mode

UPDATE.RECORD runs in batch mode of the command line includes one or more *field/value* specifications.

If the **EXCLUSIVE** keyword is used, **UPDATE.RECORD** will obtain exclusive access to the file by acquiring the file lock. If another user holds a record lock or the file lock when the command is issued, **UPDATE.RECORD** will terminate with an error message unless the **WAIT** keyword has been used, in which case a message is displayed and it repeats the attempt to lock the file at five second intervals.

For each record to be processed, **UPDATE.RECORD** first locks and reads the record. If another user has the record locked and the **WAIT** keyword has been used, **UPDATE.RECORD** will wait for the record to become available. If the **WAIT** keyword was not used, the record id is added to a list of locked records. If either the **INQUIRING** or **REPORTING** keywords was used, a message is output showing the id of the record that could not be locked.

If the specified record does not exist in the file and the **CREATING** keyword has been used, a new, empty record is created to which the amendments are then applied. If the **CREATING** keyword is not present, the record id is added to a list of missing records

Once the record has been successfully locked, **UPDATE.RECORD** performs each of the specified amendments in the order in which they appear on the command line. Each amendment may draw on the result of preceding amendments. Note in particular, that use of the **DELETING** option will result in new field positions for all later fields. The record id may be changed by specifying the target as field 0 or a dictionary item such as @ID that refers to field 0. Any I-type or EVAL expressions after the change of record id will see the new id in @ID.

The *field* specification may be a numeric field position or the name of a D-type item from the dictionary or the VOC. The *value* specification may be:

A number or a quoted string.

The name of an A, D, I or S-type dictionary or VOC item identifying the field from which data is to be copied. If this is an I-type item or an A/S-type item with a correlative expression, it must have been compiled prior to use by **UPDATE.RECORD**.

The keyword **EVAL** followed by an I-type expression in single or double quotes. This expression will be compiled by **UPDATE.RECORD** and evaluated to determine the new value of the field.

UPDATE.RECORD honours dictionary conversion specifications for both the source and target data items. Where the new *value* for a field is derived via a dictionary name, the value is first converted to its external form. Where the field to be updated is identified via a dictionary name, the new value is converted to its internal form prior to storing in the record. If the *value* specification is followed by the **CONV** keyword and a quoted conversion specification, this will overrule any conversion specified in the dictionary. **UPDATE.RECORD** will report a warning message if the conversion generates an error when applied to *value*.

The **REPORTING** keyword causes **UPDATE.RECORD** to produce a detailed report of each amendment made, including the record id together with the old and new values of each field amended. This report can be directed to a specific print unit using the **LPTR** keyword.

In the absence of the **REPORTING** and **INQUIRING** keywords or if the report is directed to a print unit rather than the display, **UPDATE.RECORD** displays a progress report in the form of a series of asterisks.

On completion of the update, **UPDATE.RECORD** may create two entries in the $SAVEDLISTS file. If one or more records could not be updated because they were locked by other users, a select list named &LOCK.*userno*& is created containing a list of such records. If one or more records specified for update did not exist in the file and the **CREATING** keyword was not used, a select list named &MISS.*userno*& is created containing a list of the missing record ids. **UPDATE.RECORD** deletes any old versions of these lists at the start of the update.

Note that the database locking system is of a voluntary nature. Both the file and record level locking performed by **UPDATE.RECORD** only prevent other users acquiring the locks. A program that does not use locks correctly may still be able to access the file during the update.

On completion of the update, **@SYSTEM.RETURN.CODE** will be set to the number of records updated. If the command terminates due to a command line error, **@SYSTEM.RETURN.CODE** will be negative.

Examples

```
UPDATE.RECORD STOCK 01-1745 IN.STOCK,0
```

This update amends field IN.STOCK of record 01-1745 in the STOCK file to be zero.

```
UPDATE.RECORD SALES ALL TOTAL.SOLD, EVAL "TOTAL.SOLD +
THIS.MONTH" THIS.MONTH,0 EXCLUSIVE REPORTING LPTR 2
```

This update processes all records from the SALES file, adding the current value of the THIS.MONTH field into the TOTAL.SOLD field, resetting THIS.MONTH to zero. The **EXCLUSIVE** keyword ensures that the file is not updated by other users during the amendment. A detailed report of the changes is sent to print unit 2.

```
UPDATE.RECORD PAYROLL INQUIRING SALARY,EVAL "SALARY * 1.05"
```

This update processes entries of the PAYROLL file specified in response to a record id prompt, increasing the value of SALARY by 5%.

```
UPDATE.RECORD STOCK FROM 2 5,"12/9/96" CONV "D2/"
```

This update uses select list 2 to identify records of the STOCK file in which field 5 is to be set to the internal form of the date 12/9/96.

The Report

The **REPORTING** keyword causes **UPDATE.RECORD** to generate a detailed report of its actions. This can be used as a simple audit trail of the changes made to the file and also contains information that enables recovery from an incorrect amendment.

The report shows the start of the amendment for a given record, the changes made to each field and the termination of the update at the point when the record has been written back to the file. Missing records and records which have been created by **UPDATE.RECORD** are highlighted in this report.

A command such as

```
UPDATE.RECORD STOCK FROM 2 OLD.VALUE,VALUE VALUE,EVAL
"VALUE*1.1" CREATING
```

might produce a report including the following lines

```
Start of update of record '01-1268'
  Field OLD.VALUE was '' now '90'
  Field VALUE was '90', now '99'
  Completed update of record 01-1268'
Record '01-6723' locked by another user.
Creating record '01-7491'
  Field OLD.VALUE was '75' now '80'
  Field VALUE was '80', now '88'
  Completed update of record 01-7491'
```

This example shows the report entries for update of a record found in the file, a record that was not updated because it was locked by another user and a record that was created by **UPDATE.RECORD**.

If the **CREATING** option was not used, record 01-7491 would have produced the following report line

```
Record '01-7491' not found.
```

UPDATE.RECORD visual mode

UPDATE.RECORD runs in visual mode if the command line contains no *field/value* specifications.

Visual mode presents a full screen display of the external (converted) form of fields from a data record. Changes are made by moving the cursor to the desired position and entering or deleting characters. Modified lines are converted back into their internal form within **UPDATE.RECORD** when the cursor is moved to a new line or when the data is to be written back to the file.

```
 1: NAME            : Site Name    : Acme Software Limited
 2: ADDRESS         : Address      : 42 High Street, Anytown
 3: POSTCODE        : Postcode     : AN11 1XX
 6: DATE.PAID       : Date Paid    : 12 Feb 98ý17 Mar 98
 7: INVOICES        : Invoices     : 001763ý001966
 8: LICENCES        : Licences     : 907881792ý1907881802ý1907881808
 9: EXPIRED.LICENCES: Expired      :
10: COUNTRY         : Country      :
11: CLASS           : Class        : 3
12: DEALER.SALES    : Sales        :
13: CALLBACK.DATE   : Callback     : 01 Jul 98
14: CALLBACK.TEXT   : Callback note: Interested in new product range
15: VAT.NO          : VAT no       : 614 1210 25
16: SITE.TEXT       : Site text    : Acme Software
17: CONTACT         : Contact      : Anne McIntosh
18: POSITION        : Position     :
19: TEL.NO          : Tel no       : 01234-56789ý01234-64526
20: FAX.NO          : Fax no       : 01234-21767
21: MOBILE.NO       : Mobile no    :
22: EMAIL           : E-mail       : acme@mailer.com
23: SALES.TOTAL     : Sales        : £12783.33
24: NOTES           : Notes        :
*CLIENTS 00106
<6,1,1>     |  D2DMYL[,A3]      | 9R          | PAYDATE    | S |
```

By default, the display shows all fields for which a D-type dictionary entry or an A/S=type entry with no correlative exists. A specific subset of fields can be displayed by creating a dictionary phrase named @UPDATE.RECORD which lists the required fields (and possibly keywords).

For each field, the display shows:

The field number
The field name (unless suppressed by use of **ID.SUP**)
The display name (unless suppressed by **COL.SUP**)
The data in its external form

The last two lines of the screen are used as a status area. The upper status line displays the file name and record id. An asterisk is shown at the start of this line if the data has been changed.

The lower status line shows the field, value and subvalue in which the cursor is positioned and the dictionary conversion code, format code, association name and single/multi-value flag for the field. The final field of this status line shows a letter O if **UPDATE.RECORD** is in overlay mode (see below).

UPDATE.RECORD uses a subset of the default key bindings of the SED full screen editor. These all consist of keystrokes which are

Control shift + key

ESCape followed by another key
Ctrl-X followed by another key

The table below summarises the key bindings. All other keystrokes except for unused control shift codes cause the character to be inserted into the record text at the current cursor position.

	Ctrl-	Esc-	Ctrl-X -
A	Home		
B	Cursor left		
C	Repeat		Quit
D	Delete char		
E	End		
F	Cursor right		
G	Cancel	Goto	
H	Backspace		
I			
J	(Return)		
K	Kill line		
L	Refresh		
M	(Return)		
N	Cursor down		
O	Overlay		Overlay
P	Cursor up		
Q	Quote char	Quote char	
R			
S			Save
T			
U	Repeat		
V	Page down	Page up	
W	Cut		Copy
X	Ctrl-X prefix	Command	
Y	Paste	Paste	
Z	Cursor up		
.			Mark
=			Expand char
<		Top	
>		Bottom	
Bkspc	Backspace		
Del	Delete char		
Return	Cursor down		

UPDATE.RECORD also recognises the following terminal control keys:

Home	End	Cursor left
Cursor right	Cursor up	Cursor down
Insert (Overlay)	Delete	Page up
Page down		

Some functions are available using alternative key sequences. Such alternatives are shown above and in the descriptions that follow.

The **repeat** function (Ctrl-C or Ctrl-U) repeats the previous function.

The **cancel** function (Ctrl-G) can be used to abort partially entered incorrect key sequences and to terminate certain functions as described below.

Cursor Movement Functions

Note: A confirmation prompt appears if the cursor is moved from a line that contains a data conversion error.

Home (Ctrl-A or Home)
Moves the cursor to the start of the current line.

End (Ctrl-E or End)
Moves the cursor to the position after the last character in the current line.

Top (Esc-<)
Moves to the start of the first displayed field.

Bottom (Esc- >)
Moves to the start of the last displayed field.

Cursor down (Ctrl-N or Ctrl-P or Cursor down)
Moves the cursor vertically down one line. If this position is beyond the end of the data in the new line, the cursor is displayed immediately to the right of the final character. **UPDATE.RECORD** remembers the column position from which the cursor was moved so that a further vertical movement will continue to place the cursor at the lesser of its original column position and the end of the current line.

Cursor up (Ctrl-P or Ctrl-Z or Cursor up)
Moves the cursor vertically up one line. The same process is used for determining the column position as for the **cursor down** operation described above.

Cursor right (Ctrl-F or Cursor right)
Moves the cursor right.

Cursor left (Ctrl-B or Cursor left)
Moves the cursor left.

Page down (Ctrl-V or Page down)
Moves the cursor down by one screen or to the last line.

Page up (Esc-V or Page up)
Moves the cursor up by one screen or to the first line.

Goto (Esc-G)
Prompts for a field, value and subvalue position and moves the cursor to that position. The position may be specified as:

field	go to specified field, value 1, subvalue 1
field, value	go to specified field and value, subvalue 1
field, value, subvalue	go to specified field, value and subvalue

Fields may be specified by number or name. Omitted *field* or *value* components mean " within the current field/value" unless a higher level component is specified in which case the default is 1. For example:

,*value*	go to specified value in current field
,*value*,*subvalue*	go to specified value/subvalue in current field
,,*subvalue*	go to specified subvalue in current field/value
field,,*subvalue*	go to specified field, value 1, specified subvalue

An asterisk can be use to imply "no change". This is useful when processing associated multi-valued fields. For example:

*,*value*	go to specified value in current field
field,*	go to current value position in specified field
field,*,*	go to current value and subvalue in specified field

If the specified value or subvalue does not exists, **UPDATE.RECORD** will offer to create it.

Data Insertion

Data is inserted at the current cursor position. If overlay mode is set the new data overwrites any existing data at this position, otherwise it is inserted before the character under the cursor. Overlay mode may be toggled using the **overlay** function (Ctrl-O or Ctrl-X O or Insert).

Any character other than a field mark or item mark may be inserted. The **quote character** function (Ctrl-Q or Esc-Q) allows insertion of non-printing characters. It may be used in three ways:

Followed by a number of up to three digits, it inserts the character with that decimal ASCII sequence.

Followed by V, S or T, it inserts a value mark, subvalue mark or text mark respectively.

Followed by any other character, usually a non-printing character, it will insert that character.

Copying, Deleting and Restoring Data

Delete char (Ctrl-D or Del, Delete)
The character at the current cursor position is deleted.

Backspace (Backspace or Ctrl-H)
The **backspace** function removes the character to the left of the cursor.

Kill line (Ctrl-K)
The **kill line** function deletes all characters following the cursor.

Copy (Esc-W)
The **copy** copies part of a field to the clipboard buffer. The required sequence of actions is:
Position the cursor on the first character to be copied.
Execute the **mark** function (Esc-.).
Position the cursor after the last character to be copied. Where the terminal device allows, the selected characters will be highlighted.
Press the **copy** key.

The **copy** function can be cancelled using the **cancel** function (Ctrl-G).

Cut (Ctrl-W)
The **cut** function cuts (deletes) part of a field, placing a copy of the deleted text in the clipboard buffer. The required sequence of actions is:
Position the cursor on the first character to be cut.
Execute the **mark** function (Esc-.).
Position the cursor after the last character to be cut. Where the terminal device allows, the selected characters will be highlighted.
Press the **cut** key.

The **cut** function can be cancelled using the **cancel** function (Ctrl-G).

Paste (Ctrl-Y or Esc-Y)
The **paste** function inserts a copy of the clipboard buffer as set using **copy** or **cut** at the current cursor position.

Miscellaneous Functions

Save (Ctrl-X S or Ctrl-X Ctrl-S)
The **save** function saves the modified data record. **UPDATE.RECORD** remains in the current record allowing further changes if required.

The **save** function cannot be executed if the current line contains a data conversion error.

Quit (Ctrl-X C or Ctrl-X Ctrl-C)
The **quit** function moves to the next record to be processed (if any). A confirmation prompt is displayed if the current record has been modified and not saved.

Expand char (Ctrl-X =)
Certain control characters (e.g. tab, form feed) are represented on the screen by question marks. The **expand char** function displays the character sequence number for the character at the cursor position on the lower status line.

Command (Esc-X)
The command function allows executing of any valid QM command from within **UPDATE.RECORD**. In addition, it supports the following built-in commands:

SPOOL Used without any following file name etc. , this command spools a copy of the record to the default printer.

QUIT Terminates processing of the current record and exits **UPDATE.RECORD**, abandoning any further records specified for processing.

4.162 WHO

The **WHO** command displays the current user number and account name.

Format

WHO

Each directory holding a VOC file is termed an **account**. Multiple accounts are useful where there are several distinct projects. They can also be used to separate development and production versions of an application.

The **WHO** command displays the current user number and account name. If the current account is not the same as the initial account on entry to QM, the initial account name is also displayed.

Example

```
WHO
   1   AC1

LOGTO AC2
WHO
   1   AC2 from AC1
```

In this example, the user enters QM in account AC1. The **WHO** command shows the user number and this account name. A **LOGTO** command is used to transfer to AC2. The **WHO** command now shows the new account and the original.

4.163 WHERE

The **WHERE** command displays the pathname of the current account.

Format

WHERE

This command is a simple sentence that displays the value of the @PATH system variable.

Example

```
WHERE
   C:\QMACC\SALES
```

Part

Query Processing

5 Query Processing

QM verbs that select records from files or produce reports are handled by the query processor. All query processor verbs follow a common format.

The query processor verbs are

LIST	List records meeting specified criteria
LIST.ITEM	List records meeting specified criteria in internal format
LIST.LABEL	List records meeting specified criteria in address label format
REFORMAT	Builds a new file from data in the source file
SHOW	Interactive select list generation
SORT	List records meeting specified criteria in order of record id
SORT.ITEM	List records meeting specified criteria in order of record id in internal format
SORT.LABEL	List records meeting specified criteria in address label format, in order of record id
SELECT	Create a select list of records meeting specified criteria
SSELECT	Create a select list of records meeting specified criteria in order of record id
SEARCH	Create a select list of records meeting specified criteria which include text matching over the entire record
COUNT	Count records meeting specified criteria
SUM	Report total of named fields

The General Form of a Query Processor Verb

All query processor verbs follow the same general format though not all parts are applicable to all verbs. The components of the command may be in any order except that the file name must immediately follow the verb and the order may be significant in repeated instances of an element.

verb {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*field.name* {*field.qualifier*} ...}
{*selection.clause* }
{*sort.clause* }
{*display.clause* }
{*record.id...*}

{**FROM** *select.list.no*}
{**TO** *select.list.no*}

where

verb is the query processor verb name

{**DICT**} *file.name* identifies the file to be processed. The optional **DICT** keyword indicates that the dictionary part of the file is to be processed. The DICT.DICT file will be used as the dictionary defining the items in the dictionary being reported.

USING {**DICT**} *file.name* indicates that a dictionary other than the one normally associated with the file is to be used.

field.name is the name of a field (D or I-type) to be displayed. Multiple fields may be specified in a single command. In addition, the special construct **F***n* may be used to reference field *n* and the **EVAL** keyword may be used to introduce an evaluated expression.

field.qualifier provides qualifying information about the immediately preceding *field.name* such as the format in which it is to be displayed.

selection.clause specifies criteria determining which records from the file are to be included.

sort.clause specifies the order in which records are to be processed.

display.clause controls the manner in which data is displayed or printed.

record.id specifies a particular record id is to be processed. Multiple record ids may be specified.

FROM *select.list.no* specifies that a select list is to be used to control which records are processed. If the **FROM** option is not used and the default select list (list 0) is active, this list will be used automatically. If used in conjunction with one or more *record.id* items, only records that appear in the select list and are named *record.id*s will be processed.

TO *select.list.no* for verbs that produce a select list, specifies which list is to be created. If the **TO** option is not used, the default select list (list 0) is used.

Phrases defined in the VOC or the dictionary may be included at any point in a query processor command and will be expanded at that position in the command line.

Literal values used in selection or sort clauses do not need to be enclosed in quotes unless they correspond to names defined in either the VOC or the file's dictionary or if the contain spaces, commas or quotes. Use of quotes is recommended to prevent incorrect interpretation of commands.

The $QUERY.DEFAULTS Record

The default actions of the query processor **LIST**, **SORT**, **LIST.LABEL** and **SORT.LABEL**

commands can be controlled by adding an X-type record to the VOC file or to the dictionary of the file referenced by the query command. Field 2 of this record contains query processor command line elements that will be inserted into the command after the file name but before any further command line options. The options may extend over multiple lines by use of an underscore as the last character of the line to indicate that a continuation line is present. The lines are merged together with the underscore replaced by a single space.

The query processor checks first for this optional record in the dictionary of the file. If it is not found, it then looks in the VOC. It is therefore possible to use a VOC record to set account level defaults which can be overridden by an alternative record in individual dictionaries. A $QUERY.DEFAULTS record in the dictionary with a type code of X but no further content will effectively disable use of the VOC $QUERY.DEFAULTS record whilst not applying any defaults of its own.

Links

Dictionary L-type records can be used to represent a relationship between two files without the need to include a separate I-type **TRANS()** expression for each field.

In a query command, a link is used by specifying a field name that is constructed from the link name and the name of a field in the linked file, separated by a percent sign (%).

For example, consider a library application where the BOOKS file representing a physical copy of a book uses a composite key constructed from the id of a record in the TITLES file and the copy number, separated by a hyphen. A link record could be placed in the dictionary of the BOOKS file:

```
TITLES  1: L
        2: @ID['-', 1, 1]
        3: TITLES
```

A query against the BOOKS file may then refer to fields from the TITLES file as, for example, TITLES%AUTHOR. The linked field (AUTHOR in this example) must be a D or I-type item.

To allow use of field names that contain % characters, the query processor only interprets a field name containing a % character as a link if there is no dictionary or VOC item corresponding to the entire name.

5.1 The Selection Clause

A **selection clause** may be provided to specify criteria governing which records are processed by the command. If omitted, all records are processed. Selection clauses can be used with all query processor verbs

The selection clause is described in detail under the **WITH** and **WHEN** keywords.

The performance of queries against large files can be improved dramatically by use of alternate key indices. These are index files that relate a particular value of a data field or virtual attribute to the ids of records that have that value. Alternate key indices are created in a two step operation using the **CREATE.INDEX** and **BUILD.INDEX** commands. Once an index has been built, it is maintained automatically by QM and is used by the query processor whenever it is advantageous to do so.

Ranges of values can also be satisfied using indices if the upper and lower limits are defined in the first two conditional elements. For example,

```
LIST STOCK WITH QOH > 3 AND QOH < 10 AND SUPPLIER = 27
```

will use an index on the QOH field to access the data whereas

```
LIST STOCK WITH QOH > 3 AND SUPPLIER = 27 AND QOH < 10
```

will not. Use of unnecessary brackets may also defeat the indexing system. For example,

```
LIST STOCK WITH QOH > 3 AND (QOH < 10 AND SUPPLIER = 27)
```

will not use the index as the second conditional element is not a simple item.

Selection clause comparisons are case sensitive by default. Case insensitivity can be applied by including the **NO.CASE** qualifier after the relation operator or by use of the QUERY.NO.CASE mode of the **OPTION** command.

The PICK.IMPLIED.EQ mode of the **OPTION** command can be used to select Pick style behaviour where a field name followed by a literal value enclosed in double quotes has and implied equals operator. Thus

```
LIST CLIENTS WITH CUST.NO "1234" "5678"
```

is equivalent to

```
LIST CLIENTS WITH CUST.NO = "1234" "5678"
```

Without this option, the semantics of the query are such that the two literal values are treated as record ids and the selection element restricts processing to records in which the CUST.NO field is not empty.

5.2 The Sort Clause

The optional **sort clause** determines the order in which records are inserted into the select list (**SELECT**, **SSELECT**, **SEARCH**) or reported (**LIST**, **SORT**, **LIST.ITEM**, **SORT.ITEM**).

Sorting is performed before conversion of data to its external format. Thus sorts of date fields, for example, will correctly sequence dates regardless of their conversion.

The justification mode of the field's format is used to determine whether a left of right aligned sort is performed. For dates, a right aligned sort is required to avoid problems with dates with internal values of differing numbers of digits.

There are two sort clause operators for single valued fields, **BY** and **BY.DSND**, which differ only in that **BY** sorts into ascending order and **BY.DSND** sorts into descending order. Similarly, there are two **exploded sort** operators, **BY.EXP** and **BY.EXP.DSND**, for use with multi-valued fields. These explode the multi-valued records to their single valued equivalents, allowing a query to process values in sequence.

Where multiple sort items are specified, the query processor examines them in the order in which they appear in the command. The second and subsequent sort items are only examined where the previous sort was not sufficient to identify the record sequence.

The **SORT**, **SORT.ITEM** and **SSELECT** verbs are equivalent to the **LIST**, **LIST.ITEM** and **SELECT** verbs with a **BY** @ID clause as the final sort.

5.3 The Display Clause

The optional **display clause** determines which fields (columns) are reported and how they are displayed. This clause is applicable to the **LIST** and **SORT** verbs only. If omitted, the query processor uses the **default listing phrase** to determine what is shown.

Fields appear in the report left to right in the order of the display clause elements. The default view of the record id (@ID) is always shown as the leftmost column unless it is suppressed using the **ID.SUP** keyword.

The display clause is constructed from the elements in the table below.

Prefix	Data Item	Suffix
AVG	D-type item	CONV "*code*"
PCT [*n*]	I-type item	FMT "*spec*"
TOTAL	EVAL "*expr*" [AS *xx*]	COL.HDG "*text*"
MAX	F*n*	ASSOC "*name*"
MIN		ASSOC.WITH *field*
BREAK.ON ["*text*"]		DISPLAY.LIKE *field*
BREAK.SUP ["*text*"]		SINGLE.VALUE
ENUM		MULTI.VALUE
CALC		NO.NULLS
CUMULATIVE		

Each data item may optionally be prefixed by one of the qualifiers in the first column and followed by any number of compatible options from the third column.

Where no such item is defined in the dictionary or the VOC, the F*n* data item is recognised by the query processor as a reference to field *n*, treating the data as single valued with a format code of "15T". These display characteristics can be modified using other elements from the table above.

Qualified Display Clauses

For improved compatibility with other multi-value databases, QM supports the concept of **qualified display clauses**. These combine the role of the display clause with simple selection clause elements. Because qualified display clauses lead to a potential ambiguity in the interpretation of a query, this feature must be enabled using the **QUALIFIED.DISPLAY** mode of the **OPTION** command.

A qualified display clause element inserts a conditional test after the data item but before any items from the third column of the table above. This conditional test consists of an operator and a field or

value against which the test is to be performed. It may not include the **AND** or **OR** operator or the use of brackets.

For example, the query

```
LIST STOCK SUPPLIER = 14 DESCRIPTION
```

would list the record id (default), SUPPLIER and DESCRIPTION fields, showing only those record where the SUPPLIER field contains 14. This is equivalent to

```
LIST STOCK SUPPLIER DESCRIPTION WITH SUPPLIER = 14
```

The optional **display clause** determines the manner in which records are reported. This clause is applicable to the **LIST** and **SORT** verbs only.

There are a wide variety of options in this clause. Some determine the actual layout of the data while others set breakpoints at which totals, averages, etc are to be reported.

5.4 SELECT and SSELECT

The **SELECT** and **SSELECT** verbs build a select list containing the keys of records meeting specified criteria. **SSELECT** is equivalent to **SELECT** with a final sort by record id.

SELECT {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*selection.clause*}
{*sort.clause*}
{*record.id...*}
{**FROM** *select.list.no*}
{**SAVING** {**UNIQUE**} {**MULTI.VALUE**} *field.name* {**NO.NULLS**}}
{**TO** *select.list.no*}

SSELECT {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*selection.clause*}
{*sort.clause*}
{*record.id...*}
{**FROM** *select.list.no*}
{**SAVING** {**UNIQUE**} {**MULTI.VALUE**} *field.name* {**NO.NULLS**}}
{**TO** *select.list.no*}

Example

```
SELECT VOC WITH F1 LIKE F...
```

This command builds a select list containing the ids of VOC records with field one starting with an upper case F. Such a list corresponds to all files defined by the VOC.

5.5 SEARCH

The **SEARCH** verb is similar to **SELECT** except that it also prompts for entry of one or more text strings. Records that meet any other selection criteria given on the command line are tested for the presence of the search strings at any position in the record.

Up to 20 search strings may be specified. Entry of search strings is terminated by entering a blank response to the prompt.

The optional **NO.CASE** keyword makes the search string test case insensitive.

By default, the **SEARCH** verb builds a list of all records that contain any of the supplied search strings. This can be changed by use of the **ALL.MATCH** or **NO.MATCH** keywords. The **ALL.MATCH** keyword specifies that the selected records must contain all of the supplied strings. The **NO.MATCH** keyword specifies that the selected records must not contain any of the supplied strings.

All other options of the **SELECT** verb may be used in **SEARCH**.

Example

```
SEARCH BP
String: !SORT
```

The above lines entered at the keyboard would search all QMBasic source programs in the BP file for references to the **!SORT()** subroutine.

See also:
ALL.MATCH, **NO.CASE**, **NO.MATCH**

5.6 LIST and SORT

The **LIST** and **SORT** verbs produce reports from QM files. The **LIST** verb displays records in the order in which they are encountered in the file unless a sort clause in present in the command. The **SORT** verb is equivalent to **LIST** with a final sort by record id.

LIST {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*field.name* {*field.qualifier*} ...}
{*selection.clause*}
{*sort.clause*}
{*display.clause*}
{*record.id...*}
{**FROM** *select.list.no*}

SORT {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*field.name* {*field.qualifier*} ...}
{*selection.clause*}
{*sort.clause*}
{*display.clause*}
{*record.id...*}
{**FROM** *select.list.no*}

The record id is always reported as the first item in the output unless the **ID.SUP** keyword has been used to suppress it. The format of this item is determined by the @ID dictionary record. If this record is not found in the dictionary, a default format is used.

If **field names** are specified in the command, these fields are displayed in the order specified. If no field names are present, the query processor looks for a phrase in the dictionary defining a default set of fields to be reported. If the **LPTR** keyword has been included, the query processor first looks for a phrase record named @LPTR. If this cannot be found or the **LPTR** keyword was not used, it looks for a phrase record named @. The @LPTR and @ phrases can be used to create separate default field name lists for output to the printer and the display respectively. If no @LPTR or @ record is found, only the record id is reported.

The default listing phrase may include field qualifiers, selection, sort and display clause items.

The **LIST** and **SORT** verbs normally produce a tabular format report with items listed side by side. If the total width of the items to be reported exceeds the width of the display or printer to which the report is directed, a vertical format report is produced. This can be forced by use of the **VERTICALLY** keyword.

The **PAN** keyword allows reports wider than the display to be produced using the left and right cursor keys to pan part or all of the displayed data.

The **SCROLL** keyword allows scrolling back and forward using the up and down cursor keys.

When **LIST** or **SORT** are used to list a dictionary with the no display clause, the action of the default listing phrase (@), includes transformation of A and S-type dictionary items into a form that maps onto the standard dictionary display format used for other types.

Example

```
LIST STOCK QTY REORDER.LEVEL WITH QTY < REORDER.LEVEL
```

This command lists all records from the STOCK file for which the quantity in stock (QTY field) is less than or equal to the reorder level (REORDER.LEVEL field). These two fields are displayed together with the record id.

5.7 LIST.ITEM and SORT.ITEM

The **LIST.ITEM** and **SORT.ITEM** verbs display data from QM files in its internal format. The **LIST.ITEM** verb displays records in the order in which they are encountered in the file unless a sort clause in present in the command. The **SORT.ITEM** verb is equivalent to **LIST.ITEM** with a final sort by record id.

LIST.ITEM {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*selection.clause*}
{*sort.clause*}
{*record.id...*}
{**FROM** *select.list.no*}

SORT.ITEM {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*selection.clause*}
{*sort.clause*}
{*record.id...*}
{**FROM** *select.list.no*}

The output from these verbs displays the record id followed by each field on a separate line. No conversion or formatting is performed on the data. Multivalued data will be displayed with embedded mark characters.

The **SCROLL** keyword allows scrolling back and forward using the up and down cursor keys.

Example

```
LIST.ITEM STOCK 16798
```

This command lists the content of record 16798 of the STOCK file.

5.8 LIST.LABEL and SORT.LABEL

The **LIST.LABEL** and **SORT.LABEL** verbs are used to print address labels from QM files. The **LIST.LABEL** verb processes records in the order in which they are encountered in the file unless a sort clause in present in the command. The **SORT.LABEL** verb is equivalent to **LIST.LABEL** with a final sort by record id.

LIST.LABEL {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*field.name* {*field.qualifier*} ...}
{*selection.clause*}
{*sort.clause*}
{*display.clause*}
{*record.id*...}
{**FROM** *select.list.no*}

SORT.LABEL {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*field.name* {*field.qualifier*} ...}
{*selection.clause*}
{*sort.clause*}
{*display.clause*}
{*record.id*...}
{**FROM** *select.list.no*}

The optional clauses to **LIST.LABEL** and **SORT.LABEL** work in exactly the same way as for **LIST** and **SORT** except that arithmetic field modifiers (**AVERAGE**, **ENUMERATE**, **MAX**, **MIN**, **PERCENTAGE**, **TOTAL**), breakpoints (**BREAK.ON**, **BREAK.SUP**) and the page format keywords (**COL.SUP**, **COL.HDR.SUPP**, **COL.SPACES**, **HDR.SUP**, **DBL.SPC**, **FOOTING**, **GRAND.TOTAL**, **HEADING**, **PAN**, **SCROLL**, **VERTICALLY**) are not allowed.

The **LIST.LABEL** and **SORT.LABEL** commands produce a vertical style report set out into the positions of labels on the printed page. The label page shape may be defined by a record in the dictionary of the file or in the VOC file, or it may be entered in response to prompts.

If the command includes the **LABEL** keyword, this may be followed by the name of an X-type label template record stored in the dictionary or in the VOC. This record contains the page shape as a series of lines. Only the leading numeric part of each line is used thus allowing comments to be inserted explaining what each number represents. A typical label might read:

```
1: X
2: 2   Count of labels across the page
3: 8   Count of labels per column
4: 42  Characters per line on each label
5: 7   Lines per label
6: 0   Indentation to first column of leftmost label
7: 6   Horizontal space between labels
8: 3   Lines between labels
9: 1   Omit blanks
```

The final field determines whether blank lines within a label should be omitted. It should be set to 1 to omit or 0 to include such lines.

If no **LABEL** keyword is present in the command line (or any phrase use by the query), the query processor looks for a default label template stored in a record named @LABEL in the dictionary of the file or in the VOC. This action can be suppressed by use of **LABEL NO.DEFAULT** in the command.

If no label template has been specified and either there is no @LABEL record or the **NO.DEFAULT** keyword has been used, the query processor will prompt the user to enter the label shape parameters in the same order as above. The omit blanks option must be entered as Y or N.

It may be necessary to check that a printer font is chosen where the line spacing fits correctly onto the label page. The **SETPTR** command top margin may also need to be set to fit the page.

Example

```
LIST.LABEL CUSTOMERS NAME ADDRESS ID.SUP LABEL ADDR.LABELS
LPTR
```

This command prints address labels from all records in the CUSTOMERS file. Each label contains data from the NAME and ADDRESS fields. A label template named ADDR.LABELS is used.

5.9 REFORMAT

The **REFORMAT** verb constructs a new file from data in the source file. It is of use, for example, when constructing intermediate files in complex reporting processes.

REFORMAT {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*field.name* {*field.qualifier*} ...}
{*selection.clause*}
{*sort.clause*}
{*display.clause*}
{*record.id...*}
{**FROM** *select.list.no*}
{**TO** *new.file.name*}

REFORMAT behaves like **LIST** except that the data identified by the display clause is used to populate a new file instead of being displayed or printed. The first item in the data is used as the record id for the item in the new file. The remaining items form the fields within the record. **REFORMAT** does not automatically prefix the display clause with @ID.

The **TO** clause can be used to name the target file on the command line. If this clause is not present, a prompt is displayed for the file name. The file must already exist.

Example

```
REFORMAT CUSTOMERS ZIP.CODE CUST.NO NAME TO CUST.BY.ZIP
```

This command constructs a new file, CUST.BY.ZIP, keyed by zip code and containing two data fields, the customer number and name. Note that if two or more customers share the same zip code, the record will be overwritten by the second and subsequent items.

5.10 COUNT

The **COUNT** verb reports the number of records meeting specified criteria.

COUNT {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*selection.clause*}
{*record.id...*}
{**FROM** *select.list.no*}

Example

```
COUNT INVOICES WITH NO PAYMENT.DATE
```

This command counts records on the INVOICES file for which the PAYMENT.DATE field is null. This might be a valid means of identifying unpaid invoices.

5.11 SUM

The **SUM** verb reports the total of the values in named fields.

SUM {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
field.name {*field.qualifier*} ...
{*selection.clause*}
{*record.id...*}
{**FROM** *select.list.no*}

Example

```
SUM INVOICES BALANCE WITH NO PAYMENT.DATE
```

This command the BALANCE field of records on the INVOICES file for which the PAYMENT.DATE field is null.

5.12 SHOW

The **SHOW** command provides an interactive means of building select lists.

Format

SHOW {**DICT**} *file.name*
{**USING** {**DICT**} *file.name*}
{*field.name* {*field.qualifier*} ...}
{*selection.clause*}
{*sort.clause*}
{*display.clause*}
{*record.id...*}
{**FROM** *select.list.no*}
{**TO** *select.list.no*}

The **SHOW** command supports two special options:

MAX *n* specifies the maximum number of items that may be selected for the returned list.

MIN *n* specifies the minimum number of items that may be selected for the returned list. Returning no items is always valid regardless of the value of *n*.

Examples

```
SHOW BP
```

Displays a list of records in the BP file from which items may be chosen to build a select list.

```
SHOW CLIENTS COMPANY EVAL "BALANCE - CREDIT" ID.SUP WITH
BALANCE > CREDIT
```

For each client in the CLIENTS file with an outstanding balance greater then their credit limit, display the company name and the calculated amount by which the client has exceeded their credit limit. Display of the CLIENTS file record id is suppressed. The result of the **SHOW** operation becomes the default select list (list 0).

```
SHOW STOCK QTY REORDER.LEVEL TO 3
```

Displays the id, quantity and reorder level fields of each item in the STOCK file. The result of the **SHOW** operation is saved in select list 3.

```
SHOW CLIENTS COMPANY FMT "30T" LAST.CALL CONV "D2/"
```

Shows a list of CLIENTS file ids, the company name formatted to fit a 30 character wide field and the date on which the client was last called using the D2/ conversion for this date.

Using the SHOW Command

The **SHOW** command displays a list of records from the file being processed. This display consists of

A page heading which may be omitted using the **HDR.SUP** keyword. A default page heading is used unless specifically set by use of the **HEADING** keyword. The **SHOW** command does not support use of embedded control codes in page headings.

Column headings which may be omitted using the **COL.SUP** keyword. The heading is taken from the display name field of the dictionary entry for the item in the column. If blank, the field name is used.

Data from records being processed. The items displayed are the record id (unless the **ID.SUP** keyword has been used) and other fields named on the command line.

If the total width of the named fields exceeds the available space, **SHOW** will drop trailing fields until the data fits the display width or only one (plus the record id, if not suppressed) remains. If the data still does not fit after dropping fields, the remaining fields are displayed in reduced space.

The **SHOW** command splits multi-valued items onto successive lines and correctly relates values and subvalues in associated fields. A record is never split between two pages, a new page being started if necessary. If a single record requires more lines than will fit on a screen page, it is truncated.

Each item on the page is numbered for reference in the commands that manipulate the list. The number starts at one for the first item on each page.

A status line showing the number of selected records.

An input line on which commands are entered.

An error line on which error messages and help text appears.

Using the commands listed below, the user can scroll through the displayed records setting or clearing a marker (displayed as an asterisk next to the record number) which indicates whether the record is to be included in the generated select list.

T Move to the top of the list (first page).

N Move to the next page. The return key with no command text has the same effect.

P Move to the previous page.

Q Quit from record selection. Any records marked with an asterisk are entered into the new select list.

QC Quit, clearing any record selection.

R Redisplay the screen. This is useful if a data transmission error causes screen corruption.

^^ Synonym for R.

? Display help text on the error line. Use the return key to walk through this text, line by line. Any key other than the return key will terminate the help display.

S *item* Select *item*. The space before the item description is optional. An asterisk will be displayed next to all selected items.

C *item* Clear *item*, removing the asterisk marker from the screen.

item Synonym for S *item*.

The *item* specification may be

The number shown next to a displayed record.

A range of numbers in the form *a***-***b* which indicates that the command is to be applied to all items from that tagged with number *a* to that tagged with number *b*. There must be no spaces either side of the hyphen.

The keyword **VISIBLE** to apply the command to all items on the current page.

The keyword **ALL** to apply the command to all items in the list.

Multiple item specifications may be included in a single command by using either a space or a comma as a separator. For example "1,4,8-11".

The **VISIBLE** and **ALL** keywords may be abbreviated by omitting any number of trailing letters (e.g. **VIS** or **V**).

5.13 Query processor keywords

Field qualifiers

%	Synonym for PERCENTAGE
AS	Define synonym for field and qualifiers
ASSOC	Include field in association
ASSOC.WITH	Associate two fields
AVERAGE	Report average of field values
AVG	Synonym for AVERAGE
BREAK.ON	Define field as breakpoint control item.
BREAK-ON	Synonym for BREAK.ON
BREAK.SUP	Define field as non-displayed breakpoint control item.
BREAK-SUP	Synonym for BREAK.SUP
CALC	Calculate total of I-type item
CALCULATE	Synonym for CALC
COL.HDG	Set column heading for displayed item
CONV	Specify conversion to be applied to field
CUMULATIVE	Report cumulative value of field
DISPLAY.LIKE	Display field using attributes of another field
DISPLAY.NAME	Synonym for COL.HDG
ENUM	Synonym for ENUMERATE
ENUMERATE	Count number of values in specified field
EVAL	Defines expression to be evaluated
FMT	Specify format for display of field
MAX	Report maximum value of a field
MIN	Report minimum value of a field
MULTI.VALUE	Treat field as multi-valued
MULTIVALUED	Synonym for MULTI.VALUE
NO.NULLS	Suppress null fields in MIN and AVG calculations
PCT	Synonym for PERCENTAGE
PERCENT	Synonym for PERCENTAGE
PERCENTAGE	Report percentages
SINGLE.VALUE	Treat field as single-valued
SINGLEVALUED	Synonym for SINGLE.VALUE
TOTAL	Report total of field values

Selection clause options

FIRST	Synonym for SAMPLE
FROM	Process only records from given select list
REQUIRE.SELECT	Query must have an active select list
SAMPLE	Report only specified number of records
SAMPLED	Report only a sample of records
WHEN	Introduces multi-valued field selection criteria
WITH	Introduces record selection criteria

SEARCH options

ALL.MATCH	Record must contain all given strings
NO.CASE	Case insensitive option for SEARCH
NO.MATCH	Record must contain none of the given strings

Selection clause operators used in WITH constructs

#	Not equal. Synonym for NE
&	Logical AND. Synonym for AND

<	Less than. Synonym for LT
<	Less than or equal to. Synonym for LE
<>	Not equal. Synonym for NE
	Equals. Synonym for EQ
=<	Less than or equal to. Synonym for LE
=>	Greater than or equal to. Synonym for GE
>	Greater than. Synonym for GT
><	Not equal. Synonym for NE
>	Greater than or equal to. Synonym for GE
~	Soundex matching. Synonym for SAID
AFTER	Greater than Synonym for GT
AND	Logical AND
BEFORE	Less than. Synonym for LT
BETWEEN	Closed range test
EQ	Equals
EQUAL	Equals. Synonym for EQ
GE	Greater than or equal to
GREATER	Greater than. Synonym for GT
GT	Greater than
LE	Less than or equal to
LESS	Less than. Synonym for LT
LIKE	Pattern match
LT	Less than
MATCHES	Pattern match. Synonym for LIKE
MATCHING	Pattern match. Synonym for LIKE
NE	Not equal
NO	Test for null field
NOT	Synonym for NE
OR	Logical OR
SAID	Soundex matching
SPOKEN	Soundex matching. Synonym for SAID
UNLIKE	Inverse pattern match. Opposite of LIKE

Sort clause options

BY	Sort by ascending field value order
BY.DSND	Sort by descending field value order
BY-DSND	Synonym for BY.DSND
BY.EXP	Ascending exploded multi-valued sort
BY-EXP	Synonym for BY.EXP
BY.EXP.DSND	Descending exploded multi-valued sort
BY-EXP-DSND	Synonym for BY.EXP.DSND

Display options

BOXED	Generates a boxed report on a PCL printer
CAPTION	Synonym for GRAND.TOTAL
COL.HDG.ID	Use field names as default column headings
COL.HDR.SUPP	Suppress page and column headings
COL.HDR.SUP	Synonym for COL.HDR.SUPP
COL-HDR-SUPP	Synonym for COL.HDR.SUPP
COL-HDR-SUP	Synonym for COL.HDR.SUPP
COL.SPACES	Specifies inter-column spacing
COL.SPCS	Synonym for COL.SPACES
COL.SUP	Suppress column headings
COL-SUPP	Synonym for COL.SUP

COUNT.SUP	Suppress record count message at end of report
CSV	Specifies a comma separated delimited report
DBL.SPC	Output report with double line spacing
DBL-SPC	Synonym for DBL.SPC
DELIMITER	Specifies delimited report
DET.SUP	Suppress detail lines
DET-SUPP	Synonym for DET.SUP
FOOTER	Synonym for FOOTING
FOOTING	Specify page footing
FORCE	Force print of headings in empty report
GRAND.TOTAL	Specify format for totals line
GRAND-TOTAL	Synonym for GRAND.TOTAL
HDR.SUP	Suppress default page heading
HDR-SUPP	Synonym for HDR.SUP
HEADER	Synonym for HEADING
HEADING	Specify page heading
ID.ONLY	Suppress use of @ phrase
ID.SUP	Suppress default inclusion of @ID in report
ID-SUPP	Synonym for ID.SUP
LPTR	Direct report to a printer
MARGIN	Specify width of left margin
NEW.PAGE	Display or print each record on a separate page
NO.PAGE	Suppress pause between displayed pages
NOPAGE	Synonym for NO.PAGE
NO.SPLIT	Avoid splitting a record across pages if possible
ONLY	Synonym for ID.ONLY
OVERLAY	Sets a graphical page overlay
PAN	Pan columns of a wide report
REPEATING	Repeats single valued items or the final value of a multivalued item
SCROLL	Allow scrolling through report pages
STYLE	Sets a report style
SUPP	Synonym for HDR.SUP
VERT	Synonym for VERTICALLY
VERTICALLY	Report in vertical (one field per line) format

SELECT and SSELECT options

NO.NULLS	Ignore null fields with SAVING option
SAVING	Save field value in place of record id
TO	Specifies target select list number
UNIQUE	Omit duplicates with SAVING

Miscellaneous

ABSENT.NULL	Treats an absent record as a null item rather than an error
LABEL	Specifies the label template for LIST.LABEL and SORT.LABEL
LOCKING	Takes a file lock on the file being processed, preventing updates
NO.INDEX	Do not use an alternate key index for record selection
REQUIRE.INDEX	Do not perform the query unless an alternate key index can be used
TO	Specifies the output file name for REFORMAT
TO	Specifies the output pathname for a delimited report
USING	Use an alternative dictionary

5.14 ABSENT.NULL

The **ABSENT.NULL** keyword treats an absent record as a null item rather than an error.

Format

ABSENT.NULL

There are situations where two or more related files share a common record id (or a related id) but some ids may not appear in all of the files. The **ABSENT.NULL** keyword, normally used with a select list, allows reports to be constructed that draw data from the complete set of files, returning a null record for any item that is not present in the main file processed by the query. A dictionary I-type entry can then be used to retrieve data from the related files.

Example

FILE1 contains records 1 and 2. FILE2 contains records 2 and 3.

The dictionary for FILE1 contains an I-type entry, F2REF, that is a simple TRANS() using the record id of FILE1 to access the same record in FILE2, returning data from this file.

```
TRANS(FILE2, @ID, FIELD.NAME, 'X')
```

If we have a select list containing 1, 2 and 3,

```
LIST FILE1 F1 F2REF
```

would report records 1 and 2 but give an error for record 3.

Adding the **ABSENT.NULL** option,

```
LIST FILE1 F1 F2REF ABSENT.NULL
```

will process records 1, 2, and 3 from both files, using a null record for the absent records (3 in FILE1 and 1 in FILE2).

5.15 ALL.MATCH

The **ALL.MATCH** keyword used in a **SEARCH** command specifies that the records to be selected must contain all of the given search strings.

Format

ALL.MATCH

Without this keyword, the **SEARCH** command builds a list of records containing any of the supplied search strings. With **ALL.MATCH**, the records must contain all of the supplied strings.

Example

```
SEARCH BP ALL.MATCH
String: STOCK.FILE
String: STK.F
String:
```

This command builds a list of records in the BP file containing both the given strings.

See also:
NO.CASE, **NO.MATCH**, **SEARCH**

5.16 AND

The **AND** selection clause operator links two selection criteria where both must be true for the record to be selected. The synonym **&** can be used.

Format

WITH *condition.1* **AND** *condition.2*

where

condition.1, *condition.2* are record selection criteria.

The **AND** selection clause operator returns true if both *condition.1* and *condition.2* are true. Alternatively, multiple **WITH** clauses can be used.

The **AND** and **OR** operators are normally of equal priority and will be evaluated strictly left to right. Brackets may need to be used to enforce evaluation in an different order. Thus a query such as

```
LIST CLIENTS WITH REGION = 1 AND VALUE > 1000 OR REGION = 2
AND VALUE > 500
```

may need brackets to achieve the desired effect

```
LIST CLIENTS WITH (REGION = 1 AND VALUE > 1000) OR (REGION = 2
AND VALUE > 500)
```

Pick style multivalue database products give **AND** priority over **OR** such that the above query would not need the brackets. This behaviour can be enabled in QM by use of the QUERY.PRIORITY.AND mode of the **OPTION** command.

Example

```
LIST STOCK WITH QTY GT 100 AND REORDER LT 300
```

This command lists items found on the STOCK file with a QTY field of over 100 and a REORDER field of less than 300.

The same results can be achieved with

```
LIST STOCK WITH QTY GT 100 WITH REORDER LT 300
```

5.17 AS

The **AS** keyword is a field qualifier which defines a synonym for a field and any qualifying information.

Format

field.name {*field.qualifier*} **AS** *synonym*

where

field.name	is the name of the field (D or I-type) or an evaluated expression to be given a synonym.
field.qualifier	is any qualifying information such as **CONV** or **FMT** keywords.
synonym	is the name by which the field and its qualifiers is to be known. This name must not correspond to an existing entry in the file's dictionary or in the VOC.

The **AS** keyword creates a synonym for *field.name* together with any *field.qualifier*. It is normally only used in conjunction with a *field.qualifier* or to name an evaluated expression.

Example

```
LIST INVOICES EVAL "SUM(RECEIVED)" AS AMT BY.DSND AMT
```

This command processes records from the INVOICES file and reports the total of the multi-valued RECEIVED field . The report is displayed in descending order of total received amount. The **AS** keyword is used to give the synonym AMT to the evaluated sum so that it can be referred to again in the sort clause after the **BY.DSND** keyword without full expansion.

See also:
EVAL

5.18 ASSOC

The **ASSOC** keyword is a field qualifier to specify that the field is to be treated as part of a named association.

Format

field.name **ASSOC "***name***"**

where

field.name	is the name of the field (D or I-type) or an evaluated expression to be associated.
name	is the name of the association in which *field.name* is to be included. The name must be quoted to avoid its expansion as a phrase.

The **ASSOC** keyword causes *field.name* to be treated as part of the named association.

Example

```
LIST ORDERS PART.NO QTY EVAL "SELL * QTY" ASSOC LINE.ITEMS
```

This command processes records from the ORDERS file and reports the multi-valued part numbers, quantities and calculated line total value for each record. The evaluated expression is treated as a member of the association LINE.ITEMS to which the other reported fields already belong.

See also:
ASSOC.WITH

5.19 ASSOC.WITH

The **ASSOC.WITH** keyword is a field qualifier to specify that the field is to be associated with some other named field.

Format

field.name **ASSOC.WITH** *name*

where

field.name	is the name of the field (D or I-type) or an evaluated expression to be associated.
name	is the name of the field with which *field.name* is to be associated.

The **ASSOC.WITH** keyword causes *field.name* to be treated as associated with field *name*.

Example

```
LIST ORDERS PART.NO QTY EVAL "SELL * QTY" ASSOC.WITH PART.NO
```

This command processes records from the ORDERS file and reports the multi-valued part numbers, quantities and calculated line total value for each record. The evaluated expression is treated as associated with PART.NO.

See also:
ASSOC

5.20 AVERAGE

The **AVERAGE** field qualifier keyword causes a field to be reported together with its average value. The synonym **AVG** may be used.

Format

AVERAGE *field* {*field.qualifiers*} {**NO.NULLS**}

where

field	is the field or evaluated expression to be displayed.
field.qualifiers	are other field qualifying keywords
NO.NULLS	causes null values to be ignored.

The **AVERAGE** field qualifier keyword is placed before the field name to which it applies and causes the query processor to report the value of the field for each record processed and also to report the average value at the end of the report. Used with breakpoints, the **AVERAGE** keyword will also report the average value of the field at each breakpoint.

If the field is defined as multi-valued, the **AVERAGE** keyword operates on each value in turn.

The **AVERAGE** keyword operates only on numeric data. Non-numeric values are ignored.

The **NO.NULLS** keyword can be used to prevent null values being included in the calculation of the average value.

Example

The sentence

```
LIST INVOICES AVERAGE VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would produce a display such as that below in which the average value of the VALUE field is included at the end of the report.

```
LIST INVOICES AVERAGE VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice   ...Value  Customer...................
74529     £1712.43  J McTavish
74273       £95.23  County Newspapers
63940      £141.00  R Bryant
74993        £9.29  Write Right Stationery
          ========
           £489.49
4 records listed.
```

5.21 BETWEEN

The **BETWEEN** selection clause operator compares a field or evaluated expression against two other fields, evaluated expressions or literal values, testing whether the value of the first item lies between the other two values.

Format

field **BETWEEN** {**NO.CASE**} *value1 value2*

where

field	is the first field or evaluated expression to be compared.
value1	is the low end of the range of values to be selected.
value2	is the high end of the range of values to be selected.

The **BETWEEN** selection clause operator returns true if *field* is greater than or equal to *value1* and less than or equal to *value2*. The optional **NO.CASE** qualifier causes a case insensitive comparison to be applied.

When applied to multivalued fields, the test is applied to each value in turn. Note that the query

```
LIST ORDERS WITH PART.NO BETWEEN 200 299
```

is not the same as

```
LIST ORDERS WITH PART.NO >= 200 AND PART.NO <= 299
```

if PART.NO is a multivalued field. The first query selects only those records which include part numbers in the range 200 to 299. The second query selects those records which include a part number that is greater than or equal to 200 and another part number that is less than or equal to 299.

5.22 BOXED

The **BOXED** display clause option causes the query processor to generate a boxed report. This option is ignored if report destination is not a printer or file set in PCL mode.

Format

BOXED

The **BOXED** option draws a box around the page border as defined by the page width and depth specified in the **SETPTR** command. The effective width of the page is reduced by two characters to ensure that there is a margin between the text and sides of the box.

If the report includes a page heading or footing, these are separated from the body of the report by a horizontal line.

Note: The quality of PCL implementations varies widely and this option may not give the expected results on some printers. It is the application developer's responsibility to ensure that the printed results are acceptable.

5.23 BREAK.ON

The **BREAK.ON** field qualifier keyword causes the query processor to display the named field, generating a breakpoint whenever the field value changes.

Format

BREAK.ON { "*options*" } *field*

where

options	controls the appearance of the breakpoint.
field	is the field name or evaluated expression to be reported.

The **BREAK.ON** keyword appears before the field name and causes the query processor to generate a breakpoint whenever the field value changes. The field is also printed as part of the report. Queries using breakpoints should also sort on the breakpoint field(s).

The action taken at the breakpoint depends on the optional *options* component and whether any field value accumulations (**AVERAGE**, **CALC**, **MAX**, **MIN**, **PERCENTAGE** or **TOTAL**) are in use.

A breakpoint with no *options* and no field accumulations prints a line with two asterisks in the column for the field causing the breakpoint followed by a blank line. If field accumulations are present, subtotals are also printed for each accumulated column. A line of hyphens may appear above the subtotals depending on the use of the U breakpoint control code.

The *options* text will be used in place of the default two asterisks when a breakpoint occurs. This text may also contain control codes enclosed in single quotes. The available control codes are:

B{*n*}	Start a new page, retaining the value of the breakpoint field for inclusion in the page heading/footing by use of the B heading text option. The optional single digit qualifier, *n*, allows collection of values from multiple breakpoints for inclusion in a composite heading. If omitted, the value of *n* defaults to zero. Thus use of B alone is equivalent to use of B0.
D	Omit the subtotal line if there is only one line of detail for this breakpoint.
L	Emit a blank line in place of the breakpoint. Any text in the *options* string will be ignored.
O	Only show the value of the breakpoint field on the first detail line within the breakpoint.
P	Start a new page.
U	If the PICK.BREAKPOINT.U mode of the **OPTION**command is in effect, this mode inserts a line of hyphens above any subtotals, etc. If this option is not in effect, the line of hyphens is produced unless the U mode is used.
V	Print the breakpoint field value in place of the default two asterisks. The V control code can be embedded in text into which the value will be inserted.

Combinations of control codes may be used together.

Pick Syntax

If the PICK.BREAKPOINT mode of the **OPTION** command is in effect, the *options* element of the **BREAK.ON** appears after the *field* rather than before.

Examples

The command

```
LIST SALES BY REGION BREAK.ON REGION SALESMAN TOTAL
ORDER.VALUE
```

might produce a display such as that below.

```
LIST SALES BY REGION BREAK.ON REGION SALESMAN TOTAL
ORDER.VALUE       Page 1
SALES..... REGION  SALESMAN  ORDER VALUE
19887       North   Roberts        279.40
19859       North   Sharp          384.43
19858       North   Sharp          845.50
19845       North   Harris         234.53
            **               -----------
            North                 1743.86

19866       South   Abbott         465.31
19886       South   Abbott         397.23
19830       South   Smith          324.39
            **               -----------
            South                 1186.93

                             ===========
                                  2930.79

7 records listed.
```

For this same data, the command

```
LIST SALES BY REGION BREAK.ON "Total'O'" REGION SALESMAN TOTAL
ORDER.VALUE
```

would produce

```
LIST SALES BY REGION BREAK.ON "Total"O"" REGION SALESMAN TOTAL
ORDER.V  Page 1
SALES..... REGION  SALESMAN  ORDER VALUE
19887       North   Roberts        279.40
19859               Sharp          384.43
19858               Sharp          845.50
19845               Harris         234.53
            Total            -----------
            North                 1743.86

19866               Abbott         465.31
19886               Abbott         397.23
```

```
19830                Smith           324.39
            Total                ------------
            South                 1186.93

                                 ===========
                                  2930.79

7 records listed.
```

See also:
[BREAK.SUP]

5.24 BREAK.SUP

The **BREAK.SUP** field qualifier keyword causes the query processor to generate a breakpoint whenever the field value changes. The field is not displayed in the report.

Format

BREAK.SUP { "*options*" } *field*

where

options controls the appearance of the breakpoint.

field is the field name or evaluated expression to be reported.

The **BREAK.SUP** keyword appears before the field name and causes the query processor to generate a breakpoint whenever the field value changes. Queries using breakpoints should also sort on the breakpoint field(s).

The action taken at the breakpoint depends on the optional *options* component and whether any field value accumulations (**AVERAGE**, **CALC**, **MAX**, **MIN**, **PERCENTAGE** or **TOTAL**) are in use.

A breakpoint with no *options* and no field accumulations prints a line with two asterisks in the column for the field causing the breakpoint followed by a blank line. If field accumulations are present, subtotals are also printed for each accumulated column. A line of hyphens may appear above the subtotals depending on the use of the U breakpoint control code.

The *options* item is as for **BREAK.ON** though the text will never appear and only some control options are of use with **BREAK.SUP**. The useful control codes are:

B{*n*} Start a new page, retaining the value of the breakpoint field for inclusion in the page heading/footing by use of the B heading text option. The optional single digit qualifier, *n*, allows collection of values from multiple breakpoints for inclusion in a composite heading. If omitted, the value of *n* defaults to zero. Thus use of B alone is equivalent to use of B0.

D Omit the subtotal line if there is only one line of detail for this breakpoint.

L Emit a blank line in place of the breakpoint. Any text in the *options* string will be ignored.

P Start a new page.

U If the PICK.BREAKPOINT.U mode of the **OPTION**command is in effect, this mode inserts a line of hyphens above any subtotals, etc. If this option is not in effect, the line of hyphens is produced unless the U mode is used.

Combinations of control codes may be used together.

Pick Syntax

If the PICK.BREAKPOINT mode of the **OPTION** command is in effect, the *options* element of the **BREAK.SUP** appears after the *field* rather than before.

Examples

The command

```
LIST SALES BY REGION BREAK.SUP REGION SALESMAN TOTAL
ORDER.VALUE
```

might produce a display such as that below.

```
LIST SALES BY REGION BREAK.SUP REGION SALESMAN TOTAL
ORDER.VALUE       Page 1
SALES..... SALESMAN  ORDER VALUE
19887       Roberts       279.40
19859       Sharp         384.43
19858       Sharp         845.50
19845       Harris        234.53
                     -----------
                         1743.86

19866       Abbott        465.31
19886       Abbott        397.23
19830       Smith         324.39
                     -----------
                         1186.93

                     ===========
                         2930.79

7 records listed.
```

For this same data, the command

```
LIST SALES BY REGION BREAK.SUP "'B'" REGION SALESMAN TOTAL
ORDER.VALUE HEADING "SALES FOR REGION: 'B'"

would produce

SALES FOR REGION: North
SALES..... SALESMAN  ORDER VALUE
19887       Roberts       279.40
19859       Sharp         384.43
19858       Sharp         845.50
19845       Harris        234.53
                     -----------
                         1743.86
<<page>>
SALES FOR REGION: South
SALES..... SALESMAN  ORDER VALUE
19866       Abbott        465.31
19886       Abbott        397.23
19830       Smith         324.39
                     -----------
```

```
                    1186.93

                ===========
                    2930.79

7 records listed.
```

See also:
BREAK.ON

5.25 BY

The **BY** sort clause keyword causes the query processor to sort records prior to display or when building a select list.

Format

BY *field*

where

field is the field name or evaluated expression to be used to determine the sort order.

The **BY** keyword causes records to be sorted into ascending order of the specified field. The comparison is performed before conversion of the data to its display format. If the display format is left justified, a left justified sort is performed. Conversely, if the display format is right justified, a right justified sort is performed.

If more than one sort clause is present, sort criteria are applied in the order in which they are specified.

The command

```
LIST BOOKS BY @ID
```

is identical to

```
SORT BOOKS
```

Example

The command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID BY VALUE
```

would produce a display such as that below.

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID BY VALUE
Invoice   ...Value   Customer..................
74993        £9.29   Write Right Stationery
74273       £95.23   County Newspapers
63940      £141.00   R Bryant
74529     £1712.43   J McTavish
4 records listed.
```

See also:
BY.DSND, **BY.EXP**, **BY.EXP.DSND**

5.26 BY.DSND

The **BY.DSND** sort clause keyword causes the query processor to sort records prior to display or when building a select list. The synonym **BY-DSND** may be used.

Format

BY.DSND *field*

where

field is the field name or evaluated expression to be used to determine the sort order.

The **BY.DSND** keyword causes records to be sorted into descending order of the specified field. The comparison is performed before conversion of the data to its display format. If the display format is left justified, a left justified sort is performed. Conversely, if the display format is right justified, a right justified sort is performed.

If more than one sort clause is present, sort criteria are applied in the order in which they are specified.

Example

The command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID BY.DSND
VALUE
```

would produce a display such as that below.

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID BY.DSND
VALUE
Invoice   ...Value  Customer...................
74529     £1712.43  J McTavish
63940      £141.00  R Bryant
74273       £95.23  County Newspapers
74993        £9.29  Write Right Stationery
4 records listed.
```

See also:
BY, BY.EXP, BY.EXP.DSND

5.27 BY.EXP

The **BY.EXP** sort clause keyword applied to a multi-valued field causes the query processor to explode the multi-valued items to form separate single valued records and to sort these into ascending order prior to display or when building a select list.

Format

BY.EXP *field*

where

field is the field name or evaluated expression to be used to determine the sort order.

The **BY.EXP** keyword causes records to be sorted into ascending order of the values stored in the specified field. The comparison is performed before conversion of the data to its display format. If the display format is left justified, a left justified sort is performed. Conversely, if the display format is right justified, a right justified sort is performed.

If more than one sort clause is present, sort criteria are applied in the order in which they are specified.

Example

The command

```
LIST ORDERS PART.NO QTY LINE.TOTAL
```

might produce a display such as that below.

```
LIST ORDERS PART.NO QTY PRICE LINE.TOTAL
ORDER    PART   QTY   PRICE   TOTAL.
24842     648     7   10.00    70.00
          216     3    8.00    24.00
24851     107     2   12.50    25.00
24856     319     6    4.50    27.00
          372     1   18.75    18.75
3 records listed.
```

The command

```
LIST ORDERS PART.NO QTY LINE.TOTAL BY.EXP PART.NO
```

applied to the same data would produce the display below.

```
LIST ORDERS PART.NO QTY PRICE LINE.TOTAL
ORDER    PART   QTY   PRICE   TOTAL.
24851     107     2   12.50    25.00
24842     216     3    8.00    24.00
24856     319     6    4.50    27.00
24856     372     1   18.75    18.75
```

```
24842    648     7   10.00    70.00
3 records, 5 values listed.
```

See also:
BY, **BY.DSND**, **BY.EXP.DSND**

5.28 BY.EXP.DSND

The **BY.EXP.DSND** sort clause keyword applied to a multi-valued field causes the query processor to explode the multi-valued items to form separate single valued records and to sort these into descending order prior to display or when building a select list.

Format

BY.EXP.DSND *field*

where

field is the field name or evaluated expression to be used to determine the sort order.

The **BY.EXP.DSND** keyword causes records to be sorted into descending order of the values stored in the specified field. The comparison is performed before conversion of the data to its display format. If the display format is left justified, a left justified sort is performed. Conversely, if the display format is right justified, a right justified sort is performed.

If more than one sort clause is present, sort criteria are applied in the order in which they are specified.

Example

The command

```
LIST ORDERS PART.NO QTY LINE.TOTAL
```

might produce a display such as that below.

```
LIST ORDERS PART.NO QTY PRICE LINE.TOTAL
ORDER    PART   QTY   PRICE   TOTAL.
24842     648     7   10.00    70.00
          216     3    8.00    24.00
24851     107     2   12.50    25.00
24856     319     6    4.50    27.00
          372     1   18.75    18.75
3 records listed.
```

The command

```
LIST ORDERS PART.NO QTY LINE.TOTAL BY.EXP.DSND PART.NO
```

applied to the same data would produce the display below.

```
LIST ORDERS PART.NO QTY PRICE LINE.TOTAL
ORDER    PART   QTY   PRICE   TOTAL.
24842     648     7   10.00    70.00
24856     372     1   18.75    18.75
24856     319     6    4.50    27.00
24842     216     3    8.00    24.00
```

```
24851    107      2   12.50     25.00
3 records, 5 values listed.
```

See also:
BY, **BY.DSND**, **BY.EXP**

5.29 CALC

The **CALC** keyword prefixes an I-type field name or an evaluated expression and causes the calculation to be performed on the total lines using accumulated values from the detail lines.

Format

CALC *field*

where

field is the I-type field or expression for which the calculation is to be performed.

The **CALC** keyword works in conjunction with the I-type **TOTAL()** function. During detail lines, the **TOTAL()** function accumulates values which are then used on the subtotal and grand total lines to calculate the value in the column to which the **CALC** keyword applies.

Example

We have a file which includes a calculated PROFIT item defined as

```
100 * (SELL - COST) / COST
```

The command

```
LIST PARTS AVG COST AVG SELL AVG PROFIT
```

This might produce a report such as that below

```
LIST PARTS AVG COST AVG SELL AVG PROFIT
Part    Cost.     Sell.   Profit%
 101    10.00     13.00     30.00
 102    15.00     18.00     20.00
 103    14.00     17.00     21.43
        =====     =====     =====
        13.00     16.00     23.81
 3 records listed.
```

The average profit figure (23.81) is the average of the figures in the column above it. Perhaps what we really want to show is the percentage profit selling for 16.00 something that cost us 13.00 (the average cost and selling prices). To do this, the PROFIT expression is changed to

```
100 * (TOTAL(SELL) - TOTAL(COST)) / TOTAL(COST)
```

or, more simply,

```
100 * TOTAL(SELL - COST) / TOTAL(COST)
```

The command

```
LIST PARTS AVG COST AVG SELL CALC PROFIT
```

now produces

```
LIST PARTS AVG COST AVG SELL CALC PROFIT
Part   Cost.     Sell.  Profit%
 101   10.00     13.00    30.00
 102   15.00     18.00    20.00
 103   14.00     17.00    21.43
       =====     =====    =====
       13.00     16.00    23.08
3 records listed.
```

5.30 COL.HDG

The **COL.HDG** keyword defines an alternative column heading for reported data.
The synonym **DISPLAY.NAME** may be used.

Format

field **COL.HDG** *text*

where

field	is the field or expression to which the new column heading is to be applied.
text	is the new column heading. This must be enclosed in single or double quotes.

The default column heading for reported data is the display name from the dictionary entry or, for evaluated expressions, the expression. The **COL.HDG** field qualifier can be used to set an alternative column heading.

The *text* may include the control tokens that control how the column heading is displayed. The codes are enclosed in single quotes which implies that a column heading specification that uses the codes must itself be enclosed in double quotes.

'L'	appearing within *text* breaks the heading onto a new line at that point. This is equivalent to use of a value mark in a dictionary heading definition.
'R'	at the start of the heading *text* right aligns the heading.
'X'	at the start of the heading *text* suppresses the dot fillers normally inserted into unused columns of the heading.

If both R and X are to be used, they should be enclosed in a single set of quotes.

Examples

```
LIST INVOICES AMT.DUE COL.HDG "Outstanding" SITE.NAME WITH NO
AMT.RECEIVED
```

This command reports records from the INVOICES file where no payment has been recorded. The AMT.DUE field has the column heading set to "Outstanding".

```
LIST SALES CUST.NO COL.HDG "Client'L'Number" VALUE COL.HDG
"'RX'Value"
```

This command reports records from the SALES file. The heading for the CUST.NO field occupies two lines. The column heading for VALUE is right justified with the normal dot filler suppressed.

5.31 COL.HDG.ID

The **COL.HDG.ID** keyword causes the query processor to use the display clause field names as the default column headings.

Format

COL.HDG.ID

The query processor normally uses the display name entry from the dictionary as the column heading in a report. Use of the **COL.HDG.ID** keyword causes use of the actual field name as the column heading for all fields unless overridden by use of COL.HDG.

Example

The command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would normally produce a display such as

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice   ...Value   Customer..................
74529     £1712.43   J McTavish
74273       £95.23   County Newspapers
63940      £141.00   R Bryant
74993        £9.29   Write Right Stationery
4 records listed.
```

Adding the **COL.HDG.ID** option, the command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID COL.HDG.ID
```

would produce a display such as

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
INVOICE   ...VALUE   CUSTOMER.NAME.............
74529     £1712.43   J McTavish
74273       £95.23   County Newspapers
63940      £141.00   R Bryant
74993        £9.29   Write Right Stationery
4 records listed.
```

5.32 COL.HDR.SUPP

The **COL.HDR.SUPP** display clause keyword suppresses page and column headings. The synonyms **COL-HDR-SUPP**, **COL.HDR.SUP** and **COL-HDR-SUP** can be used.

Format

COL.HDR.SUPP

The **COL.HDR.SUPP** keyword suppresses both the page heading (normally the command that invoked the query processor) and the column headings derived from the dictionary display names or **COL.HDG** keywords.

Example

The command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would normally produce a display such as

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice   ...Value  Customer..................
74529     £1712.43  J McTavish
74273       £95.23  County Newspapers
63940      £141.00  R Bryant
74993        £9.29  Write Right Stationery
4 records listed.
```

Adding the **COL.HDR.SUPP** option, the command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
COL.HDR.SUPP
```

would produce a display such as

```
74529     £1712.43  J McTavish
74273       £95.23  County Newspapers
63940      £141.00  R Bryant
74993        £9.29  Write Right Stationery
4 records listed.
```

5.33 COL.SPACES

The **COL.SPACES** keyword determines the number of spaces inserted between columns of a tabular report. The synonym **COL.SPCS** may be used.

Format

COL.SPACES *n*

where

n is the number of spaces to be used.

Tabular reports are automatically adjusted to fit the available page space. The **COL.SPACES** keyword allows a user specified column spacing to be used.

Example

The command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would produce a display such as that below.

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice   ...Value  Customer...................
74529     £1712.43  J McTavish
74273       £95.23  County Newspapers
63940      £141.00  R Bryant
74993        £9.29  Write Right Stationery
4 records listed.
```

Use of the **COL.SPACES** keyword could modify this to become

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID COL.SPACES
8
Invoice         ...Value        Customer...................
74529           £1712.43        J McTavish
74273             £95.23        County Newspapers
63940            £141.00        R Bryant
74993              £9.29        Write Right Stationery
4 records listed.
```

5.34 CONV

The **CONV** keyword defines an alternative conversion for reported data.

Format

field **CONV** *conv.spec*

where

field	is the field or expression to which the new conversion is to be applied.
conv.spec	is the new conversion specification. This must be enclosed in single or double quotes.

The default conversion for reported data is taken from the dictionary entry for *field* or, for evaluated expressions, the first field referenced in the expression. The **CONV** field qualifier can be used to set an alternative conversion specification.

Example

```
LIST ORDERS ORDER.DATE CONV "DDMY"
```

This command reports records from the ORDERS file where using a non-default conversion specification for the ORDER.DATE field.

5.35 COUNT.SUP

The **COUNT.SUP** display option keyword suppresses display of the number of records listed or selected at the end of the command.

Format

COUNT.SUP

Query processor commands normally displays the number of records listed or selected at the end of the command. The **COUNT.SUP** keyword can be used to suppress this action.

Example

Compare the two commands and their displayed results shown below.

```
SELECT STOCK WITH QTY < REORDER.LEVEL
78 records selected.

SELECT STOCK WITH QTY < REORDER.LEVEL COUNT.SUP
```

The first command shows the normal display of the count of records selected. The second command includes the **COUNT.SUP** keyword to suppress this display.

5.36 COL.SUP

The **COL.SUP** display clause keyword suppresses column headings. The synonym **COL-SUPP** can be used.

Format

COL.SUP

The **COL.SUP** keyword suppresses the column headings derived from the dictionary display names or COL.HDG keywords.

Example

The command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would normally produce a display such as

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice  ...Value  Customer..................
74529    £1712.43  J McTavish
74273      £95.23  County Newspapers
63940     £141.00  R Bryant
74993       £9.29  Write Right Stationery
4 records listed.
```

Adding the **COL.SUP** option, the command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID COL.SUP
```

would produce a display such as

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID COL.SUP
74529    £1712.43  J McTavish
74273      £95.23  County Newspapers
63940     £141.00  R Bryant
74993       £9.29  Write Right Stationery
4 records listed.
```

5.37 CSV

The **CSV** display option keyword specifies that the report should be produced in CSV format.

Format

CSV {*mode*} {"*delimiter*"}

where

mode	is a numeric value specifying the format rules to be applied.
delimiter	is an alternative delimiting character. This may not be a double quote.

The CSV keyword produces a report in CSV (comma separated variable) format as used by many software products. In this format, each item in the report is separated by a comma instead of the usual tabular style of report. QM extends this format by allowing use of an alternative *delimiter* character.

The *mode* option specifies the format rules to be applied. A *mode* value of 1 (the default if no *mode* is given) produces output that conforms to the CSV format specification (RFC 4180). This requires that items containing double quotes or the delimiter character are enclosed in double quotes with embedded double quotes replace by two adjacent double quotes.

A *mode* value of 2 encloses all non-null values in double quotes except for numeric items that do not contain a comma. Embedded double quotes are replaced by two adjacent double quotes.

The *delimiter* may be set to a tab character by use of the special syntax "<TAB>". Other non-printing characters can be specified by use of the ^*nnn* notation where *nnn* is the three digit character number from the ASCII character set.

In normal usage, the page heading and record counts would probably need to be suppressed using the **HDR.SUP** and **COUNT.SUP** keywords. The **COL.SUP** keyword can be used to suppress column headings.

The **TO** keyword can be used to specify the pathname of a file to receive the output. Use of this option implies use of **HDR.SUP** as the output is not paginated.

Example

The command

```
LIST CUSTOMERS NAME TEL HDR.SUP COL.SUP COUNT.SUP CSV
```

would produce a display such as that below.

```
17463,Arkright Tool Hire,01726-48745
56221,"Smith,Price and Samuel", 01876-28414
```

Note how the customer name in the second line has been quoted because it contains a comma.

See also: **DELIMITER**

5.38 CUMULATIVE

The **CUMULATIVE** field qualifier keyword displays the cumulative value of a field.

Format

CUMULATIVE *field* {*field.qualifiers*}

where

field	is the field or evaluated expression to be displayed.
field.qualifiers	are other field qualifying keywords

The **CUMULATIVE** field qualifier keyword is placed before the field name to which it applies and causes the query processor to report the cumulative value of the field. A total line is also produced. Used with breakpoints, the **CUMULATIVE** keyword will also report the total value of the field at each breakpoint.

The **CUMULATIVE** keyword operates only on numeric data. Non-numeric values are ignored.

Example

The command

```
LIST INVOICES TOTAL VALUE CUMULATIVE VALUE CUSTOMER.NAME WITH
NO AMT.PAID
```

would produce a display such as that below in which the total value of the VALUE field is included at the end of the report.

```
LIST INVOICES TOTAL VALUE CUMULATIVE VALUE CUSTOMER.NAME WITH
NO AMT.PAID
Invoice  ...Value  ...Value  Customer..................
74529    £1712.43  £1712.43  J McTavish
74273      £95.23  £1807.66  County Newspapers
63940     £141.00  £1948.66  R Bryant
74993       £9.29  £1957.95  Write Right Stationery
         ========  ========
         £1957.95  £1957.95
4 records listed.
```

5.39 DBL.SPC

The **DBL.SPC** display option keyword causes records in a tabular report to be double spaced. The synonym **DBL-SPC** may be used.

Format

DBL.SPC

The **DBL.SPC** keyword inserts a blank line between each record displayed in a tabular format report. It has no effect in a vertical format report.

Example

The command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would produce a display such as that below.

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice   ...Value  Customer..................
74529     £1712.43  J McTavish
74273       £95.23  County Newspapers
63940      £141.00  R Bryant
74993        £9.29  Write Right Stationery
4 records listed.
```

Using the **DBL.SPC** keyword modifies this report to become

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID DBL.SPC
Invoice   ...Value  Customer..................
74529     £1712.43  J McTavish

74273       £95.23  County Newspapers

63940      £141.00  R Bryant

74993        £9.29  Write Right Stationery

4 records listed.
```

5.40 DELIMITER

The **DELIMITER** display option keyword specifies the separating character(s) to be used in a delimited report.

Format

DELIMITER "*string*"

where

string is the character sequence to be placed between report "columns".

A delimited report displays it output as a series of items separated by the given *string* instead of the usual tabular style of report. The **DELIMITER** keyword causes the query processor to produce this style of report and specifies the separator to be used. The output from a delimited report can, for example, be structured with comma separators, sent to a file using the **LPTR** keyword and then read into applications such as Microsoft Excel.

The *string* may contain tab characters by use of the special syntax "<TAB>". Other non-printing characters can be included by use of the ^*nnn* notation where *nnn* is the three digit character number from the ASCII character set.

In normal usage, the page heading and record counts would probably need to be suppressed using the **HDR.SUP** and **COUNT.SUP** keywords. The **COL.SUP** keyword can be used to suppress column headings.

The **TO** keyword can be used to specify the pathname of a file to receive the output. Use of this option implies use of **HDR.SUP** as the output is not paginated.

Examples

The command

```
LIST INVOICES VALUE CUSTOMER.NAME DELIMITER "," HDR.SUP
COL.SUP COUNT.SUP
```

would produce a display such as that below.

```
74529,£1712.43,J        McTavish
74273,£95.23,County         Newspapers
63940,£141.00,R        Bryant
74993,£9.29,Write        Right        Stationery
```

The command

LIST INVOICES VALUE CUSTOMER.NAME DELIMITER "<tab>" HDR.SUP COUNT.SUP

would produce a display such as that below where the spacing is performed by tab characters.

```
74529        £1712.43    J  McTavish
74273        £95.23       County   Newspapers
```

```
63940          £141.00     R  Bryant
74993            £9.29         Write  Right  Stationery
```

See also: **CSV**

5.41 DET.SUP

The **DET.SUP** keyword (synonym **DET-SUPP**) suppresses reporting of detail lines, leaving only page and column headers, totals, footers and the final record count.

Format

DET.SUP

The **DET.SUP** keyword removes all detail lines from a report. It allows easy reporting of totals without the data that contributed to the totals.

When used with report styles (see the **STYLE** option), subtotal lines will be reported using the detail line style.

Example

The command

```
LIST SALES BY REGION BREAK.ON REGION SALESMAN TOTAL
ORDER.VALUE
```

would produce a display such as that below.

```
LIST SALES BY REGION BREAK.ON REGION SALESMAN TOTAL
ORDER.VALUE         Page 1
SALES..... REGION  SALESMAN  ORDER VALUE
19887        North   Roberts        279.40
19859        North   Sharp          384.43
19858        North   Sharp          845.50
19845        North   Harris         234.53
             **                -----------
             North                 1743.86

19866        South   Abbott         465.31
19886        South   Abbott         397.23
19830        South   Smith          324.39
             **                -----------
             South                 1186.93

                               ===========
                                   2930.79
7 records listed.
```

Adding the **DET.SUP** keyword and omitting the salesman changes this report to be as below.

```
LIST SALES BY REGION BREAK.ON REGION TOTAL ORDER.VALUE DET.SU
Page 1
REGION   ORDER VALUE
North        1743.86
South        1186.93
```

```
          ===========
              2930.79
 7 records listed.
```

5.42 DISPLAY.LIKE

The **DISPLAY.LIKE** keyword is a field qualifier which causes the field to be displayed using the attributes of another field defined in the dictionary.

Format

field.name **DISPLAY.LIKE** *other.field*

where

field.name is the field or an evaluated expression to be displayed.

other.field is the field whose attributes are to be used when *field.name* is displayed.

The **DISPLAY.LIKE** keyword causes the attributes of *other.field* to be used when displaying *field.name*. The attributes are the display name, conversion, format, single / multiple value flag and association. The **COL.HDG**, **CONV**, **FMT**, **SINGLE.VALUE**, **MULTI.VALUE**, **ASSOC** and **ASSOC.WITH** field qualifiers can be used to further modify the attributes.

Example

```
LIST INVOICES EVAL "ISSUE.DATE + 90" DISPLAY.LIKE DUE.DATE
COL.HDG "Reminder date"
```

This command processes records from the INVOICES file and reports the record id (probably the invoice number) and the date 90 days after that stored in the ISSUE.DATE field using the attributes of the DUE.DATE field except for the column heading which is specifically set.

5.43 ENUMERATE

The **ENUMERATE** field qualifier keyword causes a field to be reported together with a count of values. The synonym **ENUM** may be used.

Format

ENUM *field* {*field.qualifiers*} {**NO.NULLS**}

where

field	is the field or evaluated expression to be displayed.
field.qualifiers	are other field qualifying keywords
NO.NULLS	causes null values to be ignored.

The **ENUMERATE** field qualifier keyword is placed before the field name to which it applies and causes the query processor to report the value of the field for each record processed and also to report the number of values at the end of the report. Used with breakpoints, the **ENUMERATE** keyword will also report the number of values at each breakpoint.

If the field is defined as multi-valued, the **ENUMERATE** keyword counts each value.

The **NO.NULLS** keyword can be used to ignore null values.

Example

The command

```
LIST INVOICES ENUMERATE VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would produce a display such as that below in which the number of items in the VALUE field is shown at the end of the report.

```
LIST INVOICES ENUMERATE VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice   ...Value  Customer..................
74529     £1712.43  J McTavish
74273       £95.23  County Newspapers
63940      £141.00  R Bryant
74993        £9.29  Write Right Stationery
          ========
                 4
4 records listed.
```

5.44 EQ

The **EQ** selection clause operator compares a field or evaluated expression against another field, evaluated expression or literal value and tests for the first item being equal to the second. The synonyms **EQUAL** and = can be used.

Format

field **EQ** {**NO.CASE**} *value*

where

field	is the first field or evaluated expression to be compared.
value	is the second field, evaluated expression or literal value to be compared. The optional **NO.CASE** qualifier causes a case insensitive comparison to be applied.

The **EQ** selection clause operator returns true if *field* is equal to *value*.

Example

```
LIST STOCK WITH QTY EQ 100
```

This command lists items found on the STOCK file with a QTY field of 100.

Pick Style Wildcards

If the PICK.WILDCARD option is enabled (see the **OPTION** command) and the *value* item is a literal value, the interpretation is extended to include use of Pick style wildcard characters:

- A [character at the start of the *value* replaces any number of leading characters. It is equivalent to the ... action of the **LIKE** operator.
- A] character at the end of the *value* replaces any number of trailing characters. It is equivalent to the ... action of the **LIKE** operator.
- A ^ character within the *value* replaces a single character. It is equivalent to the 1X action of the **LIKE** operator.

5.45 EVAL

The **EVAL** (or **EVALUATE**) keyword prefixes an expression to be evaluated and used as though it were an I-type defined in the dictionary.

Format

EVAL *expr*

where

expr is the expression. This must be enclosed in single or double quotes.

The **EVAL** keyword prefixes an expression which is handled as a temporary I-type. It may be used as a field for display or in selection or sort clauses.

The *expr* string conforms to the same rules as I-type expressions. It is compiled by the query processor for use within the command being executed but is not saved in the dictionary. Where the value of *expr* is a constant, the expression is evaluated only once and then treated as a literal value.

The default display name used for an **EVAL** expression in the absence of a **COL.HDG** qualifier is the expression itself.

The default display format and conversion are taken from the first field referenced by the expression. If no fields are referenced, the format defaults to 10L with no conversion. Alternative format or conversion may be specified with the **FMT** or **CONV** field qualifiers.

Example

```
LIST INVOICES EVAL "SUM(RECEIVED)"
```

This command processes records from the INVOICES file and reports the record id (probably the invoice number) and the total of the RECEIVED field which is multi-valued to allow for more than one payment against an invoice.

See also:
AS

5.46 FMT

The **FMT** keyword defines an alternative format for reported data.

Format

field **FMT** *fmt.spec*

where

field	is the field or expression to which the new format is to be applied.
fmt.spec	is the new format specification. This must be enclosed in single or double quotes.

The default format for reported data is taken from the dictionary entry for *field* or, for evaluated expressions, the first field referenced in the expression. The **FMT** field qualifier can be used to set an alternative format specification.

Example

```
LIST ORDERS SITE.NAME FMT "32L"
```

This command reports records from the ORDERS file where using a non-default format specification for the SITE.NAME field.

5.47 FOOTING

The **FOOTING** keyword defines a page footing for the report.

Format

FOOTING "*text*"

where

text is the footing text to appear on each page.

A page footing defined with the **FOOTING** keyword will appear at the bottom of each page of the report. The footing text may contain control codes enclosed in single quotes to insert variable data or to alter the appearance of the footing. These control codes are:

B{*n*}	Insert data from the corresponding B control code in a **BREAK.ON** or **BREAK.SUP** option string. The optional single digit qualifier, *n*, defaults to zero if omitted.
C	Centres the current line of the footing text.
D	Inserts the date. The default format is dd mmm yyyy (e.g. 24 Aug 2005) but can be changed using the **DATE.FORMAT** command.
F{*n*}	Inserts the file name in a field of *n* spaces. If *n* is omitted, a variable width is used.
G	Inserts a gap. Spaces are inserted in place of the G control code to expand the text to the width of the output device. If more than one G control code appears in a single line, spaces are distributed as evenly as possible. When a footing line uses both G and C, the footing is considered as a number of elements separated by the G control options. The element that contains the C option will be centered. The items either side of the centered element are processed separately when calculating the number of spaces to be substituted for each G option.
H*n*	Sets horizontal position (column) numbered from one. Use of H with C or with a preceding G token may have undesired results.
I{*n*}	Inserts the record id in a field of *n* spaces. If *n* is omitted, a variable width is used.
L	Inserts a new line at this point in the text.
N	Suppresses pagination of the output to the display.
O	Reverses the elements separated by G tokens in the current line on even numbered pages. This is of use when printing double sided reports.
P{*n*}	Insert page number. The page number is right justified in n spaces, widening the field if necessary. If omitted, n defaults to four.
R{*n*}	Same as I{*n*}.
S{*n*}	Insert page number. The page number is left justified in n spaces, widening the field if necessary. If omitted, n defaults to one.
T	Inserts the time and date in the form hh:mm:ss dd mmm yyyy. The format of the date component can be changed using the **DATE.FORMAT** command.

A single quote may be inserted in the footing by use of two adjacent single quotes in the *text*.

If more than one **FOOTING** definition is given in a single query, the first one is used. This allows a query sentence to include a footing that will override an alternative footing in the default listing phrase.

Example

The command

```
LIST SALES FOOTER "'C'SALES REPORT'LDG'Confidential" HDR.SUP
```

might produce a report such as that below.

```
SALES..... REGION  SALESMAN  ORDER VALUE
19845       North   Harris         234.53
19858       North   Sharp          845.50
19859       North   Sharp          384.43
19887       North   Roberts        279.40
19830       South   Smith          324.39
19886       South   Abbott         397.23
19866       South   Abbott         465.31

7 records listed.


                              SALES REPORT
26 Jun 2000
Confidential
```

5.48 FORCE

The **FORCE** keyword forces output of page headings in an empty report.

Format

FORCE

A query report that finds no records to output normally shows only the zero record count. The **FORCE** option causes the page and column headings to be displayed in this situation.

5.49 FROM

The **FROM** keyword specifies the select list to be used as a source of record ids for processing by the query.

Format

FROM *list.no*

where

list.no is the select list number (0 to 10) to be used.

If the **FROM** keyword is not present, the query processor will automatically use the default list, list 0, if it is active.

Example

```
LIST STOCK FROM 4
```

This command lists items from the STOCK file using select list 4 as the source of record ids to be processed.

5.50 GE

The **GE** selection clause operator compares a field or evaluated expression against another field, evaluated expression or literal value and tests for the first item being greater than or equal to the second. The synonyms >= and => can be used.

Format

field **GE** {**NO.CASE**} *value*

where

field	is the first field or evaluated expression to be compared.
value	is the second field, evaluated expression or literal value to be compared. The optional **NO.CASE** qualifier causes a case insensitive comparison to be applied.

The **GE** selection clause operator returns true if *field* is greater than or equal to *value*.

Example

```
LIST STOCK WITH QTY GE 100
```

This command lists items found on the STOCK file with a QTY field of 100 or over.

5.51 GRAND.TOTAL

The **GRAND.TOTAL** keyword (synonyms **GRAND-TOTAL** and **CAPTION**) specifies text to appear at the left edge of the grand total line when any field accumulations (**AVERAGE**, **ENUMERATE**, **MAX**, **MIN**, **PERCENTAGE** or **TOTAL**) are used.

Format

GRAND.TOTAL "*text***"**

where

text is the text to appear on the grand total line.

The **GRAND.TOTAL** text may include control options enclosed in single quotes. These are:

L Suppress the grand total line completely (see also **NO.GRAND.TOTAL**).

P Print the grand total line on a new page.

The text normally appears on the same line as the row of equals signs (=) that are shown above the total values. The **PICK.GRAND.TOTAL** keyword of the **OPTION** command can be used to move this text down to the line that holds the values.

Example

The command

```
LIST SALES TOTAL ORDER.VALUE GRAND.TOTAL "TOTAL"
```

might produce the report below.

```
LIST SALES TOTAL ORDER.VALUE GRAND.TOTAL "TOTAL"
      Page 1
SALES..... ORDER VALUE
19845            234.53
19858            845.50
19859            384.43
19887            279.40
19830            324.39
19886            397.23
19866            465.31
TOTAL       ===========
                2930.79

7 records listed.
```

See also:
NO.GRAND.TOTAL

5.52 GT

The **GT** selection clause operator compares a field or evaluated expression against another field, evaluated expression or literal value and tests for the first item being greater than the second. The synonyms **AFTER**, **GREATER** and > can be used.

Format

field **GT** {**NO.CASE**} *value*

where

field	is the first field or evaluated expression to be compared.
value	is the second field, evaluated expression or literal value to be compared. The optional **NO.CASE** qualifier causes a case insensitive comparison to be applied.

The **GT** selection clause operator returns true if *field* is greater than *value*.

Example

```
LIST STOCK WITH QTY GT 100
```

This command lists items found on the STOCK file with a QTY field of over 100.

5.53 HDR.SUP

The **HDR.SUP** display clause keyword suppresses the default page heading. The synonyms **HDR-SUPP** and **SUPP** can be used.

Format

HDR.SUP

The **HDR.SUP** keyword suppresses the default page heading (the command that invoked the query processor). Any heading specified by use of the **HEADING** keyword will still be output.

Example

The command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would normally produce a display such as

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice   ...Value   Customer...................
74529     £1712.43   J McTavish
74273       £95.23   County Newspapers
63940      £141.00   R Bryant
74993        £9.29   Write Right Stationery
4 records listed.
```

Adding the **HDR.SUP** option, the command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID HDR.SUP
```

would produce a display such as

```
Invoice   ...Value   Customer...................
74529     £1712.43   J McTavish
74273       £95.23   County Newspapers
63940      £141.00   R Bryant
74993        £9.29   Write Right Stationery
4 records listed.
```

5.54 HEADING

The **HEADING** keyword defines a page heading for the report.

Format

HEADING "*text*"

where

text is the heading text to appear on each page.

A page heading defined with the **HEADING** keyword will appear at the top of each page of the report in place of the default heading. Except when used with the **SHOW** verb, the heading text may contain control codes enclosed in single quotes to insert variable data or to alter the appearance of the heading. These control codes are:

B{*n*} Insert data from the corresponding B control code in a **BREAK.ON** or **BREAK.SUP** option string. The optional single digit qualifier, *n*, defaults to zero if omitted.

C Centres the current line of the heading text.

D Inserts the date. The default format is dd mmm yyyy (e.g. 24 Aug 2005) but can be changed using the **DATE.FORMAT** command.

F{*n*} Inserts the file name in a field of *n* spaces. If *n* is omitted, a variable width is used.

G Inserts a gap. Spaces are inserted in place of the G control code to expand the text to the width of the output device. If more than one G control code appears in a single line, spaces are distributed as evenly as possible.

When a heading line uses both G and C, the heading is considered as a number of elements separated by the G control options. The element that contains the C option will be centered. The items either side of the centered element are processed separately when calculating the number of spaces to be substituted for each G option.

H*n* Sets horizontal position (column) numbered from one. Use of H with C or with a preceding G token may have undesired results.

I{*n*} Inserts the record id in a field of *n* spaces. If *n* is omitted, a variable width is used.

L Inserts a new line at this point in the text.

N Suppresses pagination of the output to the display.

O Reverses the elements separated by G tokens in the current line on even numbered pages. This is of use when printing double sided reports.

P{*n*} Insert page number. The page number is right justified in n spaces, widening the field if necessary. If omitted, n defaults to four.

R{*n*} Same as I{*n*}.

S{*n*} Insert page number. The page number is left justified in n spaces, widening the field if necessary. If omitted, n defaults to one.

T Inserts the time and date in the form hh:mm:ss dd mmm yyyy. The format of the date component can be changed using the **DATE.FORMAT** command.

A single quote may be inserted in the heading by use of two adjacent single quotes in the *text*.

If more than one **HEADING** definition is given in a single query, the first one is used. This allows a query sentence to include a heading that will override an alternative heading in the default listing phrase.

Example

The command

```
LIST SALES HEADER "'C'SALES REPORT'LDG'Confidential" HDR.SUP
```

might produce a report such as that below.

```
                                 SALES REPORT
26 Jun 2000
Confidential SALES..... REGION  SALESMAN  ORDER VALUE
19845        North   Harris         234.53
19858        North   Sharp          845.50
19859        North   Sharp          384.43
19887        North   Roberts        279.40
19830        South   Smith          324.39
19886        South   Abbott         397.23
19866        South   Abbott         465.31

7 records listed.
```

5.55 ID.ONLY

The **ID.ONLY** keyword causes the query processor to ignore the default listing phrase and show only record ids. The synonym **ONLY** may be used.

Format

ID.ONLY

Used with no field names on the command line, the **ID.ONLY** keyword causes the query processor to ignore the default listing phrase (@ or @LPTR) and to show the record its only. If field names are given on the command line this keyword has no effect.

For compatibility with other multivalue products, the **ID.ONLY** keyword may appear before the file name in a query processor sentence. For example:

```
LIST ID.ONLY ORDERS
```

5.56 ID.SUP

The **ID.SUP** display option keyword causes the record id to be omitted from the report. The synonym **ID-SUPP** may be used.

Format

ID.SUP

The record id is normally included automatically as the first item in a **LIST** or **SORT** report. The **ID.SUP** keyword can be used to suppress this item either where it is not required or where it is named explicitly in the command so that, for example, non-standard display attributes can be used

Example

The command

```
LIST STOCK DESCRIPTION QTY WITH QTY < REORDER.LEVEL
```

might produce a report such as

```
LIST STOCK DESCRIPTION QTY WITH QTY < REORDER.LEVEL
Item code  Description..............  Stock
A17439     A4 four hole binder, black    12
A50993     Adhesive tape, 25mm x 30m      3
D94266     Fibre pens, 10 pack, blue      6
3 records listed.
```

including the **ID.SUP** keyword would change this to become

```
LIST STOCK DESCRIPTION QTY WITH QTY < REORDER.LEVEL ID.SUP
Description..............  Stock
A4 four hole binder, black    12
Adhesive tape, 25mm x 30m      3
Fibre pens, 10 pack, blue      6
3 records listed.
```

5.57 LABEL

The **LABEL** keyword specifies the label template record name for **LIST.LABEL** and **SORT.LABEL**.

Format

LABEL *template.name*

LABEL NO.DEFAULT

The first format of the **LABEL** keyword specifies the name of a label template record stored in the dictionary of the file being processed or in the VOC.

The second format specifies that the default @LABEL record is not to be used. The query processor will then prompt for the label page shape parameters.

5.58 LE

The **LE** selection clause operator compares a field or evaluated expression against another field, evaluated expression or literal value and tests for the first item being less than or equal to the second. The synonyms <= and =< can be used.

Format

field **LE** {**NO.CASE**} *value*

where

field is the first field or evaluated expression to be compared.

value is the second field, evaluated expression or literal value to be compared. The optional **NO.CASE** qualifier causes a case insensitive comparison to be applied.

The **LE** selection clause operator returns true if *field* is less than or equal to *value*.

Example

```
LIST STOCK WITH QTY LE 100
```

This command lists items found on the STOCK file with a QTY field of 100 or less.

5.59 LIKE

The **LIKE** selection clause operator compares a field or evaluated expression against another field, evaluated expression or literal value and tests for the first item matching the pattern template given by the second. The synonyms **LIKE**, **MATCHES** and **MATCHING** can be used.

Format

field **LIKE** {**NO.CASE**} *template*

where

field	is the first field or evaluated expression to be compared.
template	is the field, evaluated expression or literal value representing the pattern against which *field* is to be compared. The optional **NO.CASE** qualifier causes a case insensitive comparison to be applied.

The **LIKE** selection clause operator returns true if *field* matches *template*.

The **LIKE** operator treats characters that do not correspond to any valid component of a pattern as literal values which must be matched exactly. Thus it is possible to find all the **QMBasic** include records (which have a suffix of .H) in the BP file by a command of the form

```
SELECT BP WITH @ID LIKE ....H
```

The initial three dots are a valid template component. The remaining two characters are not and are hence treated as literals. It would be better to enter this as

```
SELECT BP WITH @ID LIKE "...'.H'"
```

to avoid confusion. In some cases quotes must be used to handle literal values which are also valid components of a pattern template.

Example

```
LIST STOCK WITH PRODUCT.CODE LIKE A...
```

This command lists items found on the STOCK file with a PRODUCT.CODE starting with A.

See also:
Pattern Matching

5.60 LOCKING

The **LOCKING** keyword locks the file during a report, preventing updates.

Format

LOCKING

The **LOCKING** keyword causes the query processor to take a file lock on the file named in the query sentence. This prevents any other process from modifying the file during the report, ensuring that the report reflects a snap shot view of the data at the point when the query began.

Files accessed using the **TRANS()** function in I-type dictionary records or using the T conversion code will not be locked and hence may be modified during the report.

It is the user's responsibility to ensure that use of the lock in lengthy reports does not cause operational problems. In particular, be aware that a user who leaves a query on a "Press return to continue" prompt may severely affect the ability of other users to access the file.

5.61 LPTR

The **LPTR** keyword directs the output of the query to a printer.

Format

LPTR { *unit* }

where

unit is the print unit number. If omitted, print unit 0 is used.

The **LPTR** keyword directs the query processor output to the specified print unit. It also changes the way in which the default listing phrase operates. With this option, if no report fields are specified on the command line, the query processor first looks for a phrase named @LPTR and then, if this does not exist, it reverts to the @ phrase. This allows different default report formats for the printer and the display.

5.62 LT

The **LT** selection clause operator compares a field or evaluated expression against another field, evaluated expression or literal value and tests for the first item being less than the second. The synonyms **BEFORE**, **LESS** and < can be used.

Format

field **LT** {**NO.CASE**} *value*

where

field is the first field or evaluated expression to be compared.

value is the second field, evaluated expression or literal value to be compared. The optional **NO.CASE** qualifier causes a case insensitive comparison to be applied.

The **LT** selection clause operator returns true if *field* is less than *value*.

Example

```
LIST STOCK WITH QTY LT 100
```

This command lists items found on the STOCK file with a QTY field of less than 100.

5.63 MARGIN

The **MARGIN** keyword specifies the width of a blank left margin to appear in the report output.

Format

MARGIN *width*

where

width specifies the margin width in characters.

The **MARGIN** keyword allows a blank left margin to be produced at the edge of the report. It is intended for use when the printed report is to be bound and thus requires clear space at the left edge.

5.64 MAX

The **MAX** field qualifier keyword causes a field to be reported together with its maximum value.

Format

MAX *field* {*field.qualifiers*}

where

field	is the field or evaluated expression to be displayed.
field.qualifiers	are other field qualifying keywords

The **MAX** field qualifier keyword is placed before the field name to which it applies and causes the query processor to report the value of the field for each record processed and also to report the maximum value at the end of the report. Used with breakpoints, the **MAX** keyword will also report the maximum value of the field at each breakpoint.

If the field is defined as multi-valued, the **MAX** keyword operates on each value in turn.

The **MAX** keyword operates on all types of data. Where the field holds non-numeric data, a string comparison is performed.

Used with the **SHOW** verb, the **MAX** keyword specifies the maximum number of records allowed in the resultant select list.

Example

The command

```
LIST INVOICES MAX VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would produce a display such as that below in which the maximum value of the VALUE field is repeated at the end of the report.

```
LIST INVOICES MAX VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice   ...Value   Customer...................
74529     £1712.43  J McTavish
74273       £95.23  County Newspapers
63940      £141.00  R Bryant
74993        £9.29  Write Right Stationery
          ========
          £1712.43
4 records listed.
```

5.65 MIN

The **MIN** field qualifier keyword causes a field to be reported together with its minimum value.

Format

MIN *field* {*field.qualifiers*} {**NO.NULLS**}

where

field	is the field or evaluated expression to be displayed.
field.qualifiers	are other field qualifying keywords
NO.NULLS	causes null values to be ignored.

The **MIN** field qualifier keyword is placed before the field name to which it applies and causes the query processor to report the value of the field for each record processed and also to report the minimum value at the end of the report. Used with breakpoints, the **MIN** keyword will also report the minimum value of the field at each breakpoint.

If the field is defined as multi-valued, the **MIN** keyword operates on each value in turn.

The **MIN** keyword operates on all types of data. Where the field holds non-numeric data, a string comparison is performed.

The **NO.NULLS** keyword can be used to prevent null values being included in the test for the minimum value.

Used with the **SHOW** verb, the **MIN** keyword specifies the minimum number of records allowed in the resultant select list.

Example

The command

```
LIST INVOICES MIN VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would produce a display such as that below in which the minimum value of the VALUE field is repeated at the end of the report.

```
LIST INVOICES MIN VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice   ...Value  Customer..................
74529     £1712.43  J McTavish
74273       £95.23  County Newspapers
63940      £141.00  R Bryant
74993        £9.29  Write Right Stationery
          ========
             £9.29
```

```
4 records listed.
```

5.66 MULTI.VALUE

The **MULTI.VALUE** keyword is a field qualifier that forces the field to be processed as a multi-valued item. The synonym **MULTIVALUED** can be used.

Format

field **MULTI.VALUE**

where

field is the field or expression which is to be treated as multi-valued.

The query processor verbs normally use the dictionary to determine whether a field should be treated as single or multi-valued. The **MULTI.VALUE** field qualifier forces the field to be processed as a multi-valued item regardless of the dictionary definition. It is normally only used with an **EVAL** expression.

See also:
SINGLE.VALUE

5.67 NE

The **NE** selection clause operator compares a field or evaluated expression against another field, evaluated expression or literal value and tests for the first item being not equal to the second. The synonyms **NOT**, #, <> and >< can be used.

Format

field **NE** {**NO.CASE**} *value*

where

field	is the first field or evaluated expression to be compared.
value	is the second field, evaluated expression or literal value to be compared. The optional **NO.CASE** qualifier causes a case insensitive comparison to be applied.

The **NE** selection clause operator returns true if *field* is not equal to *value*.

Example

```
LIST STOCK WITH QTY NE 0
```

This command lists items found on the STOCK file with a non-zero QTY.

Pick Style Wildcards

If the PICK.WILDCARD option is enabled (see the **OPTION** command) and the *value* item is a literal value, the interpretation is extended to include use of Pick style wildcard characters:

- A [character at the start of the *value* replaces any number of leading characters. It is equivalent to the ... action of the **UNLIKE** operator.
- A] character at the end of the *value* replaces any number of trailing characters. It is equivalent to the ... action of the **UNLIKE** operator.
- A ^ character within the *value* replaces a single character. It is equivalent to the 1X action of the **UNLIKE** operator.

5.68 NEW.PAGE

The **NEW.PAGE** display option keyword causes each record in a report to start on a new page.

Format

NEW.PAGE

5.69 NO

The **NO** selection clause operator tests whether a field or evaluated expression is null.

Format

WITH NO *field*

where

field is the field or evaluated expression to be tested.

The **NO** selection clause operator returns true if *field* is null.

Example

```
LIST STOCK WITH NO SUPPLIER.CODE
```

This command lists items found on the STOCK file with a null SUPPLIER.CODE.

5.70 NO.CASE

The **NO.CASE** keyword used in the **SEARCH** verb specifies that the string comparison is to be performed in a case insensitive manner.

Format

NO.CASE

The **SEARCH** verb is normally case sensitive in its comparison of the given search strings. The **NO.CASE** option performs a case insensitive comparison.

The **NO.CASE** keyword can also be used as a qualifier with relational operators in the selection clause.

See also:
ALL.MATCH, **NO.MATCH**, **SEARCH**

5.71 NO.GRAND.TOTAL

The **NO.GRAND.TOTAL** phrase suppresses the grand total in a query report.

Format

NO.GRAND.TOTAL

The **NO.GRAND.TOTAL** phrase suppresses the grand total line. It is only of use when the query includes breakpoints that produce subtotals.

Example

```
LIST ORDERS BY CUST.NO BREAK.ON CUST.NO TOTAL ORDER.VALUE
NO.GRAND.TOTAL
```

This is equivalent to

```
LIST ORDERS BY CUST.NO BREAK.ON CUST.NO TOTAL ORDER.VALUE
GRAND.TOTAL "'L'"
```

See also:
GRAND.TOTAL

5.72 NO.INDEX

The **NO.INDEX** keyword causes the query processor to ignore any index that would otherwise be used to handle the selection clause of the query.

Format

NO.INDEX

Use of the **NO.INDEX** keyword may result in faster query processing where the selection clause includes a large proportion of the records in the file.

5.73 NO.MATCH

The **NO.MATCH** keyword used in a **SEARCH** command specifies that the records to be selected must contain none of the given search strings.

Format

NO.MATCH

Without this keyword, the **SEARCH** command builds a list of records containing any of the supplied search strings. With **NO.MATCH**, the records must contain none of the supplied strings.

Example

```
SEARCH BP NONE.MATCH
String: STOCK.FILE
String: STK.F
String:
```

This command builds a list of records in the BP file containing neither of the given strings.

See also:
ALL.MATCH, **NO.CASE**, **SEARCH**

5.74 NO.NULLS

The **NO.NULLS** keyword suppresses null items.

Format

NO.NULLS

The **NO.NULLS** keyword has three uses:

1. With the query processor **AVERAGE**, **ENUMERATE** and **MIN** keywords, this keyword suppresses use of null values when calculating averages, enumerations or minimum values.

2. With the query processor **SAVING** keyword, this keyword omits null field values from the generated select list.

3. With the **CREATE.INDEX** command, it omit records with null field values from the index.

5.75 NO.PAGE

The **NO.PAGE** display option keyword suppresses the normal page end prompt. The synonym **NOPAGE** may be used.

Format

NO.PAGE

The **LIST** and **SORT** commands normally pause at the end of each page when output is directed to the display. The **NO.PAGE** keyword suppresses this page end prompt.

5.76 NO.SPLIT

The **NO.SPLIT** keyword causes the query processor to avoid splitting records across pages where possible.

Format

NO.SPLIT

The **NO.SPLIT** causes the query processor to start a new page when there is insufficient space on the current page for the record about to be reported.

5.77 OR

The **OR** selection clause operator links two selection criteria where either may be true for the record to be selected.

Format

WITH *condition.1* **OR** *condition.2*

where

condition.1, *condition.2* are record selection criteria.

The **OR** selection clause operator returns true if either or both of *condition.1* and *condition.2* are true.

The **AND** and **OR** operators are normally of equal priority and will be evaluated strictly left to right. Brackets may need to be used to enforce evaluation in an different order. Thus a query such as

```
LIST CLIENTS WITH REGION = 1 AND VALUE > 1000 OR REGION = 2
AND VALUE > 500
```

may need brackets to achieve the desired effect

```
LIST CLIENTS WITH (REGION = 1 AND VALUE > 1000) OR (REGION = 2
AND VALUE > 500)
```

Pick style multivalue database products give **AND** priority over **OR** such that the above query would not need the brackets. This behaviour can be enabled in QM by use of the QUERY.PRIORITY.AND mode of the **OPTION** command.

Example

```
LIST STOCK WITH QTY GT 100 OR REORDER LT 300
```

This command lists items found on the STOCK file with a QTY field of over 100 or a REORDER field of less than 300.

5.78 OVERLAY

The **OVERLAY** option specifies a catalogued subroutine to emit a graphical page overlay.

Format

OVERLAY *subr.name*

where

subr.name is the name of a catalogued subroutine.

The **OVERLAY** option allows a report to include a graphical overlay to draw a form on each page of a report directed to a printer or a file. This is equivalent to use of the OVERLAY option of the **SETPTR** command except that it applies only to the one report.

The *subr.name* qualifier is the name of a catalogued subroutine that will emit the page overlay. This subroutine takes a single argument, the print unit number, and should not perform any other action.

Example

```
LIST ORDERS OVERLAY ORD.OV LPTR
```

This command lists the ORDERS file, overlaying each page with a graphical image generated by the ORD.OV subroutine.

5.79 PAGESEQ

The **PAGESEQ** option identifies a record that controls page numbering.

Format

PAGESEQ *filename id*

where

filename	is the name of the file containing the control record.
id	is the record id of the control record.

The **PAGESEQ** option provides a way in which successive uses of the same report can produce sequentially numbered pages allowing, for example, separate monthly business reports to be assembled into a single item. The option is ignored for reports directed to the screen.

The **PAGESEQ** option specifies the name of a file and a record within that file. This record should contain a single field which holds the page number to be applied to the first page of the report. The query processor will retain a lock on this record for the duration of the query and will update it on completion to contain a value one greater than the number of the final page in the report.

If the control record does not exist, a default page number of 1 is used for the first page and the record will be created when the query terminates.

Example

The command

```
LIST MONTHLY.INVOICES PAGESEQ SEQFILE INV LPTR
```

would produce a report of the MONTHLY.INVOICES file, using the value in SEQFILE INV as the start page number and updating this value on completion of the report.

5.80 PAN

The **PAN** keyword, used in reports directed to the display, permits the total width of the report to exceed that of the display by allowing the user to pan columns.

Format

PAN

The **PAN** keyword causes the query processor to buffer the report page and allows the user to pan columns using the left and right cursor key. The panning operation never displays only part of a column.

The **PAN** keyword operates differently depending on where it is placed in the query sentence. If it appears before or after all the displayed fields, the entire display is panned. If it appears between displayed fields, only those fields following the keyword are panned; the remaining fields being locked in position.

The L and R keys or Ctrl-B and Ctrl-F can be used in place of the cursor keys.

5.81 PERCENTAGE

The **PERCENTAGE** field qualifier keyword causes a field to be reported as a percentage of the total of the value of the field in all selected records.

Format

PERCENTAGE {*dp*} *field* {*field.qualifiers*}

where

dp is the number of decimal places to be displayed. This defaults to zero if omitted.

field is the field or evaluated expression to be displayed.

field.qualifiers are other field qualifying keywords

The **PERCENTAGE** field qualifier keyword is placed before the field name to which it applies and causes the query processor to report the value of the field for each record processed as a percentage of the total value of the field in all selected records. The total percentage (always 100 unless the data has changed during the query) is shown at the end of the report. Used with breakpoints, the **PERCENTAGE** keyword will also report the percentage value at each breakpoint.

If the field is defined as multi-valued, the **PERCENTAGE** keyword operates on each value in turn.

The **PERCENTAGE** keyword operates only on numeric data. Non-numeric values are treated as zero.

Example

The command

```
LIST INVOICES TOTAL VALUE PCT VALUE CUSTOMER.NAME WITH NO
AMT.PAID
```

would produce a display such as that below.

```
LIST INVOICES TOTAL VALUE PCT VALUE CUSTOMER.NAME WITH NO
AMT.PAID
Invoice  ...Value  Value  Customer..................
74529    £1712.43     87  J McTavish
74273      £95.23      5  County Newspapers
63940     £141.00      7  R Bryant
74993       £9.29      1  Write Right Stationery
         ========  =====
         £1957.95    100

4 records listed.
```

5.82 REQUIRE.INDEX

The **REQUIRE.INDEX** keyword causes the query processor to terminate the query unless it can make use of an alternate key index.

Format

REQUIRE.INDEX

Use of the **REQUIRE.INDEX** keyword can help determine whether a query has been phrased in a manner that can make use of an alternate key index.

5.83 REQUIRE.SELECT

The **REQUIRE.SELECT** keyword indicates that the query should only proceed if there is an active select list.

Format

REQUIRE.SELECT

The **REQUIRE.SELECT** keyword is useful in automated queries from paragraphs, etc. where a preceding **SELECT** might have found no items and hence not left an active list. The following query would therefore process all records instead of none.

If no select list is active when a query using this keyword is initiated, an error message is displayed.

Example

```
SELECT ORDERS WITH VALUE > 1000 SAVING UNIQUE CUST.NO
0 records selected to list 0
LIST CUSTOMERS REQUIRE.SELECT
Select list required - Processing terminated
```

The above sequence shows how the **REQUIRE.SELECT** keyword causes the query processor to terminate the **LIST** operation when no records were found matching the selection criteria. Without this keyword, the **LIST** would have reported all the customers.

5.84 REPEATING

The **REPEATING** keyword causes the query processor to repeat single valued data against further values in other fields.

Format

REPEATING

In a report that includes multivalued fields, the value of any single valued items normally only appears once. The **REPEATING** keyword duplicates the single valued items against each multivalued element of other fields.

The decision as to whether an item is single or multivalued is based on the S/M flag in the D/I-type dictionary definition or use of the equivalent field qualifiers, not by whether the data includes value marks. This is to ensure that a multivalued field with only a single entry does not get repeated.

Pick style A/S-type dictionary items are always treated as multivalued.

Example

A file containing a multivalued list of order numbers corresponding to each customer might produce a report that includes the following section:

```
LIST CUST.SALES ORDER.NO HDR.SUP

Customer    Order No
1447        10045
1587        10051
            10059
```

Using the **REPEATING** keyword changes this to:

```
LIST CUST.SALES ORDER.NO HDR.SUP REPEATING

Customer    Order No
1447        10045
1587        10051
1587        10059
```

5.85 SAID

The **SAID** selection clause operator compares a field or evaluated expression against another field, evaluated expression or literal value and tests for the first item having the Soundex phonetic code given by the second. The synonyms **SPOKEN** and ~ can be used.

Format

field **SAID** *value*

where

field is the first field or evaluated expression to be compared.

value is the second field, evaluated expression or literal value to be compared.

The **SAID** selection clause operator returns true if the Soundex phonetic code for *field* is *value*.

The Soundex phonetic code for a word is made up from the first letter of the word in upper case followed by three digits which are found by examination of further characters of the word according to the following table.

0 A E H I O U W Y
1 B F P V
2 C G J K Q S X Z
3 D T
4 L
5 M N
6 R

Other letters are ignored. Consecutive letters that result in the same value result in only a single character. If the result is less than four characters long, zeros are added to fill the remaining positions. Thus the word SOUNDEX encodes to S532.

Example

```
LIST STAFF WITH SURNAME SAID EVAL "SOUNDEX('REED')"
```

This command names in the STAFF file that sound like Reed (Read, Reid, etc).

5.86 SAMPLE

The **SAMPLE** selection clause keyword causes only a limited number of records to be selected or displayed. The synonym **FIRST** can be used in place of **SAMPLE**.

Format

SAMPLE {*n*}

where

n is the number of records to be processed. If *n* is omitted, this defaults to 10.

The **SAMPLE** keyword causes selection or listing of records to terminate after the given number of records have been found. Sampling occurs after selection criteria but before sorting. Thus it cannot be used to show, for example, only the first three records in sorted order of the whole file.

Example

```
LIST STOCK WITH QTY > 100 SAMPLE 5
```

This command lists the first 5 items found on the STOCK file with a QTY field of over 100.

5.87 SAMPLED

The **SAMPLED** selection clause keyword causes only a proportion of records to be selected or displayed.

Format

SAMPLED {*n*}

where

n is the sample interval. If *n* is omitted, this defaults to 10.

The **SAMPLED** keyword causes only every *n*'th record meeting the selection criteria (if any) to be selected or listed.

Example

```
LIST STOCK WITH QTY > 100 SAMPLED 5
```

This command lists every fifth item found on the STOCK file with a QTY field of over 100.

5.88 SAVING { UNIQUE}

The **SAVING** clause can be used in a SELECT or SSELECT command to save the content of a field in place of the record id.

Format

SAVING {**UNIQUE**} {**MULTI.VALUE**} *field.name* {**NO.NULLS**}

where

UNIQUE	specifies that duplicate values are not to be repeated in the saved list.
MULTI.VALUE	specifies that values and subvalues in the field are to be saved as separate list entries.
field.name	is the field or evaluated expression to be saved.
NO.NULLS	causes null values to be omitted from the saved list.

The **SAVING** clause changes the action of SELECT or SSELECT to save the content of a field (D or I-type) or evaluated expression into the target select list in place of the record id. It is normally used to saved fields which are ids of records in some other file.

Use of the **UNIQUE** keyword suppresses multiple inclusion of the same field value in the list.

For compatibility with other products, the **SAVING** clause normally treats value marks and subvalue marks as part of the data without applying any special meaning. Use of the **MULTI.VALUE** keyword causes each value or subvalue to be inserted in the list as a separate entry.

Example

```
SELECT INVOICES SAVING UNIQUE SITE.REF
```

This command creates a save list of all the site references appearing in the invoices file. The **UNIQUE** keyword ensures that site references only appear once regardless of the number of invoices that refer to them.

5.89 SCROLL

The **SCROLL** keyword used in a report directed to the display enables scrolling back through report pages.

Format

SCROLL { *pages* }

where

pages	This value is ignored but is preserved in the command syntax for backward comaptibility.

Use of the **SCROLL** keyword allows paging back through a displayed report. The following options are available at the end of page prompt:

A	Abort. The query is terminated, returning to the command prompt. The ON.ABORT paragraph will be executed, if it exists.
Q	Quit. The query is terminated, returning to the menu or paragraph from which the query was initiated or to the command prompt.
N	Next. The next page of the report is shown. The cursor down key or ctrl-N can also be used.
P	Previous. The previous page of the report is shown. The cursor up key, ctrl-P or ctrl-Z can also be used.
n	Page number. The specified page number is shown.
C	Continue. Used when the display is showing a saved page, this continues with the first unseen page.
S	Suppress pagination. The query continues with no further screen pagination.

5.90 SINGLE.VALUE

The **SINGLE.VALUE** keyword is a field qualifier that forces the field to be processed as a single-valued item.

Format

field **SINGLE.VALUE**

where

field is the field or expression which is to be treated as single-valued.

The query processor verbs normally use the dictionary to determine whether a field should be treated as single or multi-valued. The **SINGLE.VALUE** field qualifier forces the field to be processed as a single-valued item regardless of the dictionary definition. It is normally only used with an **EVAL** expression.

See also:
MULTI.VALUE

5.91 STYLE

The **STYLE** keyword selects the report style to be used, overriding any style selected using the **REPORT.STYLE** or **SETPTR** commands or the QMBasic **SETPU** statement.

Format

STYLE *name*

where

name is the name of a VOC style record. Use of **STYLE NONE** will disable use of any style selected using the **REPORT.STYLE** or **SETPTR** commands or the QMBasic **SETPU** statement.

Each line of a report falls into one of the following classifications: Heading, Column heading, Detail, Subtotal, Total, Footing, Other. Report styles allow users to attribute each of these classifications a colour for a displayed report or a font weight for a report directed to a PCL printer. An additional style, Exit, is used to determine how the screen is left on exit from the query processor. If this is absent, the query processor sends the terminfo sgr0 code to turn off all display attributes.

Report styles are defined using an X-type VOC record where fields 2 onwards consist of a line classification, foreground colour, background colour and font weight in the form:

Heading=Bright blue,Black,Bold

Only the first character of the line classification name is used. Thus the above line could be written as

H=Bright blue,Black,Bold

The colour names are taken from the following list:
Black, Blue, Green, Cyan, Red, Magenta, Brown, White, Grey, Bright Blue, Bright Green, Bright Cyan, Bright Red, Bright Magenta, Yellow, Bright White

Any non-alphabetic characters are ignored. Thus Bright Green can also be written as, for example, Bright.Green, Bright-Green or BrightGreen. Numeric colour values of 0 to 15 can be used where these correspond to the order of the colour names above.

Note that the colour palette used by AccuTerm may need to be amended from its default settings to improve the rendering of the non-bright colours.

Font weights are taken from the list defined in SYSCOM $PCLDATA which defaults to:
Ultra-Thin, Extra-Thin, Thin, Extra-Light, Light, Demi-Light, Semi-Light, Medium, Semi-Bold, Demi-Bold, Bold, Extra-Bold, Black, Extra-Black, Ultra-Black

Any non-alphabetic characters are ignored in the same way as for colour names Numeric font weight values in the range -7 to +7 can be used where these correspond to the order of the font weight names above.

All components of a style definition are case insensitive.

Any classification not defined in the style record, or any omitted component within a classification, takes on the values of the Other classification which itself defaults to White foreground, Black background, Medium font weight if not defined.

When the **DET.SUP** keyword is used, subtotals are reported using the detail line style.

Example

```
X
H=Bright  Blue,,Bold
S=Blue
T=Bright  Red,,Bold
```

See also:
REPORT.STYLE

5.92 TO (Selection verbs)

The **TO** keyword used in a **SELECT**, **SSELECT** or **SEARCH** command specifies the select list to be created.

Format

TO *list.no*

where

list.no is the select list number (0 to 10) to be created.

If the **TO** keyword is not present, the default list, list 0, will be created.

Example

```
SELECT STOCK WITH COST > 100 TO 4
```

This command builds a list of records in the STOCK file with the COST field greater than 100, placing the resultant record ids in select list 4.

5.93 TO (REFORMAT)

The **TO** keyword used in a **REFORMAT** command specifies the name of the output file.

Format

TO *new.file.name*

where

new.file.name is the name of an existing file into which the **REFORMAT** output is to be written.

If the **TO** keyword is not present, the **REFORMAT** command prompts for the file name.

Example

```
REFORMAT CUSTOMERS ZIP.CODE CUST.NO.NAME TO CUST.BY.ZIP
```

This command constructs a new file, CUST.BY.ZIP, keyed by zip code and containing two data fields, the customer number and name. Note that if two or more customers share the same zip code, the record will be overwritten by the second and subsequent items.

5.94 TO (Delimited reports)

The **TO** keyword used in a **LIST** or **SORT** command with the **CSV** or **DELIMITER** options specifies the pathname of the output file.

Format

TO *pathname* {**NO.QUERY** | **APPENDING**}

where

pathname is the pathname of the file to receive the output.

The **CSV** and **DELIMITER** options of the query processor create a delimited format report which is normally directed to the screen or, by use of the **LPTR** keyword, to a print unit. The **TO** option can be used to direct the output to the file identified by *pathname*.

If the target *pathname* already exists, the user will be prompted to confirm whether it should be overwritten. The **NO.QUERY** option suppresses this prompt, overwriting the existing file. The **APPENDING** option causes the output to be appended to the output file if it already exists. The **NO.QUERY** and **APPENDING** options may not be used together.

Use of **TO** implies use of **HDR.SUP** as the output is not paginated.

Example

```
LIST STOCK PROD.NO QOH DESCR CSV TO C:\STOCK.CSV
```

This command constructs comma separated format report of the STOCK file into the C:\STOCK.CSV file.

5.95 TOTAL

The **TOTAL** field qualifier keyword causes a field to be reported together with its total value.

Format

TOTAL *field* {*field.qualifiers*}

where

field	is the field or evaluated expression to be displayed.
field.qualifiers	are other field qualifying keywords

The **TOTAL** field qualifier keyword is placed before the field name to which it applies and causes the query processor to report the value of the field for each record processed and also to report the total value at the end of the report. Used with breakpoints, the **TOTAL** keyword will also report the total value of the field at each breakpoint.

If the field is defined as multi-valued, the **TOTAL** keyword operates on each value in turn.

The **TOTAL** keyword operates only on numeric data. Non-numeric values are ignored.

Example

The command

```
LIST INVOICES TOTAL VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would produce a display such as that below in which the total value of the VALUE field is included at the end of the report.

```
LIST INVOICES TOTAL VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice   ...Value  Customer...................
74529     £1712.43  J McTavish
74273       £95.23  County Newspapers
63940      £141.00  R Bryant
74993        £9.29  Write Right Stationery
          ========
          £1957.95
4 records listed.
```

5.96 UNLIKE

The **UNLIKE** selection clause operator compares a field or evaluated expression against another field, evaluated expression or literal value and tests for the first item not matching the pattern template given by the second. The synonym **NOT.MATCHING** can be used.

Format

field **UNLIKE** {**NO.CASE**} *template*

where

field	is the first field or evaluated expression to be compared.
template	is the field, evaluated expression or literal value representing the pattern against which *field* is to be compared. The optional **NO.CASE** qualifier causes a case insensitive comparison to be applied.

Example

```
LIST STOCK WITH PRODUCT.CODE UNLIKE A...
```

This command lists items found on the STOCK file with a PRODUCT.CODE not starting with A.

See also:
Pattern Matching

5.97 USING

The **USING** clause allows a query to be processed using the dictionary of another file.

Format

USING { **DICT** } *file.name*

where

DICT	specifies that the dictionary of the named file is to be used.
file.name	is the file to be used as the dictionary for the query.

The **USING** keyword allows a query to be processed with an alternative dictionary. It is of particular use where files share a dictionary.

The query processor uses the dictionary of the file being reported until the **USING** clause is encountered. All subsequent command line items are parsed using the specified dictionary. It is therefore usual to place the **USING** clause immediately after the query file name.

Example

```
LIST ARCHIVED.CUSTOMERS USING DICT CUSTOMERS
```

This command lists an archive file of customer data using the dictionary of the main CUSTOMERS file.

5.98 VERTICALLY

The **VERTICALLY** display option keyword causes a vertical format report to be produced. The synonym **VERT** may be used.

Format

VERTICALLY

The **LIST** and **SORT** commands normally produce a tabular report unless the total width of the data to be reported exceeds that of the display or printer to which it is directed. The **VERTICALLY** keyword forces a vertical format report regardless of display width. A blank line is produced between each record in the report.

Example

The command

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
```

would produce a display such as that below.

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice   ...Value   Customer...................
74529     £1712.43   J McTavish
74273       £95.23   County Newspapers
63940      £141.00   R Bryant
3 records listed.
```

Including the **VERTICALLY** keyword would modify the display format to become

```
LIST INVOICES VALUE CUSTOMER.NAME WITH NO AMT.PAID
Invoice...74529
Value.....£1712.43
Customer..J McTavish

Invoice...74273
Value..... £95.23
Customer..County Newspapers

Invoice...63940
Value..... £141.00
Customer..R Bryant

3 records listed.
```

5.99 WHEN

The **WHEN** keyword introduces a selection clause for a multi-valued field.

Format

WHEN *condition*

where

condition is	*field1 operator field2*	to compare two fields
or	*field1 operator value*	to compare a field with a literal value

operator is any of the query processor operators:

EQ	=	**EQUAL**		
NE	#	**NOT**	<>	><
LT	<	**LESS**	**BEFORE**	
LE	<=	=<		
GT	>	**GREATER**	**AFTER**	
GE	>=	=>		
LIKE	**MATCHES**	**MATCHING**		
UNLIKE	**NOT.MATCHING**			
SAID	**SPOKEN**	~		
NO				
BETWEEN				

A **selection clause** specifies criteria governing which records are processed by the command. If omitted, all records are processed. The **WHEN** clause performs selection on exploded values from within the named multi-valued field, showing only the selected value of the named field and all associated fields

Field comparisons are performed using the internal format of *field1*, converting the *field2* or *value* item to this format if required. Thus a field holding an internal date, for example, may be compared with the more natural external form of the date. For example,

```
LIST INVOICES WHEN ISSUE.DATE > "12 OCT 96"
```

will list all invoice records with an issue date after 12 October 1996.

Example

The command

```
LIST SALES WITH PART = 100
```

to find only orders containing part 100 might produce a report such as

```
LIST SALES WITH PART = 100
Order     Part     Qty
10001     100        4
          107        3
          219        3
10021     100        3
          206        3
          219        7
10014     105        3
          100        1
          210        7

3 records listed.
```

For the same data, use of the **WHEN** keyword to select only part 100 with a query such as

```
LIST SALES WHEN PART = 100
```

would produce the report below.

```
LIST SALES WHEN PART = 100
Order     Part     Qty
10001     100        4
10021     100        3
10014     100        1

3 records listed.
```

5.100 WITH

The **WITH** keyword introduces a selection clause.

Format

WITH {**EVERY**} *condition* {*rel.op* {**EVERY**} *condition...*}

where

condition is	*field1 operator field2*	to compare two fields
or	*field1 operator value*	to compare a field with a literal value
rel.op is	**AND** or **OR**	
operator is	any of the query processor operators:	

EQ	=	**EQUAL**		
NE	#	**NOT**	<>	><
LT	<	**LESS**	**BEFORE**	
LE	<=	=<		
GT	>	**GREATER**	**AFTER**	
GE	>=	=>		
LIKE	**MATCHES**	**MATCHING**		
UNLIKE	**NOT.MATCHING**			
SAID	**SPOKEN**	~		
NO				
BETWEEN				

A **selection clause** specifies criteria governing which records are processed by the command. If omitted, all records are processed.

The relational operators may be followed by the keyword **NO.CASE** to apply a case insensitive comparison. This also occurs if the QUERY.NO.CASE mode of the **OPTION** command is in effect.

The **EVERY** keyword indicates that every value or subvalue of *field1* must match *field2* in the manner defined by the *operator*. For example, the command

```
LIST EXAM.RESULTS STUDENTS SUBJECTS WITH EVERY GRADE = "A"
```

might be used to report a list of students achieving grade A in every examination. The SUBJECTS and GRADE fields in this example are a pair of associated multi-valued fields recording examination subjects and grades.

The **AND** and **OR** operators may be used to build complex conditions. For example,

```
LIST STOCK WITH QTY < REORDER AND SUPPLIER = 26
```

selects only those records where the content of the QTY field is less than the content of the REORDER field and the SUPPLIER field contains the value 26.

The **AND** and **OR** operators are of equal priority and, if both appear in a single **WITH** clause, are evaluated left to right. Brackets may be used to modify the evaluation sequence. For example,

```
LIST STOCK WITH QTY < REORDER AND (SUPPLIER = 26 OR WAREHOUSE
= 14)
```

A query may contain more than one **WITH** clause. There is normally an implied **AND** relationship between these clauses. Thus the command

```
LIST STOCK WITH QTY < REORDER AND SUPPLIER = 26
```

is identical in effect to

```
LIST STOCK WITH QTY < REORDER WITH SUPPLIER = 26
```

The WITH.IMPLIES.OR mode of the **OPTION** command changes the effect of multiple **WITH** clauses to have an implied **OR** between the clauses.

Field comparisons are performed using the internal format of *field1*, converting the *field2* or *value* item to this format if required. Thus a field holding an internal date, for example, may be compared with the more natural external form of the date. For example,

```
LIST INVOICES WITH ISSUE.DATE > "12 OCT 96"
```

will list all invoice records with an issue date after 12 October 1996.

Short forms

The query processor offers a variety of short forms for selection clause elements.

Implicit field names

If two or more tests are to be performed against the same field, the field name only needs to appear in the first test. A relational operator without a preceding field name uses the same field as in the previous operator or the record id if this is the first relational operator.

In each of the following examples, the second query is an abbreviated form of the first

```
LIST VOC WITH TYPE = F OR TYPE = Q
LIST VOC WITH TYPE = F OR = Q

LIST ORDERS WITH DATE AFTER '31 DEC 99' AND DATE BEFORE '1 JAN
01'
LIST ORDERS WITH DATE AFTER '31 DEC 99' AND BEFORE '1 JAN 01'

LIST SALES WITH @ID > 10000
LIST SALES > 10000
```

Implicit OR relation

A relational operator followed by a series of values tests each of the values against the given field in an implicit OR relationship.

```
LIST ORDERS WITH REGION = 'SOUTH' OR REGION = 'NORTH'
LIST ORDERS WITH REGION = 'SOUTH' 'NORTH'
```

5.101 WITHOUT

The **WITHOUT** phrase is a synonym for use of **WITH NO**.

Format

WITHOUT *condition* {*rel.op condition...*}

Example

```
LIST ORDERS WITHOUT PAYMENT.DATE
```

This is equivalent to

```
LIST ORDERS WITH NO PAYMENT.DATE
```

Part 6

QMBasic

6 QMBasic

There are times when the powerful facilities available using the standard commands of QM are not sufficient to meet application demands. For these occasions, the QMBasic programming language provides a very easy to use means of developing components of the application. User written programs can be mixed with standard commands to give maximum capabilities with minimum development costs.

QMBasic is not difficult to learn. As the name implies, it has its origin in the Basic language found on many personal computers, however, the powerful string handling and screen formatting functions make development extremely fast. QMBasic has very high compatibility with the equivalent languages found in other similar data management products but also has some major extensions such as object oriented programming.

QMBasic Overview

Variable Names and Values

Scalars, Matrices and Dynamic Arrays

Objects

Common Blocks

Labels

Expressions and Operators

Assignment Statements

Type Conversion

Matrix file i/o

Sequential file i/o

Multivalue functions

Object oriented programming

Compiler Directives

Limits

QMBasic Statements by Name

6.1 QMBasic overview

QM applications are written using QMBasic. Unlike many other programming languages, the individual source modules are not linked together to form a single executable program but remain separate items that are loaded into memory dynamically when they are first needed. This approach generally results in lower memory usage and easier maintenance.

The program modules are stored as simple text records in **directory files** where each field of the record represents a line of the program (a transformation that corresponds exactly to how directory file records are stored by the underlying operating system). Although you may place your program modules in any directory file you wish or scatter them over several files, by convention programmers often use a file named **BP** (Basic Programs). The **BASIC** and **RUN** commands will look here for programs by default if no file name is given in the commands.

QMBasic modules are of four types:

Programs	A program is a simple program module that can be run directly from the command line. It can also be called from other programs using **CALL** in the same way as a subroutine that has no arguments. A program optionally starts with a **PROGRAM** statement though this is implied if none of the statements used to start the module types below are present.
Subroutines	A subroutine is a module that is called from another QMBasic element using **CALL**. Subroutines usually take **arguments**, variables that are passed in or out of the subroutine to transfer data between modules. A subroutine module starts with a **SUBROUTINE** statement.
Functions	A function is very similar to a subroutine but returns a value to the program that executed it. A function module starts with a **FUNCTION** statement.
Class modules	A class module contains the property and method routines that are used for object oriented programming. A class module starts with a **CLASS** statement.

Throughout all documentation, the word program is used to refer to all of the above module types unless the context explicitly states otherwise.

Before a program can be executed, the source form written by the developer must be **compiled** (translated into corresponding executable program modules) using the **BASIC** command. The executable items are written to records of the same name as the source but in a file with a **.OUT** suffix added. For example, the compiled version of a program stored as MYPROG in BP will be in MYPROG in the BP.OUT file. Programs may be executed directly from the .OUT file or may be moved into the **system catalogue** using the **CATALOGUE** command. Subroutines, functions and class modules must be catalogued before use.

Often, it is useful to place QMBasic source code elements that are used in more than one program in a separate record which is read during compilation as though it was part of the main program. In particular, common data structures or names representing keys to subroutines may be handled in this way to ensure that all components of the application have a common view of the information instead of needing to make changes in many places. The **SYSCOM** file is an example of this technique with records containing keys and other values that you may need in many programs. The QMBasic **$INCLUDE** directive described later in this section is used to direct the compiler to include text from another record. Include records may be stored in any file and are not separately compiled as the text is imported into other programs. It is recommended that a suffix of **.H** is used

on include record names as the compiler will automatically skip these when using a select list. This suffix has its origins in the C programming language where it is used to denote a "header file" that serves the same purpose as QMBasic include records.

A QMBasic program has a very simple to understand format. The program is made up of a series of **statements**. Each statement normally corresponds to a single line of source program text though it is possible to place multiple statements on a single line by separating them with semicolons. Some statements have a syntax which allows them to span multiple lines without special action. Any statement may be split over multiple lines by ending each line except the last with a tilde (~) character. Also, any statement that includes a comma in its syntax may start a new line immediately after the comma.

Lines commencing with an asterisk or an exclamation mark are treated as comments and ignored by the compiler. Comments can be included on the same line as a source program statement by using a semicolon to start a new statement followed by an asterisk or an exclamation mark. Blank lines and leading spaces are ignored by the compiler.

```
* A comment on a line of its own
A = 44                     ;* This is a trailing comment
B = "abc" ; C = LEN(B)     ;* Two statements on a single line
CALL MYSUBR(TITLE,         ;* A subroutine call
            DATA,          ;*     with each argument
            ITEM.COUNT)    ;*          on a separate line
```

The compiler is not case sensitive in language keywords. By default, variable names are also case insensitive but this can be altered using the **$MODE** directive or the $BASIC.OPTIONS record.

A program usually commences with a **PROGRAM**, **SUBROUTINE**, **FUNCTION** or **CLASS** statement. This serves to identify the type of QMBasic item and to assign a name to it. If none of these statements is present it is assumed to be a program.

The formats of these statements are

```
PROGRAM name
SUBROUTINE name(arg1,arg2,...)
FUNCTION name(arg1,arg2,...)
```
and
```
CLASS name
```

where a subroutine may take up to 255 arguments, a function 254.

A program ends with an **END** statement. Only blank lines and comments may follow this final **END**. For compatibility with other multivalue database products there is a compiler option to make this final **END** optional.

QMBasic - Variable names and values

Variable names must commence with a letter and may contain letters, digits, periods (full stops), percentage signs and dollar signs. Names may also contain underscore characters but not as the last character of the name. Users are discouraged from defining names containing dollar signs for their own purposes as these are reserved to identify system functions and constants. Except as indicated elsewhere, there is no restriction on the length of a name though very long names may appear truncated in debugging information.

Although QMBasic imposes few restrictions on the choice of names, it is advisable to avoid using names which correspond to QMBasic statements, functions and keywords. The only reserved names which may not be usable in some contexts are

AND	GOSUB	ON
BEFORE	GOTO	OR
BY	GT	REPEAT
CAPTURING	IN	RETURNING
CAT	LE	SETTING
DO	LOCKED	STEP
ELSE	LT	THEN
EQ	MATCH	TO
FROM	MATCHES	TRAPPING
GE	NE	UNTIL
GO	NEXT	WHILE

QMBasic variables are **type variant**, that is, that they may hold, for example, an integer value at one point in time and a character string later on. The actual form in which the data is held is determined by how it was assigned. If a variable is set to contain a string of digits and is subsequently used in an arithmetic calculation, the value is converted internally to a numeric form without affecting the variable itself. If this arithmetic calculation was performed many times in a loop, it may be worth forcing a type conversion to prevent repeated temporary conversions. For this reason, QMBasic programs often contain apparently redundant looking statements of the form

```
A = A + 0     ;* Convert to numeric form
```
or
```
S = S : ""    ;* Convert to string form
```

Numeric values may are held as integers wherever possible, conversion to floating point format occurring when the result of an arithmetic operation is non-integer or when the value is too large to be stored as an integer.

A variable holding a string of no characters is referred to as a **null string** and is treated as a special case in many operations. Users familiar with SQL type environments should take care to distinguish the multivalue database meaning of the word null from its SQL meaning.

A string variable may hold any number of characters. The actual total limit for all strings in a program is imposed by the disk space available for paging and is typically many megabytes. Although QMBasic avoids copying strings unnecessarily whenever it can, operations involving very large strings are likely to have a detrimental effect on performance.

A variable may hold many other types of information. For example, a **file variable** holds a reference to an open file and is used in all statements that refer to that file. A **subroutine variable** contains a fast reference to a catalogued subroutine that has been loaded into memory. Users cannot directly create subroutine variables, they are the result of transforming a string variable holding the subroutine name when it is first called. Until otherwise determined, variables are initially unassigned. Reference to an **unassigned variable** (where no value has yet been stored) will cause a run time error.

Constants

Constant values may be numbers or strings.

Numeric constants are written as a sequence of digits, optionally preceded by a sign or containing a decimal point. If a sign is used, there must be no space between it and the first digit.

QMBasic also allows hexadecimal numbers in equated tokens and most expressions. These are written with a prefix of 0x as used in the C programming language (e.g. 0x23 is decimal 35).

String constants are sequences of characters enclosed by delimiters. Valid delimiter characters are the single quote ('), the double quote (") and the back slash (\). The delimiter at the start and end of the string value must be the same but there is no difference in the internal treatment of the delimiters.

The compiler imposes no limit on the length of a string literal value though it may not extend from one line to the next. Very long strings can be constructed by concatenating component substrings.

The mark characters are available as @FM, @VM, @SM, @TM and @IM. These are described in a later section.

QMBasic - Scalars, matrices and dynamic arrays

QMBasic provides support for both scalar and matrix variables. A **scalar variable** is a simple value referenced by its name alone. It may contain data of any type.

A **matrix variable** is a one or two dimensional array of values. Matrices must be declared by use of the **DIMENSION** (more usually **DIM**) statement. Because memory for matrices is allocated dynamically, the **DIM** statement must be executed at program run time before the variable is used in any other way.

A one dimensional matrix of ten elements is defined by a statement of the form

```
DIM A(10)
```

For a two dimensional matrix with 5 rows of 8 columns this becomes

```
DIM B(5,8)
```

A single dimensional matrix is effectively a two dimensional matrix with one column. Thus references of the forms A(B) and A(B,1) are totally interchangeable.

By default, all matrices have an additional element, the zero element, which is used by some QMBasic statements. This is referred to as A(0) or B(0,0). The **$MODE** compiler directive can be used to create Pick style matrices which do not have a zero element. Note that, in a two dimensional matrix, this is a single element, not a complete row 0 and column 0.

The elements of a matrix may be of differing types (numbers, strings, file variables, etc).

A variable holding a string value may be considered as a **dynamic array**, the mark characters being used to divide it into fields, values and subvalues. Such a string may correspond to a record in a data file or may be totally internal to the program. Special operations are provided in QMBasic to manipulate dynamic arrays. These include sorted and unsequenced searching, insertion, deletion, replacement and extraction as well as some extremely powerful operations to build or decompose dynamic arrays.

A dynamic array in which each field, value or subvalue contains a numeric value is known as a **numeric array**. Many of the arithmetic operations operate on numeric arrays by processing corresponding elements in turn. For example, a statement

```
A = B + C
```

adds B and C together, storing the result in A. Where B and C are simple numeric values or strings that can be converted to numbers, this operation behaves as in most other computer languages. If B and C are dynamic arrays the operation handles each corresponding pair of values in turn.

```
B = "1" : @FM : "2" : @VM : "3" : @FM : "4"
C = "5" : @FM : "6" : @VM : "7" : @FM : "8"
A = B + C
```

The result of this operation would be to set A to 6FM8VM10FM12. The effect of operations on numeric arrays where the placement of fields, values and subvalues do not match exactly is determined by the use of the **REUSE()** function.

QMBasic - Common blocks

Variables are normally available to all statements within a single QMBasic program or subroutine. Although the language provides an internal subroutine call through the **GOSUB** statement, this does not automatically bring in the concept of the internal subroutine having its own variables or any other aspect of variable scope found in other languages.

QMBasic extends the language definition by adding the concept of variables that are private to an internal subroutine. This is achieved by use of the **LOCAL** statement and the associated **PRIVATE** variable declaration statement. Variables declared in this way are private to the one internal subroutine and cannot be accessed by other parts of the program. Furthermore, they are stacked if the subroutine calls itself, either directly or indirectly via another intermediate subroutine. For more information, see the description of the **LOCAL** statement.

QMBasic provides **common blocks** for data which is to be shared between two or more programs. These are declared by a statement of the form

```
COMMON /name/ var1, var2, var3,...
```

where *name* is the name by which the common block is to be known. A common block may contain any number of variables and is created when it is first referenced. It remains in existence until the user leaves QM. Once a common block is created, subsequent programs using the same common block name access the same data. The number of variables in the common block may not be increased by later definition but programs can define fewer variables than in the actual common block. Normally, the structure of a common block is best defined in an include file so that the same definition is used by all parts of the application.

Where programs use separate **COMMON** statements to reference the same block, note that the variables are defined by their position in the list, not the names used. Thus it would be valid (but not a good idea) for one program to have

```
COMMON /MYCOMMON/ A, B, C
```

and another program

```
COMMON /MYCOMMON/ D, E, F
```

where the data stored in B by the first program would be visible to the second program as E.

The name of a common block must conform to the same rules as a variable name. There is also an **unnamed common** (sometimes known as blank or unlabelled common) which is defined by a **COMMON** statement without a name:

```
COMMON A, B, C
```

This operates in exactly the same way except that each command processor level has its own unnamed common. Thus, an **EXECUTE** statement used to run one program from within another would result in a new unnamed common block being created for the executed program, the original being restored on return.

The variables in a common block are initialised to integer zero when the block is created. It is thus possible to include QMBasic code to perform further initialisation just once by statements of the form

```
COMMON /MYCOMMON/ INITIALISED,
                  VAR1,
                  VAR2,
                  VAR3,...etc...
IF NOT(INITIALISED) THEN
```

```
      do initialisation tasks
      INITIALISED = @TRUE
   END
```

Note how the names of the variables within the common block may extend from one line to the next. The compiler will continue the common block definition over multiple lines wherever the line ends with a comma.

The same common block could be defined as

```
COMMON/MYCOMMON/ VAR1
COMMON/MYCOMMON/ VAR2
COMMON/MYCOMMON/ VAR3
...etc...
```

The compiler assumes that definitions of variables with the same common block name are a continuation of the previous definitions.

Common blocks may also contain matrices. These are defined by including the row and column bounds in the **COMMON** statement, for example

```
COMMON /MYCOMMON/ MAT1(5,3)
```

Except when using Pick style matrices, the size of a matrix in common may be changed by a later **DIM** statement. The size given in the COMMON declaration is the initial size of the matrix.

QMBasic - Labels

Any statement of a QMBasic program may be labelled. A label may take one of three formats; a name of the same format as a variable name followed by a colon, a sequence of digits and periods followed by a colon, or a sequence of digits and periods with no trailing colon.

The following are all valid label names.

```
REDISPLAY:
100
12.9.6:
```

The label must appear as the first item on the source line. Labels and variables may have the same name though this may lead to some confusion when maintaining a program.

Statements that reference the label (e.g. **GOSUB**) may optionally include the colon after the label name. This is not recommended as it can make using an editor to search for a label in a program more difficult as the search will also find references to the label.

Numeric labels are provided for compatibility with other products. Use of numeric labels is discouraged as the "names" do not impart any information about the role of the label. For example, a statement such as

```
GOSUB 9600
```

gives the reader no clue about the action performed by the subroutine at label 9600 whereas

```
GOSUB GET.CUSTOMER.ID
```

suggests what the subroutine does.

QMBasic - Expressions and operators

A QMBasic expression consists of one or more data items (constants or variables) linked by operators.

constant	Use constant value (string or numeric)
var	Use value of named variable
var[*s*,*n*]	Use *n* character substring starting at character *s* of variable
var[*n*]	Use last *n* characters of string
var<*f*>	Use field *f* of dynamic array variable
var<*f*,*v*>	Use field *f*, value *v* of dynamic array variable
var<*f*,*v*,*s*>	Use field *f*, value *v*, subvalue *s* of dynamic array variable
func(*args*)	Use value of function which may take arguments

In all cases above, var may be a matrix reference, for example

var(*r*,*c*)[*s*,*n*]

where *r* and *c* are expressions which evaluate to the desired matrix index values.

There is also a special conditional item of the form

IF *conditional.expr* **THEN** *expr.1* **ELSE** *expr.2*

where *conditional.expression* is evaluated to determine whether the overall value is that of *expr.1* or *expr.2*.

The boolean (true/false) values used by QMBasic are that any value other than zero or a null string is treated as true, zero or a null string being treated as false. An expression returning a boolean value returns the integer value 1 for true, zero for false. The boolean values are available as @TRUE and @FALSE for use in programs.

The substring extraction operation x[*s*,*n*] extracts *n* characters starting at character *s* of the string x. Character positions are numbered from one. Thus

```
A = "abcdefghijkl"
Z = A[5,3]
```

sets Z to the string "efg".

If the bounds of the substring extend beyond the end of the string from which it is to be extracted, the result is truncated. Trailing spaces are not added to make up the shortfall. A start position of less than one is treated as one.

The trailing substring extraction operation x[*n*] extracts the last *n* characters of the string x. Thus

```
A = "abcdefghijkl"
Z = A[3]
```

sets Z to the string "jkl".

If the length of the substring to be extracted is greater than the length of the source string, the entire source string is returned.

The field extraction operator x<*f*,*v*,*s*> extracts field *f*, value *v*, subvalue *s* from the source string *x*. If *s* is omitted or zero, field *f*, value *v* is extracted. If *v* is omitted or zero, field *f* is extracted. Thus

`x<2>`	extracts field 2
`x<2,7>`	extracts field 2, value 7
`x<2,7,3>`	extracts field 2, value 7, subvalue 3

The operators of QMBasic are set out in the table below. The numbers in the right hand column are the operator precedence, the lower valued operators taking precedence in execution. Operations of equal precedence are processed left to right with the exception of the exponentiation operator which is processed right to left. Round brackets may be used to alter the order of execution or to improve readability of complex expressions.

< >	Dynamic array extraction	1
[ ]	Substring extraction	1
** or ^	Exponentiation (raising to power)	2
*	Multiplication	3
/	Division	3
//	Integer division	3
+	Addition	4
-	Subtraction	4
	Implicit format (See **FMT()** function)	5
:	Concatenation	6
<	Less than	7
>	Greater than	7
=	Equal to	7
#	Not equal to	7
<=	Less than or equal to	7
>=	Greater than or equal to	7
MATCHES	Pattern match (see below)	7
AND	Logical and	8
OR	Logical or	8

The following alternative logical and relational operator formats may be used

<	LT		
>	GT		
=	EQ		
#	NE	<>	><
<=	LE	=<	#>
>=	GE	=>	#<
MATCHES	MATCH		
AND	&		

OR !

The relational operators are defined such that, if the two items to be compared can both be treated as numbers, a simple numeric comparison is performed. If one or both items cannot be treated as numbers, they are compared as left aligned character strings. The **COMPARE()** function can be used to force a string comparison.

Note: The language syntax includes an ambiguity with the use of the < and > characters as both relational operators and in dynamic array references. For example, the statement

```
A = B<C> + 0
```

could be extracting field C from dynamic array B and adding zero to it (to force it to be stored as a numeric value) or it could be testing whether B is less than C and the result of this comparison is greater than zero. In cases such as this, the compiler looks at the overall structure of the statement and takes the most appropriate view. Use of brackets when mixing relational operators with field references will always avoid possible misinterpretation.

The **MATCHES** operator matches a string against a pattern consisting of one or more concatenated items from the following list.

...	Zero or more characters of any type
0X	Zero or more characters of any type
*n*X	Exactly *n* characters of any type
*n-m*X	Between *n* and *m* characters of any type
0A	Zero or more alphabetic characters
*n*A	Exactly *n* alphabetic characters
*n-m*A	Between *n* and *m* alphabetic characters
0N	Zero or more numeric characters
*n*N	Exactly *n* numeric characters
*n-m*N	Between *n* and *m* numeric characters
"*string*"	A literal string which must match exactly. Either single or double quotation marks may be used. Backslashes may not be used as string quotes in this context.

The values *n* and *m* are integers with any number of digits. *m* must be greater than or equal to *n*.

The 0A, *n*A, 0N, *n*N and "*string*" patterns may be preceded by a tilde (~) to invert the match condition. For example, ~4N matches four non-numeric characters such as ABCD (not a string which is not four numeric characters such as 12C4).

A null string matches patterns ..., 0A, 0X, 0N, their inverses (~0A, etc) and "".

The 0X and *n-m*X patterns match against as few characters as necessary before control passes to the next pattern. For example, the string ABC123DEF matched against the pattern 0X2N0X matches the pattern components as ABC, 12 and 3DEF.

The 0N, *n-m*N, 0A, and *n-m*A patterns match against as many characters as possible. For example, the string ABC123DEF matched against the pattern 0X2-3N0X matches the pattern components as ABC, 123 and DEF.

The pattern string may contain alternative templates separated by value marks. The **MATCHES** operator tries each template in turn until one is a successful match against the string.

As an example of the MATCHES operator, the statement

```
IF S MATCHES "1N0N'-'1N0N" THEN PRINT "OK"
```

would print OK when S contains one or more digits followed by a hyphen and one or more digits. Note the use of 1N0N to ensure that at least one digit is present.

See also:
Pattern Matching

QMBasic - Assignment statements

Variables may be assigned values by statements of the following forms

var op expr	Assign *expr* to *var*
var[*s*,*n*] = expr	Assign *expr* to substring of *var*
var[*d*,*i*,*n*] = expr	Assign *expr* to delimited substring of *var*
var<*f*> = expr	Assign *expr* to field *f* of *var*
var<*f*,*v*> = expr	Assign *expr* to field *f*, value *v* of *var*
var<*f*,*v*,*s*> = expr	Assign *expr* to field *f*, value *v*, subvalue *s* of *var*

In all cases, var may be a dimensioned matrix element.

The var op expr format allows the following operators.

=	Simple assignment
+=	Add *expr* to original value
-=	Subtract *expr* from original value
*=	Multiply original value by *expr*
/=	Divide original value by *expr*
:=	Concatenate *expr* as string to original value

Additionally, many other statements set values into variables.

Substring Assignment

The substring assignment operator is

var[*s*,*n*] = *expr*

In the default compiler modes, substring assignment overlays an existing portion of a string. If the substring bounds extend beyond the end of the actual value stored in the string, the excess data is lost. If the value of *expr* is longer than the substring to be set, the trailing characters are lost. If the value of *expr* is shorter than the substring to be set, the remainder is filled with spaces.

Two alternative implementations are provided for compatibility with various Pick style multivalue environments. Use of the PICK.SUBSTR option of the **$MODE** compiler directive extends the definition above such that the original string is extended if the region to be overwritten extends beyond the end of the current string value.

Use of the PICK.SUBSTR.ASSIGN option of the **$MODE** compiler directive changes the behaviour of substring assignment considerably. If the value of *s* is negative, the new contents of *var* are formed by copying the value or *expr*, adding -*s* spaces, skipping *n* characters of the original value of *var* and copying the remainder. If the value of *s* is greater than or equal to zero, the new value of *var* is formed by copying *s*-1 characters of the original value of *var*, adding spaces if necessary, skipping *n* characters, inserting the value of *expr* and then copying any remaining characters from the original *var*.

Delimited Substring Assignment

Delimited substring assignment replaces or inserts a portion of a string which is divided into substrings by use of a delimiter character. This character does not have to be one of the mark characters. The first character of string d is taken as the delimiter character. Starting at substring i, n substrings are replaced by the value of the assignment expression. For full details of delimited substring assignment, see the description of the FIELDSTORE statement.

Field Assignment

Field (or value, or subvalue) assignment replaces an existing field (or value, or subvalue) with the result of the expression. If the specified field, value or subvalue does not already exist within the string, mark characters are added as necessary. When adding a new field at the end of a string, the syntax

```
Z<-1> = expr
```

can be used. The QMBasic language will add a new field to receive the result. Similarly, the operations

```
Z<5,-1> = expr
Z<5,3,-1> = expr
```

would add a new value or subvalue to the end of existing data.

The way in which the append operation is performed depends on the setting of the COMPATIBLE.APPEND option of the **$MODE** compiler directive.

By default, QM prefixes the appended data with a field, value or subvalue mark unless the string, field or value in which the item is being appended is completely null.
Thus, if S = "ABCFMDEFVMFMXYZFM"

```
S<-1> = "ghi"      sets S to "ABCFMDEFVMFMXYZFMFMGHI"
S<1,-1> = "ghi"    sets S to "ABCVMGHIFMDEFVMFMXYZFM"
S<2,-1> = "ghi"    sets S to "ABCFMDEFVMVMGHIFMXYZFM"
```

Setting the COMPATIBLE.APPEND mode modifies the behaviour such that a mark character is not inserted if the final element of the portion of the dynamic array to which data is being appended is null. This is the how other multivalue database products work and results in

```
S<-1> = "ghi"      sets S to "ABCFMDEFVMFMXYZFMGHI"
S<1,-1> = "ghi"    sets S to "ABCVMGHIFMDEFVMFMXYZFM"
S<2,-1> = "ghi"    sets S to "ABCFMDEFVMGHIFMXYZFM"
```

This same rule applies to the **INS** statement and the **INSERT()** and **REPLACE()** functions. Dictionary I-type expressions that use **INSERT()** or **REPLACE()** always adopt the default QM behaviour.

Note that the S<-1> syntax should not be used when working with an association because it can lose the relation between the members of the association. Suppose we are working with an inventory in which we are associating a part number, description, and a comment. Every item has a part number and description but the comment i snot always present. If we write

```
PART.NO<-1> = part number
DESCRIPTION<-1> = description
COMMENT<-1> = text
```

the COMMENT field will not not be updated as expected if the *text* item is a null string. Next time these items are updated, the associations may get out of step.

To avoid this problem, use the field assignment or the **REPLACE()** function in code such as this:

```
PART.NO<N> = part number
DESCRIPTION<N> = description
COMMENT<N> = text
```

where N is the dynamic array filed position to be updated. This will ensure that any null values are inserted correctly, so that the association between the values will also be correctly maintained.

QMBasic - Type conversion

QMBasic variables are of variant type, the stored type being determined by the context in which the value was set and conversion being carried out on a temporary basis wherever necessary to perform processing. For example, the following program fragment

```
A = 962
S = A[2,1]
```

would result in A containing the integer value 962 and S containing the digit 6 as a string. The type conversion from integer to string is implicit in the use of the substring extraction on the second line.

Where a variable is accessed a very large number of times, there may be performance benefits to be obtained from ensuring that it is stored in an appropriate type thus minimising implicit temporary conversions. The QMBasic language does not have any specific type conversion functions as the automatic type variant nature of the language is adequate for most purposes. Where a variable is to be forced to be a number, this can be achieved by adding zero

```
A = A + 0
```

or, more typically, combined with some other operation such as

```
NUM.INVOICES = CLI.REC<C.INV.CT> + 0
```

Similarly, data can be forced to string format by appending a null string

```
A = A : ""
```

This is a much less common operation in real programs.

File Processing

QMBasic programs usually need to access database files. This section discusses the various techniques available. Further information can be found by following the links to detailed sections.

The QM file system supports two distinct types of file:

- **Hashed files** use a mathematical approach to locate data such that, when correctly configured, it should be possible to read any record with just one disk access regardless of the number of records in the file. For more information on the creation and configuration of these files see the section on dynamic files.
- **Directory files** do not offer the high performance of hashed files but allow access to their data from outside of the QM environment. For this reason, they are typically used for data interchange between applications. They are also ideal for storing extremely large records. For more information on the creation of these files, see the section on directory files.

Directory files also allow data to be processed in a line by line manner or as a simple byte stream. There are also special program operations to simplify reading and writing comma separated data as used, for example, by some spreadsheet packages. For more information on this style of access, see sequential file i/o.

Opening Files

Before a file can be processed, it must be opened. This is normally done using the **OPEN** statement, identifying the file by referencing the name of the corresponding F-type VOC record. By having this level of indirection, the physical location of the file can be changed without affecting the application; all that is necessary is to edit the VOC record to reference the new file location. There are three special file name syntaxes available to reference files in other accounts without needing a Q-type VOC record:

Implicit Q-pointer	*account*:*file*
Implicit QMNet pointer	*server*:*account*:*file*
Pathname	PATH:*pathname*

Because these syntaxes potentially weaken the security provided by the VOC indirection, their availability is determined by a system configuration parameter, **FILERULE**.

It is also possible for an application to open files directly by pathname using the **OPENPATH** statement. This should only be used where the normal VOC indirection is not appropriate.

A typical application may open many files simultaneously and it is therefore necessary to have a way to determine which file is being referenced by subsequent data transfer operations. This link is provided by the **OPEN** and **OPENPATH** statements setting up a **file variable** which is then used in other operations on the same file. The file remains open so long as the file variable remains in place. Overwriting the file variable will implicitly close the file that it referenced. Exit from the program will discard local variables and hence close the file.

Most applications adopt a convention for the names of variables. Many examples in this documentation use a convention where the file name is contracted to three of four characters and a suffix of .F is added to form the file variable name. Thus a file named ORDERS might be referenced via a file variable named ORD.F. It is common to continue the convention into other variables so that, for example, ORDERS file record ids would be stored in ORD.ID and records would be read from the file into the ORD.REC variable. These are examples only. There is no restriction on naming imposed by QM itself.

A file variable may be copied, just like any other variable. In this case, the file remains open until the last file variable referencing it is discarded or overwritten.

There are two factors that limit the number of files that can be open at one time. Firstly, QM has an internal file table that contains a reference to every distinct file open on the system by all QM processes. The size of this table is set by the **NUMFILES** configuration parameter. If several users all open the same file, that only requires one entry in the table. If a program attempts to open a file when the table is full, the operation will fail, taking the **ELSE** clause to allow the program to report an error. The **LIST.FILES** command can be used to monitor how close a system is to reaching this configuration limit.

The second limit is imposed by the operating system. On some systems this may be configurable, on others it is fixed. QM tries to hide this limit by implementing a mechanism whereby, if the limit is reached, the file that has not been accessed for longest is closed internally to make room for the new file. Subsequent access to the file that has been closed will automatically reopen it, probably closing something else to make space. Although this mechanism is totally automatic and gives the developer the illusion that there is no limit, the impact on performance can be quite serious.

Opening a file is a complex process. Although QM maintains a file cache to improve the situation, developers should avoid continually re-opening the same file. One useful way to achieve this is to place the file variable in a common block so that is is not discarded when the program or subroutine exits. By using this technique it is possible for a program to open all of its main data files as it starts up and to keep them open for the entire life of the application. Keeping large numbers of files open will require careful configuration of NUMFILES and the corresponding operating system parameters.

Reading, Writing and Deleting Data

Programs read data using the QMBasic **READ** statement. With a hashed file, the internal processing of this statement applies the hashing process to read just the group that would contain the requested record and then locates the record within that group. If it is not found, it is not in the file and there is no need to look elsewhere. This process ensures that hashed files give best performance. For a directory file, QM uses operating system functions to locate and read the requested item. This will not give the performance of hashed files as it requires a scan of the directory to locate the item.

The **READ** statement returns a variable that contains a dynamic array representing the data of the requested record. The program can then use the various dynamic array operations such as field extraction to access the data in the record.

If the record is to be updated by the application, it is essential to ensure that other processes cannot update the record at the same time. This protection is provided by QM's locking mechanisms and corresponding QMBasic statements, most importantly **READU**. A program should never write or delete a record unless it owns a lock to protect it. There is a configuration parameter, **MUSTLOCK**, that allows administrators to enforce strong locking rules. Unfortunately, this cannot be made the default behaviour as there is much software which does not use locking because the developer knew that there could never be an interaction with other processes.

A data record is written to the file using the QMBasic **WRITE** statement. If the record already exists in the file, the new version replaces the previous one. If the record does not already exist, the write operation adds it to the file. The record lock is automatically released when the write completes.

A data record is deleted from the file using the QMBasic **DELETE** statement. The record lock is automatically released after the record has been deleted.

The QMBasic statements named above work with dynamic arrays. There is an alternative style of file i/o that uses dimensioned matrices. For details, see Matrix File I/O.

Select Lists and Alternate Key Indices

The **READ** statement requires that the program knows the id of the record it needs to read. To process a file sequentially or to process only records that meet a specific condition, programs use a select list. This list may be generated by executing a query processor **SELECT** operation or by use of the QMBasic **SELECT** statement. Whichever method is used, the program then reads items from the list using the **READNEXT** statement, typically in a loop that then uses **READ** or one of its locking variants to process each record from the list.

Building a select list requires the system to traverse the entire file, examining every record. For situations where only a small number of records are to be selected, an alternate key index can give substantial performance improvements. Effectively, this is a set of pre-built select lists based on the content of a specific field or the result of evaluating an I-type expression. The index is automatically updated whenever a change is made to the file. The cost of this additional update on write is usually significantly outweighed by the performance improvement of being able to go directly to the desired set of records.

The ON ERROR Clause

Most of the QMBasic file handling statements have an optional **ON ERROR** clause. This is rarely needed by applications but allows a program to trap an error that would otherwise cause QM to abort the program. If an **ON ERROR** clause is present, the program can take its own recovery action or display alternative diagnostic messages. Developers should avoid using the **ON ERROR** clause simply to condition an **ABORT** statement as this will usually give less diagnostic information than would have appeared if no **ON ERROR** clause had been present.

Examples

```
OPEN 'CLIENTS' TO CLI.F ELSE STOP 'Cannot open CLIENTS'
LOOP
   DISPLAY 'Enter client number: ' :
   INPUT CLI.ID
UNTIL CLI.ID = ''
   READ CLI.REC FROM CLI.F, CLI.ID THEN
      DISPLAY CLI.REC<2>
   END ELSE
      DISPLAY 'Client not found'
   END
REPEAT
```

This short program opens the CLIENTS file and then enters a loop in which it prompts for a client number, reads the client record and displays the content of field 2. The loop continues until the user enters a blank client number.

This example shows why direct use of field numbers in programs is a bad idea. Anyone reading this program has no idea what information about the client is being displayed. A better approach is to use the **EQUATE** statement to define names for each field (typically in an include record). The data display statement might then become

```
DISPLAY CLI.REC<CLI.NAME>
```

which suggests to anyone reading the program that it is displaying the client's name. The **GENERATE** command can be used to construct an include record of field names from the file dictionary rather than having to maintain two separate descriptions of the data.

```
SELECT @VOC TO 1
LOOP
   READNEXT ID FROM 1 ELSE EXIT
   READ VOC.REC FROM @VOC, ID THEN
      IF VOC.REC[1,1] = 'F' THEN
         OPEN ID TO TEST.F ELSE
            DISPLAY 'File ' : ID : ' cannot be opened'
         END
      END
   END
REPEAT
```

This program uses the system defined file variable @VOC to reference the VOC instead of opening it explicitly. The **SELECT** statement builds a list of all records in the file into select list 1 which is then processed in the loop. For each item in the list, the record is read from the VOC and, if it is an F-type record, the program attempts to open the file. If it cannot be opened, an error message is displayed.

Note the use of **EXIT** to exit from the loop when the list is exhausted. Some multivalue environments do not support this statement and require developers to devise alternative exit schemes that are generally not as efficient.

Note also that the file opened to variable TEST.F is not explicitly closed. Each **OPEN** will implicitly close the previous file as the file variable is overwritten. The final file opened will remain open until the program terminates.

This program has needed to include a test to process only F-type VOC records. Alternatively, the program could use the query processor to build a list of F-type records and then process all records in this list:

```
EXECUTE "SELECT VOC WITH TYPE = 'F' TO 1"
LOOP
   READNEXT ID FROM 1 ELSE EXIT
   READ VOC.REC FROM @VOC, ID THEN
      OPEN ID TO TEST.F ELSE
         DISPLAY 'File ' : ID : ' cannot be opened'
      END
   END
REPEAT
```

Although this approach may look simpler and does not require the unwanted records to be read, it is actually less efficient than the first method as the query processor will need to read every record and the loop then re-reads the records of interest. In the previous example, use of the QMBasic **SELECT** actually only sets a pointer to the start of the file and the subsequent **READNEXT** reads each group when it needs to process the first record from the group, effectively reading the file only

once. This exposes an interesting problem that is highlighted in the next example.

```
OPEN 'CLIENTS' TO CLI.F ELSE STOP 'Cannot open CLIENTS'
SELECT CLI.F TO 1
LOOP
   READNEXT CLI.ID FROM 1 ELSE EXIT
   READU CLI.REC FROM CLI.F, CLI.ID THEN
      RECORDLOCKU CLI.F, '0':CLI.ID
      WRITE CLI.REC TO CLI.F, '0':CLI.ID
      DELETE CLI.F, CLI.ID
      END
   END
REPEAT
```

The above program might be used to convert a CLIENTS file to add a zero on the front of each record id, perhaps to allow more clients on a system where the application requires fixed length ids. Because it is the **READNEXT** that actually traverses the file rather than the **SELECT** statement, new records written to higher numbered groups would be seen by a later **READNEXT** and get processed for a second time. For example, if the record for client number 1234 was in group 6 and the new version of this record with id 01234 hashed to group 10, it would appear in the list constructed when processing reaches group 10 and the record would be renamed once more to become 001234.

Although programs that might suffer from this problem are rare, we need to force completion of the record selection before entering the loop. One way to do this would be to use the query processor **SELECT** instead of the QMBasic equivalent:

```
EXECUTE 'SELECT CLIENTS TO 1'
```

Note the use of **RECORDLOCKU** to set an update lock on the record to be added to the file. Although this is probably strictly unnecessary in this example because the new record will not already exist, it does ensure compliance with the locking rules.

Matrix File I/O

QMBasic has two styles of file i/o that may be freely mixed within an application. Using **READ** and **WRITE** to transfer data using dynamic arrays is simpler and usually faster for programs that do little processing of the data. For programs that perform a significant amount of processing of the data in a record, it may be worth the cost of breaking the fields into separate elements of a dimensioned matrix using **MATREAD** and **MATWRITE**.

These statement have the same locking variants as their dynamic array counterparts. They also share an almost identical syntax where the prefix MAT is used to select the matrix version of the operation and the variable representing the database record must be a dimensioned array. For example, the dynamic array read:

```
READ var FROM filevar, id
```

becomes

```
MATREAD array FROM filevar, id
```

The **MATREAD** statement places each field of the record into a separate element of the array, keeping values and subvalues together as these are instances of the same data item.

For example, if a record has three fields, the second of which is multivalued:

AFMB1VMB2FMC

using **MATREAD** to read this into a three element (plus the zero element) matrix would result in:

0	
1	A
2	B1VMB2
3	C

The **MATWRITE** operation joins together each element of the matrix, inserting field marks between them and writes this to the file.

If the matrix has more elements than there are fields in the record, the excess elements are set to null strings:

0	
1	A
2	B1VMB2
3	C
4	
5	

The **INMAT()** function can be used to determine how many fields the record had. The **MATWRITE** operation ignores all trailing empty fields so that above situation would not write two empty fields at the end of the record.

If the matrix has fewer elements than there are fields in the record, the zero element is used to store the excess data. Consider the a record with five fields and an array with three elements:

0	DFME
1	A
2	B1VMB2
3	C

The **MATWRITE** operation adds the contents of the zero element to the record formed from the remaining elements of the matrix, reconstructing the correctly formed data. The zero element thus acts as an "overflow bucket" allowing programs that did not expect to find the excess data to function correctly.

Pick style matrices do not have a zero element. In this case, the excess data is stored in the final element of the matrix:

1	A
2	B1VMB2
3	CFMDFME

This is likely to cause the program to malfunction if it updates element 3 where it expected only to find the third field of the database record. To avoid this, Pick style programmers usually ensure that the matrix has at least one more element than they expect it to need, effectively moving the "overflow bucket" to the end of the matrix.

Sequential File I/O

Directory files are so called because they are represented by an operating system directory. The records in these files are represented by operating system files in the directory. These files do not give the high performance of hashed files but they allow access to the data from outside of QM. They are therefore particularly useful for data interchange.

Records in directory files are sometimes very large and may consist of a number of lines of textual information with a fixed layout. In such cases, it may be useful to process the data line by line. QM provides statements to perform sequential reading or writing of text data. These can only be used with directory files.

An item is opened for sequential processing using the **OPENSEQ** statement. This has two forms, one that opens a record in a directory file by name:

```
OPENSEQ file, id TO filevar
```

the other opens a file by pathname:

```
OPENSEQ pathname TO filevar
```

In both forms, the statement takes the optional **ON ERROR**, **LOCKED**, **THEN** and **ELSE** clauses. At least one of the **THEN** and **ELSE** clauses must be present. Because the **OPENSEQ** operation is effectively opening a record, it applies a lock to this record to prevent other users overwriting it.

The **OPENSEQ** statement will take the ELSE clause for three reasons:

- The file does not exist.
- The file exists but is not a directory file.
- The file exists as a directory file but the record does not exist.

The last of these three situations would be an error in a program that is intending to read the item but is usually not an error in a program that will write to the item. The **STATUS()** function can be used to determine which of the above three conditions exist as discussed in the detailed **OPENSEQ** statement description.

OPENSEQ also has options to open the item in read-only mode, append to an existing item, or overwrite an existing item.

The QMBasic statements that can be used to access the sequential item are:

READSEQ	Read text line by line
READBLK	Read a given number of bytes
WRITESEQ	Write text line by line
WRITESEQF	Write text line by line, flushing to disk before continuing
WRITEBLK	Write a given number of bytes
READCSV	Read comma separated variable (CSV) format data
WRITECSV	Write comma separated variable format data
SEEK	Position within the sequential item
NOBUF	Suppress buffering
WEOFSEQ	Write end of file (truncate the item)
CLOSESEQ	Close the sequential item, flushing buffers and releasing the lock.

Examples

```
OPENSEQ 'C:\PRICES' TO SEQ.F ELSE STOP 'Cannot open price data'
OPEN 'STOCK' TO STK.F ELSE STOP 'Cannot open STOCK'
LOOP
   READSEQ TEXT FROM SEQ.F ELSE EXIT
   STK.ID = TEXT[1,5]
   READU STK.REC FROM STK.F, STK.ID THEN
      STK.REC<STK.PRICE> = ICONV(TEXT[6,8], 'MD2')
      WRITE STK.REC TO STK.F, STK.ID
   END ELSE
      RELEASE STK.F, STK.ID
      DISPLAY 'Stock item ' : STK.ID : ' not found'
   END
REPEAT
```

This short program reads lines from a text file, C:\PRICES. Each line within this file has a stock part number in the first five characters and a new price in external format in the next eight characters. For each line, the program reads the corresponding STOCK file record and updates field STK.PRICE to contain the internal form of the price value. The token STK.PRICE would typically be defined in an include record.

```
OPENSEQ 'C:\IMPORT.CSV' TO SEQ.F ELSE STOP 'Cannot open import
file'
OPEN 'STOCK' TO STK.F ELSE STOP 'Cannot open STOCK'
LOOP
   READCSV FROM SEQ.F TO STK.ID, PRICE ELSE EXIT
   READU STK.REC FROM STK.F, STK.ID THEN
      STK.REC<STK.PRICE> = ICONV(PRICE, 'MD2')
      WRITE STK.REC TO STK.F, STK.ID
   END ELSE
      RELEASE STK.F, STK.ID
      DISPLAY 'Stock item ' : STK.ID : ' not found'
   END
REPEAT
```

This program is a variation on the first example where the import data contains comma separated items as might have been written by a spreadsheet tool such as Excel. The **READCSV** statement reads the first two comma separated items in each line of text into STK.ID and PRICE. Any additional values on the line are discarded.

```
OPENSEQ 'C:\EXPORT.CSV' OVERWRITE TO SEQ.F ELSE
   IF STATUS() THEN STOP 'Cannot open export file'
END
OPEN 'STOCK' TO STK.F ELSE STOP 'Cannot open STOCK'
SELECT STK.F TO 1
LOOP
   READNEXT STK.ID FROM 1 ELSE EXIT
   READ STK.REC FROM STK.F, STK.ID THEN
      WRITECSV STK.ID, OCONV(STK.REC<STK.PRICE>, 'MD2'),
            STK.REC<STK.QOH> TO SEQ.F ELSE
         STOP 'Write error'
      END
```

```
   END
REPEAT
```

This program creates a text item in C:\EXPORT.CSV where each line contains the stock part number, the price and the quantity on hand as a comma separated list suitable for import into spreadsheets such as Excel.

Multivalue Functions

The QMBasic language has many functions that provide multivalued equivalents of their more commonly used single valued counterparts. In each case, these work element by element through the dynamic arrays passed into the functions, performing the operation on each element in turn to produce an equivalent dynamic array of results.

For example, if we have two dynamic arrays

A contains ABC_{FM}DEF_{FM}GHI

and

B contains 123_{FM}456_{FM}789

We can concatenate these two dynamic arrays in two ways:

C = A : B	sets C to ABCFMDEFFMGHI123FM456FM789
C = CATS(A, B)	sets C to ABC123FMDEF456FMGHI789

The main multivalued string functions are

CATS()	Concatenate elements of a dynamic array
COUNTS()	Multivalued variant of **COUNT()**
FIELDS()	Multivalued variant of **FIELD()**
FMTS()	Format elements of a dynamic array
ICONVS()	Perform input conversion on a dynamic array
INDEXS()	Multivalued equivalent of **INDEX()**
NUMS()	Multivalued variant of **NUM()**
OCONVS()	Perform output conversion on a dynamic array
SPACES()	Multivalued variant of **SPACE()**
STRS()	Multivalued variant of **STR()**
SUBSTRINGS()	Multivalued substring extraction
TRIMBS()	Multivalued variant of **TRIMB()**
TRIMFS()	Multivalued variant of **TRIMF()**
TRIMS()	Multivalued variant of **TRIM()**

There are also a number of multivalued logical functions. These provide equivalents to the relational operators and other functions that return boolean values.

For example, the **GTS(*arr1*, *arr2*)** function takes two dynamic arrays and returns a new dynamic array of true / false values indicating whether the corresponding elements of *arr1* are greater than those of *arr2*.

Thus, if A contains 11FM0VM17VMPQRFM2
and B contains 12FM0VM14VMACBFM2

C = GTS(A, B)

Returns C as 0FM0VM1VM1FM0

The multi-valued logical functions are

ANDS()	Multi-valued logical AND
EQS()	Multi-valued equality test
GES()	Multi-valued greater than or equal to test
GTS()	Multi-valued greater than test
LES()	Multi-valued less than test
LTS()	Multi-valued less than or equal to test
NES()	Multi-valued inequality test
NOTS()	Multi-valued logical NOT
ORS()	Multi-valued logical OR

The **IFS()** function returns a dynamic array constructed from elements chosen from two other dynamic arrays depending on the content of a third dynamic array.

IFS(*control.array***,** *true.array***,** *false.array***)**

where

control.array	is a dynamic array of true / false values.
true.array	holds values to be returned where the corresponding element of *control.array* is true.
false.array	holds values to be returned where the corresponding element of *control.array* is false.

The **IFS()** function examines successive elements of *control.array* and constructs a result array where elements are selected from the corresponding elements of either *true.array* or *false.array* depending on the *control.array* value.

Example

A contains 1VM0VM0VM1VM1VM1VM0
B contains 6VM2VM3VM4VM9VM6VM3
C contains 2VM8VM5VM0VM3VM1VM3

```
D = IFS(A, B, C)
```

D now contains 6VM8VM5VM4VM9VM6VM3

Object Oriented Programming

QMBasic includes support for object orientated programming. Users familiar with other object oriented languages will find that QM offers many of the same concepts but, because they are integrated into an existing programming environment, there may be some significant differences in usage.

What is an Object?

An object is a combination of data and program operations that can be applied to it. An object is defined by a **class module**, a QMBasic program that is introduced by the **CLASS** statement and contains the definitions of persistent data items and public subroutine and functions. An object is a run time instance of the class, **instantiated** by use of the **OBJECT()** function

```
OBJ = OBJECT("MYCLASS")
```

where "MYCLASS" is the catalogue name of the class module. The OBJ variable becomes a reference to an **instance** of the class.

A second use of the **OBJECT()** function with the same catalogue name will create a second instance of the object. On the other hand, copying the object variable creates a second reference to the same instance.

In other program types, data is stored either in local variables that are discarded on return from the program, or in common blocks that persist and may be shared by many programs. A class module has the additional concept of persistent data that is related to the particular instance of the object and is preserved across repeated entry to the object. If an object is instantiated more than once, each instantiation has its own version of the persistent data.

Persistent data is defined using the **PRIVATE** or **PUBLIC** statements:

```
PRIVATE A, B(5)
PUBLIC C, D(2,3)
```

These statements must appear at the start of the class module, before any executable program statements. Data items defined as private are only accessible by program statements within the class module. Data items defined as public can be accessed from outside of the class module (subject to rules set out below). Private and public data items are frequently used to store what other object oriented programming environments would term **property** values.

PRIVATE and **PUBLIC** variables are set to unassigned when the object is instantiated.

Public Functions and Subroutines

Another important difference between class modules and other program types is that a class module usually has multiple entry points, each corresponding to a **public function** or **public subroutine**. Indeed, simply calling the class module by its catalogue name will generate a run time error.

Just as with conventional QMBasic functions and subroutines, a public function must return a value to its caller whereas a public subroutine does not (though it can do so by updating its arguments).

A public function is defined by a group of statements such as

```
PUBLIC FUNCTION XX(A,B,C)
   ...processing...
```

```
    RETURN Z
END
```

where XX is the function name, A, B and C are the arguments (optional), and Z is the value to be returned to the caller.

A public subroutine is defined by a group of statements such as

```
PUBLIC SUBROUTINE XX(A,B,C)
     ...processing...
    RETURN
END
```

where XX is the function name and A, B and C are the arguments (optional)

The number of arguments in a public function or subroutine is normally limited to 32 but this can be increased using the MAX.ARGS option of the **CLASS** statement.

Both styles of public routine allow use of the VAR.ARGS qualifier after the argument list to indicate that it is of variable length. Argument variables for which the caller has provided no value will be unassigned. The **ARG.COUNT()** function can be used to find the actual number of arguments passed. A special syntax of three periods (...) used as the final argument specifies that unnamed arguments are to be added up to the limit on the number of arguments. These can be accessed using the **ARG()** function and the **SET.ARG** statement. See the **PUBLIC** statement for more details of this feature.

It is valid for a class module to contain combinations of a **PUBLIC** variable, **PUBLIC SUBROUTINE** and **PUBLIC FUNCTION** with the same name. If there is a public subroutine of the same name as a public variable, the subroutine will be executed when a program using the object attempts to set the value of the public item. If there is a public function of the same name as a public variable, the function will be executed when a program using the object attempts to retrieve the value of the public item. If both are present, the public property variable will never be directly visible to programs using the object.

Sometimes an application developer may wish a public variable to be visible to users of the class for reading but not for update. Although this could be achieved by use of a dummy **PUBLIC SUBROUTINE** that ignores updates or reports an error, public variables may be defined as read-only by including the **READONLY** keyword after the variable declaration:

```
PUBLIC A READONLY
```

or

```
PUBLIC B(5) READONLY
```

Referencing an Object

References to an object require two components, the object variable and the name of a property or method within that object. The syntax for such a reference is

```
OBJ->PROPERTY
```

or, if arguments are required,

```
OBJ->PROPERTY(ARG1, ARG2, ...)
```

When used in a QMBasic expression, for example,

```
ITEMS += OBJ->LISTCOUNT
```

the object reference returns the value of the named item, in this case LISTCOUNT. This may be a

public variable or the value of a public function. If the same name is defined as both, the public function is executed.

When used on the left of an assignment, for example,

```
OBJ->WIDTH = 70
```

the object reference sets the value of the named item, in this case WIDTH. This may be a public variable or the value of a public subroutine that takes the value to be assigned as an argument. If the same name is defined as both, the public subroutine is executed.

This dual role of public variables and functions or subroutines makes it very easy to write a class module in which, for example, a property value may be retrieved without execution of any program statements inside the object but setting the value executes a subroutine to validate the new value.

All object, property and public routine names are case insensitive.

Using Dimensions and Arguments

Public variables may be dimensioned arrays. Subscripts for index values are handled in the usual way:

```
OBJ->MODE(3) = 7
```

where MODE has been defined as a single dimensional array. If MODE has an associated public subroutine, the indices are passed via the arguments and the new value as the final argument. Thus, if MODE was defined as

```
PUBLIC SUBROUTINE MODE(A,B)
```

the above statement would pass in A as 3 and B as 7.

Execution of Object Methods

Other object oriented languages usually provide **methods**, subroutines that can be executed from calling programs to do some task. QMBasic class modules do this by using public subroutines. The calling program uses a statement of the form:

```
OBJ->RESET
```

where RESET is the name of the public subroutine representing the method. Again, arguments are allowed:

```
OBJ->RESET(5)
```

This leads to an apparent syntactic ambiguity between assigning values to public properties and execution of methods. Actually, there is no ambiguity but the following two statements are semantically identical:

```
OBJ->X(2,3)
OBJ->X(2) = 3
```

Expressions as Property Names

All of the above examples have used literal (constant) property names. QMBasic allows expressions as property names in all contexts using a syntax

```
OBJ->(expr)
```

where *expr* is an expression that evaluates to the property name.

Object References in Subroutine Calls

Any reference to an object element in a subroutine call, for example

```
CALL SUBNAME(OBJ->VAR)
```

is considered to be read access. If the subroutine updates the argument, this will not update the object property value.

The ME Token

Sometimes an object needs to reference itself. The reserved data name ME can be used for this purpose:

```
ME->RESET
```

The CREATE.OBJECT Subroutine

When an object is instantiated using the **OBJECT()** function, part of this process checks whether there is a public subroutine named CREATE.OBJECT and, if so, executes it. This can be used, for example, to preset default values in public and private variables. Up to 32 arguments may be passed into this subroutine by extending the **OBJECT()** call to include these after the catalogue name of the class module.

The DESTROY.OBJECT Subroutine

An object remains in existence until the last object variable referencing it is discarded or overwritten. At this point, the system checks for a public subroutine named DESTROY.OBJECT and, if it exists, it is executed.

The UNDEFINED Name Handler

The optional UNDEFINED public subroutine and/or public function can be used to trap references to the object that use property names that are not defined. This handler is executed if a program using the object references a name that is not defined as a public item. The first argument will be the undefined name. Any arguments supplied by the calling program will follow this. The **ARG.COUNT()** and **ARG()** functions can be used to help extract this data in a meaningful way.

If there is no UNDEFINED subroutine/function, object references with undefined names cause a run time error.

Inheritance

Sometimes it is useful for one class module to incorporate the properties and methods of another. This is termed **inheritance**.

Use of the **INHERITS** clause of the **CLASS** statement effectively inserts declaration of a private variable of the same name as the inherited class (removing any global catalogue prefix character)

and adds

```
name = OBJECT(inherited.class)
INHERIT name
```

to the CREATE.OBJECT subroutine.

Alternatively, inheritance can be performed during execution of the object by direct use of the **INHERIT** statement.

The name search process that occurs when an object is referenced scans the name table of the original object reference first. If the name is not found, it then goes on to scan the name tables of each inherited object in the order in which they were inherited. Where an inherited object has itself inherited further objects, the lower levels of inheritance are treated as part of the object into which they were inherited. If the name is not found, the same search process is used to look for the undefined name handler.

An inherited object can subsequently be disinherited using **DISINHERIT**.

Syntax Summary

```
CLASS name {INHERITS class1, class2...}
   PUBLIC A {READONLY}, B(3), C
   PRIVATE X, Y, Z

   PUBLIC SUBROUTINE SUB1(ARG1, ARG2) {VAR.ARGS}
      ...processing...
   END

   PUBLIC FUNCTION FUNC1(ARG1, ARG2) {VAR.ARGS}
      ...processing...
      RETURN RESULT
   END

   ...Other QMBasic subroutines...
END
```

See also:
CLASS, **DISINHERIT**, **INHERIT**, **OBJECT()**, **PRIVATE**, **PUBLIC**.

6.2 QMBasic - Compiler Directives

Compiler directives control the way in which the compiler processes the QMBasic source programs. They do not result directly in executable statements.

Directive names may be written with a # character in place of the $ character.

The available directives are

- $CATALOG
- $CATALOGUE
- $DEBUG
- $DEFINE
- $EXECUTE
- $IFDEF and $IFNDEF
- $INCLUDE
- $LIST
- $MODE
- $NOCASE.STRINGS
- $QMCALL

$CATALOGUE compiler directive

$CATALOGUE *name* {**GLOBAL** | **LOCAL**}

The **$CATALOGUE** directive (or the American spelling **$CATALOG**) causes the compiler to add the program to the system catalogue with the given call name if the compilation is successful. If name is omitted, the source record name is used. When using this default name, an error will be reported if the name is not the same as the name specified in the **PROGRAM**, **SUBROUTINE**, **FUNCTION** or **CLASS** statement.

If the *name* does not follow the normal QMBasic name construction rules (e.g. a Pick user exit such as 50BB) it should be enclosed in quotes. The rules for catalogue name format are described with the **CATALOGUE** command.

Automatic cataloguing can also be performed using the CATALOGUE entry in the $BASIC.OPTIONS record as described under the **BASIC** command. Use of the **$CATALOGUE** compiler directive will override any alternative settings specified in the $BASIC.OPTIONS record.

See also:
$NO.CATALOGUE, **$BASIC.OPTIONS**

$DEBUG compiler directive

$DEBUG

The **$DEBUG** directive compiles the program in debug mode. This is an alternative to use of the DEBUGGING keyword to the **BASIC** command. The **$DEBUG** directive must appear before any executable statements in the program.

See also:
QMBasic debugger

$DEFINE compiler directive

The **$DEFINE** directive is used to associate a value with a symbolic name at compile time. The standard include records in the SYSCOM file contain many examples of **$DEFINE**.

The format of a **$DEFINE** directive is

$DEFINE *name value*

where *name* is the symbol to be used in the program and *value* is a constant.

The token QM is automatically defined and may be used to determine whether a program is being compiled on the QM database. The token QM.WINDOWS, QM.LINUX, QM.FREEBSD, QMMAC or QMPDA is defined corresponding to the underlying operating system. Because these are only relevant at compile time, take care when using them in programs that may be moved between platforms. The **SYSTEM(1010)** function can be used to determine platform type at run time.

See also:
EQUATE

$EXECUTE compiler directive

The **$EXECUTE** directive executes a command during program compilation.

The format of a **$EXECUTE** directive is

$EXECUTE "*command*"

where *command* is the command to be executed. This must be enclosed in quotes..

This directive can be useful, for example, when program generated include records are used.

$IFDEF and $IFNDEF compiler directives

The **$IFDEF** directive provides conditional compilation. The format of this directive is

$IFDEF *name*
...statements...
$ELSE
...statements...
$ENDIF

The **$ELSE** and associated statements are optional. Statements conditioned by the **$IFDEF** directive are ignored if *name* has not been defined by a previous $DEFINE directive. Statements under the **$ELSE** directive are ignored if *name* has been defined by a previous $DEFINE directive.

The **$IFNDEF** directive provides the inverse action of **$IFDEF**, compiling the following statements if *name* has not been defined.

$IFDEF and **$IFNDEF** statements may be nested to any depth though nesting more than two deep can make program maintenance very difficult.

$INCLUDE compiler directive

The **$INCLUDE** directive is used to direct the compiler to include text from another record. Include records may be in either directory or dynamic files.

$INCLUDE { *filename* } *record.id*

For compatibility with some other systems, **$INSERT** may be used as a synonym for **$INCLUDE**.

Examples

```
$INCLUDE SYSCOM ERR.H
$INCLUDE MYKEYS.H
```

The first example includes record ERR.H from the SYSCOM file. The second example, which has no file name specified, includes MYKEYS.H from the same file as the source program.

Use of a .H suffix is recommended on include records as these will be skipped automatically by the compiler when using a select list.

The file name in the first **$INCLUDE** is not strictly necessary as the compiler will always look in SYSCOM if no file name is given and the include record is not found in the same file as the source program.

Because directory files on non-Windows platforms have case sensitive record names, the compiler will look for the record name as entered and then, if it has not been found, in uppercase. Thus programs may be written in either upper or lowercase if the records are always stored with uppercase name. The standard include records in the SYSCOM file follow this rule.

Include files may be nested (one included from within another) though this can lead to difficulties when maintaining complex programs and is discouraged.

For compatibility with other multivalue databases, the **$INCLUDE** directive can also be written without the $ prefix. Used in this way, it must be the only statement on the source line.

$LIST compiler directive

The **$LIST** directive can be used to start, suspend and resume generation of a listing of the program and any associated error messages. The format of this directive is

$LIST {**ON**}

$LIST OFF

The listing is directed to a record of the same name as the program source but with a suffix of .LIS. Any existing listing record is deleted by the compiler at the start of compilation regardless of whether a new listing is to be produced.

A **$LIST ON** directive in the main program starts generation of a listing record from that point onwards. The compiler LISTING option is equivalent to a **$LIST ON** at the start of the program.

A **$LIST OFF** directive stops generation of the listing record. If this is on an include record, listing will resume on return to the source or include record from which it was entered.

A **$LIST ON** directive in an include record only resumes generation of the listing record if listing was active when processing of the include record began.

$MODE compiler directive

The **$MODE** directive enables language options for improved compatibility with other multi-value databases.

$MODE *option*

where

option	is the feature to be turned on

The available options are:

DEFAULT	Turn off all options.
CASE.SENSITIVE	Enables case sensitivity for names of labels, variables and user defined functions.
COMPATIBLE.APPEND	Modifies the behaviour of the append modes of the S<*f*,*v*, *sv*> assignment operator, the **INS** statement and the **INSERT()** and **REPLACE()** functions to match that of other multivalue products.
COMPOSITE.READNEXT	Modifies how a **READNEXT** statement handles exploded select lists.
FOR.STORE.BEFORE.TEST	Stores the new value of the control variable in a **FOR/NEXT** construct before testing the end condition.
OPTIONAL.FINAL.END	Suppresses the warning message if there is no **END** statement at the end of the program.
PICK.ENTER	Pick style processing of **ENTER**.
PICK.ERRMSG	Pick style syntax for **STOP** and **ABORT**.
PICK.JUMP.RANGE	Causes the **ON GOSUB** and **ON GOTO** statements to continue at the next statement if the index value is out of range.
PICK.MATRIX	Create Pick style matrices. See the **COMMON** and **DIMENSION** statements for a discussion of the implications of this mode.
PICK.READ	Causes **READ**, **READL**, **READU**, **READV**, **READVU** and **READVL** statements to take on the Pick style behaviour in which the target variable is left unchanged if the record is not found.
PICK.SUBSTR	Causes substring assignment operations to take on the Pick style behaviour in which the variable is extended by adding trailing spaces if the region to be overwritten is beyond the end of the current string value.
PICK.SUBSTR.ASSIGN	Causes substring assignment operations to take on the full Pick style behaviour as described under Assignment Statements. Setting this mode overrides the PICK.SUBSTR mode.

PRCLOSE.DEFAULT.0	**PRINTER CLOSE** defaults to printer 0 rather than closing all printers.
SELECTV	Changes the action of **SELECT** to be as for **SELECTV**.
STRING.LOCATE	Numeric data in right aligned **LOCATE** is not treated as a special case.
TRAP.UNUSED	Displays a warning about variables that are assigned a value but never used.
UNASSIGNED.COMMON	Variables in common blocks are created unassigned instead of being initialised to zero.
UV.LOCATE	UniVerse Ideal / Reality flavour style **LOCATE**.

Prefixing a mode name (other than DEFAULT) with a minus sign turns off the named option.

Default modes can be set by creating a record named $BASIC.OPTIONS in the source file or in the VOC. Details of how to do this can be found with the description of the **BASIC** command.

Examples

```
$MODE TRAP.UNUSED
FUNCTION INV.CLI(INV.REC)
   CLEINT.NO = INV.REC<4>
   IF CLIENT.NO = '' THEN CLIENT.NO = INV.REC<18>
   RETURN CLIENT.NO
END
```

The above program contains a typographical error in the spelling of the first use of CLIENT.NO. Because it has been compiled with the TRAP.UNUSED option, the compiler will display a warning message that the CLEINT.NO variable is assigned but never used.

```
PROGRAM INVOICE
FOR I = 1 TO 3
NEXT I
DISPLAY "I on exit = " : I
END
```

The above program displays the loop exit value as being 3 whereas the program below uses the FOR.STORE.BEFORE.TEST mode and displays the loop exit value as being 4.

```
$MODE FOR.STORE.BEFORE.TEST
PROGRAM INVOICE
FOR I = 1 TO 3
NEXT I
DISPLAY "I on exit = " : I
END
```

$NO.CATALOGUE compiler directive

$NO.CATALOGUE

The **$NO.CATALOGUE** directive (or the American spelling **$NO.CATALOG**) specifies that a QMBasic program is not to be catalogued where the $BASIC.OPTIONS record includes a CATALOGUE entry that would otherwise cause the module to be catalogued automatically.

See also:
$CATALOGUE, **$BASIC.OPTIONS**

$NOCASE.STRINGS compiler directive

$NOCASE.STRINGS

Compiles the program using case insensitive string operations. This directive must appear before any executable statements in the program source and applies to the entire program module.

Selecting case insensitive string mode affects the relational operators (=, #, <, >, <=, >=), their multivalue function equivalents (**EQS()**, **NES()**, **LTS()**, **GES()**, **LES()**, **GES()**), the **CHANGE()**, **CONVERT()**, **COUNT()**, **DCOUNT()**, **FIELD()**, **INDEX()** and **SWAP()** functions and the **CONVERT**, **FIND**, **FINDSTR** and **LOCATE** statements.

$QMCALL compiler directive

For processes running with the **QMCLIENT** configuration parameter set to 2, this directive makes the subroutine in which it appears available for calling using the QMClient API **QMCall** function.

By using the **QMCLIENT** configuration parameter and this directive, it is possible to restrict the actions of a QMClient session thus allowing tighter control of QMClient security.

6.3 QMBasic Limits

Number of local variables or elements in a matrix
Dependant on system swap file size.

Maximum file size
Dynamic files may have up to 2147483647 groups (16384Gb with 8kb group size) unless a lower limit is imposed by the underlying operating system.

Maximum string size
There is effectively no limit imposed by QMBasic. The actual limit will be determined by the total dynamic memory size which must be mapped to the swap file.

Number of open files
The underlying operating system may impose a limit on the number of files which may be open simultaneously. QMBasic provides an automated file sharing scheme whereby files may be closed at the operating system level if the limit is reached. QMBasic will save details of the file which has been closed and will reopen it automatically when required.

This scheme provides access to a virtually unlimited number of files but can have severe performance effects when many files are used in frequent rotation.

Maximum precision
14 decimal places

Maximum variable name or statement label length
No limit

Maximum characters in a string constant
No limit though long string constants are broken into fragments of no more than 255 characters by the compiler and reassembled at run time.

Maximum arguments to a subroutine
255

Maximum labels in an ON GOSUB or ON GOTO
65535

Maximum characters in a catalogue call name
63 (32 for trigger functions)

Maximum characters in a record id
Default 63 but can be increased up to 255 using the **MAXIDLEN** configuration parameter.

6.4 QMBasic Statements and Functions by Name

@(x,y)	Terminal cursor movement and control
ABORT	Abort to command prompt
ABORTE	Abort to command prompt with Pick style message handling
ABORTM	Abort to command prompt with Information style message handling
ABS()	Absolute value
ABSS()	Multi-valued absolute value
ACCEPT.SOCKET.CONNECTION()	Accept an incoming connection on a server socket
ACOS()	Arc-cosine
ALPHA()	Test if string holds only alphabetic characters
ANDS()	Multi-valued logical AND
ARG()	Returns an argument variable based on its argument list position
ARG.COUNT()	Returns the number of arguments passed into a subroutine
ASCII()	Convert an EBCDIC string to ASCII
ASIN()	Arc-sine
ASSIGNED()	Test whether variable is assigned
ATAN()	Arc-tangent
BEGIN TRANSACTION	Start a new transaction
BINDKEY()	Set, remove, query, save or restore key bindings
BITAND()	Bitwise logical AND operation
BITNOT()	Bitwise logical NOT operation
BITOR()	Bitwise logical OR operation
BITRESET()	Turn off specified bit
BITSET()	Turn on specified bit
BITTEST()	Test specified bit
BITXOR()	Bitwise logical exclusive OR operation
BREAK	Enable or disable break key handling
CALL	Call an external subroutine
CASE	Perform statements according to multiple conditions
CATALOGUED()	Check catalogue entry
CATS()	Concatenate elements of a dynamic array
CHAIN	Terminate program and execute a command
CHANGE()	Replace substring in a string
CHAR()	Get ASCII character for a given collating sequence value
CLASS	Declare a class module
CLEAR	Set all local variables to zero
CLEARCOMMON	Set all unnamed common variables to zero
CLEARDATA	Clear DATA queue
CLEARFILE	Clear a file, deleting all records and releasing disk space
CLEARINPUT	Clear keyboard type-ahead
CLEARSELECT	Clear one or all select lists
CLOSE	Close a file
CLOSESEQ	Close a record opened for sequential access
CLOSE.SOCKET	Close a socket
COL1()	Start of substring position from FIELD()
COL2()	End of substring position from FIELD()
COMMIT	Commit transaction updates
COMMON	Define a common block
COMPARE()	Compare strings
CONFIG()	Returns the value of a configuration parameter
CONNECT.PORT()	Connect a serial port to a phantom process

CONTINUE	Continue next iteration of a loop
CONVERT	Substitute characters with replacements
CONVERT()	Substitute characters with replacements
COS()	Cosine
COUNT()	Count occurrences of substring in string
COUNTS()	Multi-valued variant of COUNT()
CREATE	Create an empty sequential file record
CREATE.FILE	Create a file
CREATE.SERVER.SOCKET()	Open a server socket
CROP()	Remove redundant mark characters
CRT	Synonym for DISPLAY
CSVDQ()	Dequote a CSV string
DATA	Save text in DATA queue
DATE()	Return the current date as a day number
DCOUNT()	Count delimited substrings in string
DEBUG	Enter debugger
DECRYPT()	Decrypt text
DEFFUN	Define a function
DEL	Delete a field, value or subvalue
DELETE	Delete record from a file
DELETE()	Delete a field, value or subvalue
DELETELIST	Delete a saved select list
DELETESEQ	Delete an operating system file
DELETEU	Delete record from a file preserving locks
DIM	Synonym for DIMENSION
DIMENSION	Set matrix dimensions
DISINHERIT	Disinherit an object
DISPLAY	Output to the display
DIR()	Return the contents of a directory
DIV()	Divide
DOWNCASE()	Convert string to lowercase
DPARSE	Split elements of a delimited string
DPARSE.CSV	Split elements of a CSV format delimited string
DQUOTE()	Synonym for QUOTE()
DTX()	Convert a number to hexadecimal
EBCDIC()	Convert an EBCDIC string to ASCII
ECHO	Enable or disable input echo
ENCRYPT()	Encrypt data
END	Terminate program or statement group
END TRANSACTION	Terminate a transaction
ENTER	Synonym for CALL
ENV()	Retrieve an operating system environment variable
EQS()	Multi-valued equality test
EQUATE	Define a symbolic name for a constant or matrix element
ERRMSG	Display a Pick style message from the ERRMSG file
EXECUTE	Execute a command
EXIT	Leave a loop
EXP()	Exponential
EXTRACT()	Extract a field, value or subvalue
FIELD()	Extract delimited fields
FIELDS()	Multi-valued variant of FIELD()
FIELDSTORE()	Replace or insert delimited fields
FILE	Open a file and access data by field name
FILEINFO()	Return information about an open file

FILELOCK	Lock a file
FILEUNLOCK	Unlock a file
FIND	Find a string in a dynamic array element
FINDSTR	Find a substring in a dynamic array element
FLUSH	Flush sequential file data to disk
FMT()	Format a string
FMTS()	Format a dynamic array
FOLD()	Break a string into sections, splitting at spaces where possible
FOLDS()	Multi-valued variant of FOLD()
FOOTING	Set footing text
FOR / NEXT	Iterative loop construct
FORMLIST	Create a select list from a dynamic array
FUNCTION	Declare function name and arguments
GES()	Multi-valued greater than or equal to test
GETLIST	Restore a saved select list
GET.MESSAGES()	Retrieve messages from the message queue
GET.PORT.PARAMS()	Get serial port parameters
GETNLS()	Get national language support parameter value
GETPU	Get a characteristic of a print unit
GETREM()	Get remove pointer position
GO / GOTO	Jump to a label
GOSUB	Enter an internal subroutine
GTS()	Multi-valued greater than test
HEADING	Set heading text
HUSH	Suppress or enable display output
ICONV()	Perform input conversion
ICONVS()	Perform input conversion on a dynamic array
IDIV()	Integer division
IF / THEN / ELSE	Perform conditional statements
IFS()	Multi-valued conditional expression
INDEX()	Locate occurrence of substring within a string
INDEXS()	Multi-valued equivalent of INDEX()
INDICES()	Return information about alternate key indices
INHERIT	Inherit an object
INMAT()	Return status of matrix operations
INPUT	Input a string from the keyboard or data queue
INPUT @	Input a string from the keyboard or data queue
INPUTCLEAR	Synonym for CLEARINPUT
INPUTCSV	Input CSV format data
INPUTERR	Synonym for PRINTERR
INPUTFIELD	Input a string with function key handling
INS	Insert a field, value or subvalue
INSERT()	Insert a field, value or subvalue
INT()	Truncate value to integer
ITYPE()	Execute a compiled I-type
KEYCODE()	Input a single keystroke from the keyboard with terminfo translation
KEYEDIT	Define editing keys for INPUT @
KEYEXIT	Define exit keys for INPUT @
KEYIN()	Input a single keystroke from the keyboard
KEYINC()	Input a single keystroke from the keyboard with case inversion
KEYINR()	Input a single keystroke from the keyboard in raw mode (no internal processing)
KEYREADY()	Test for keyboard input

KEYTRAP	Define trap keys for INPUT @
LEN()	Return length of a string
LENS()	Multi-valued equivalent of LEN()
LES()	Multi-valued less than test
LISTINDEX()	Return position of an item in a delimited list
LN()	Natural log
LOCATE	Locate string in dynamic array
LOCATE()	Locate string in dynamic array
LOCK	Set task lock
LOGMSG	Add an entry to the system error log
LOOP / REPEAT	Define a loop to be repeated
LOWER()	Convert delimiters to lower level
LOCAL	Declares an internal subroutine or function that has private local variables
LTS()	Multi-valued less than or equal to test
MARK.MAPPING	Control field mark translation in directory files
MAT	Matrix initialisation or copy
MATBUILD	Build a dynamic array from matrix elements
MATCHFIELD()	Return portion of string matching pattern
MATPARSE	Break a dynamic array into matrix elements
MATREAD	Read a record, parsing into a matrix
MATREADCSV	Read a CSV format text item into a matrix
MATREADL	Read a record setting a read lock, parsing into a matrix
MATREADU	Read a record setting an update lock, parsing into a matrix
MATWRITE	Write a record from matrix elements
MATWRITEU	Write a record from matrix elements, retaining any lock
MAX()	Returns the greater of two values
MAXIMUM()	Find the greatest value in a dynamic array
MIN()	Returns the lesser of two values
MINIMUM()	Find the lowest value in a dynamic array
MOD()	Modulus value from division
MODS()	Multi-valued modulus value from division
NAP	Suspend program for a short period
NEG()	Arithmetic inverse
NEGS()	Multi-valued arithmetic inverse
NES()	Multi-valued inequality test
NOBUF	Turn off buffering for a record opened using OPENSEQ
NOT()	Logical NOT
NOTS()	Multi-valued logical NOT
NULL	No operation
NUM()	Test if string holds a numeric value
NUMS()	Multi-valued variant of NUM()
OBJECT()	Instantiates an object
OBJINFO()	Returns information about an object variable
OCONV()	Perform output conversion
OCONVS()	Perform output conversion on a dynamic array
ON GOSUB	Jump to one of a list of labels selected by value
ON GOTO	Enter one of a list of internal subroutines selected by value
OPEN	Open a file
OPENPATH	Open a file by pathname
OPENSEQ	Open a record for sequential access
OPEN.SOCKET()	Open a socket connection
ORS()	Multi-valued logical OR
OS.ERROR()	Return operating system error information

OS.EXECUTE	Execute an operating system command
OUTERJOIN()	Fetch data from a file using an "outer join"
PAGE	Start a new page
PAUSE	Pause execution until awoken by another process
PERFORM	Synonym for EXECUTE
PRECISION	Set number of decimal places in numeric conversion
PRINT	Output to a logical print unit
PRINTER CLOSE	Close a print unit
PRINTER DISPLAY	Associate a print unit with the display
PRINTER FILE	Associate a file with a print unit
PRINTER NAME	Associate a print device with a print unit
PRINTER OFF	Disable print unit zero
PRINTER ON	Enable print unit zero
PRINTER RESET	Reset default print unit and display
PRINTER SETTING	Set a print unit parameter
PRINTER.SETTING()	Set or retrieve a print unit parameter
PRINTERR	Display an error message
PRIVATE	Declare private variables in a local subroutine or a class modules
PROCREAD	Read data from the PROC primary input buffer
PROCWRITE	Write data to the PROC primary input buffer
PROGRAM	Declare program name
PROMPT	Set the input prompt character
PUBLIC	Declare public properties in a class module
PWR()	Raise value to power
QUOTE()	Enclose a string in quotes
RAISE()	Convert delimiters to higher level
RDIV()	Rounded integer division
READ	Read a record from a file
READBLK	Read bytes from a sequential file
READCSV	Read a CSV format text item
READL	Read a record from a file, setting a read lock
READLIST	Save a select list in a dynamic array
READNEXT	Read a record id from a select list
READSEQ	Read from a sequential file
READU	Read a record from a file, setting an update lock
READV	Read a field from a record in a file
READVL	Read a field from a record in a file, setting a read lock
READVU	Read a field from a record in a file, setting an update lock
READ.SOCKET()	Read data from a socket
RECORDLOCKED()	Test if record is locked
RECORDLOCKL	Set a read lock on a record
RECORDLOCKU	Set an update lock on a record
RELEASE	Release record or file locks
REM()	Remainder value from division
REMARK	Alternative syntax for comments
REMOVE	Remove an item from a dynamic array
REMOVE()	Remove an item from a dynamic array
REPLACE()	Replace a field, value or subvalue
RESTORE.SCREEN	Restore screen image data
RETURN	Return from program or subroutine
RETURN TO	Return from program or subroutine to a specific label
REUSE()	Reuse element of numeric arrays in mathematical functions
RND()	Generate random number
ROLLBACK	Discard transaction updates

RQM	Synonym for SLEEP
RTRANS()	Fetch data from a file
SAVE.SCREEN()	Save screen image data
SAVELIST	Save a select list in the $SAVEDLISTS file
SEEK	Position a sequential file
SELECT	Build a select list of all records in an open file
SELECTE	Transfer select list 0 to a select list variable
SELECTINDEX	Build a select list from an alternate key index
SELECTINFO()	Return information regarding a select list
SELECTLEFT	Scan left through an alternate key index
SELECTN	Build a numbered select list of all records in an open file
SELECTRIGHT	Scan right through an alternate key index
SELECTV	Build a select list variable of all records in an open file
SENTENCE()	Returns the command line that started the current program
SEQ()	Get collating sequence value for a given ASCII character
SERVER.ADDR()	Find the IP address for a given server name
SET.ARG	Sets an argument variable based on its argument list position
SET.EXIT.STATUS	Set final exit status value
SET.PORT.PARAMS()	Set serial port parameters
SET.SOCKET.MODE()	Set mode of a socket
SETLEFT	Set alternate key index scan position to leftmost
SETNLS()	Set national language support parameter value
SETPU	Set a characteristic of a print unit
SETRIGHT	Set alternate key index scan position to rightmost
SETREM	Set remove pointer position
SHIFT()	Perform bit shift
SIN()	Sine
SLEEP	Suspend program to / for given time
SOCKET.INFO()	Retrieve information about a socket
SOUNDEX()	Form a soundex code value for a string
SOUNDEXS()	Multi-valued variant of SOUNDEX()
SPACE()	Create a string of spaces
SPACES()	Multi-valued variant of SPACE()
SPLICE()	Concatenates elements of two dynamic arrays, inserting a string between the items.
SQRT()	Square root
SQUOTE()	Enclose a string in single quotes
SSELECT	Build a sorted select list of all records in an open file
STATUS()	Return status from previous operation
STATUS	Returns a dynamic array of information about an open file
STOP	Terminate program
STOPE	Terminate program with Pick style message handling
STOPM	Terminate program with Information style message handling
STR()	Create a string from a repeated substring
STRS()	Multi-valued variant of STR()
SUBR()	Call a subroutine as a function
SUBROUTINE	Declare subroutine name and arguments
SUBSTITUTE()	Multi-valued substring replacement
SUBSTRINGS()	Multi-valued substring extraction
SUM()	Sum lowest level elements of a numeric array
SUMMATION()	Sum all elements of a numeric array
SWAP()	Synonym for CHANGE()
SWAPCASE()	Invert case of alphabetic characters in a string
SYSTEM()	Return system information

TAN()	Tangent
TCLREAD	Returns the sentence that started the current program
TERMINFO()	Retrieve information from the terminfo database
TIME()	Return the current time
TIMEDATE()	Return the date and time as a string
TIMEOUT	Sets a timeout for READBLK and READSEQ
TRANS()	Fetch data from a file
TRANSACTION ABORT	Abort a transaction
TRANSACTION COMMIT	Commit a transaction
TRANSACTION START	Start a new transaction
TRIM()	Trim characters from string
TRIMB()	Trim spaces from back of string
TRIMBS()	Multi-valued variant of TRIMB()
TRIMF()	Trim spaces from front of string
TRIMFS()	Multi-valued variant of TRIMF()
TRIMS()	Multi-valued variant of TRIM()
TTYGET()	Get current terminal mode settings
TTYSET	Set terminal modes
UNASSIGNED()	Test whether variable is unassigned
UNLOCK	Release task lock
UNTIL	Leave loop if condition is met
UPCASE()	Convert string to uppercase
VSLICE()	Extract a value slice from a dynamic array
WAKE	Restart execution of a process on a PAUSE
WEOFSEQ	Write end of file position to sequential file
WHILE	Leave loop unless condition is met
WRITE	Write a record to a file
WRITEBLK	Write bytes to a sequential file
WRITECSV	Write CSV format data to a sequential file
WRITESEQ	Write to sequential file
WRITESEQF	Write to sequential file, flushing to disk
WRITEU	Write a record to a file, retaining any lock
WRITEV	Write a field to a record in a file
WRITEVU	Write a field to a record in a file, retaining any lock
WRITE.SOCKET()	Write data to a socket
VOID	Discard the result of evaluating an expression
XLATE()	Synonym for TRANS()
XTD()	Convert a hexadecimal number

@(x,y) Function

The @(*x*, *y*) function is used to control the format of displayed output.

Format

@(*col* {, *line*})	Cursor movement
@(*mode* {, *arg*})	Device control functions

where

col	evaluates to a display column position.
line	evaluates to a display line position.
mode	evaluates to a mode value as described below.
arg	provides qualifying information for use with some *mode* values.

The @(*x*, *y*) functions return string values which can be used in the same way as any other strings. They only take effect when the string is used in a **CRT**, **DISPLAY** or **PRINT** statements directed to the display. The actual value returned by the function is a control code to be sent to the terminal and is dependant on the type of terminal in use (see the **TERM** command).

When output is directed to a printer or to a file for later printing rather than to the display, escape sequences relevant to the printer may be used for formatting, etc. Because the @(*x*,*y*) function returns codes specific for the terminal in use, it is unlikely that these codes are relevant for printers.

Cursor Positioning

The @(*col* {, *line*}) format specifies that subsequent output is to appear at the given column and, optionally, line position. Columns and lines are numbered from zero where the top left of the screen is line 0, column 0. The effect of attempting to move to a cursor position outside the display area is undefined.

Use of the @(*col* {, *line*}) function disables screen pagination (automatic display of the "Press return to continue" prompt after each screen of output). Pagination remains disabled until the program executes the **PRINTER RESET** statement or return to the command prompt.

Use of the **EXECUTE** statement enables screen pagination, executes the command(s) and then restores pagination to its state when the **EXECUTE** was performed.

Special Functions

@(*x*, *y*) functions with negative values of *x* are used to provide a variety of control functions. These are largely in common with the functions defined for other systems. The token names shown in the table below are defined in the KEYS.H include record in the SYSCOM file.

Functions not supported by the terminal device in use return a null string and hence will be ignored.

Note that individual terminal types may place restrictions on use of display attributes such as flashing, underline, colour, etc. For example, although each attribute has a corresponding start and end control code pair, many terminals can only apply a single attribute to any particular screen region.

Display attributes are also implemented in two fundamentally distinct ways. Most modern terminals maintain an attribute for each character position on the display and data is stored by the terminal using the currently active attributes regardless of any intervening cursor movements. On some other terminals, the code sent by an @() function to set or clear an attribute occupies a character position on the screen. Starting at the top left of the screen and working row by row through each character position, the attributes of any particular character are determined by the most recent attribute setting encountered.

For example,

```
DISPLAY @(-1):@(-15):'ABC':@(-16):'DEF'
```

on a terminal that stores the attribute for each character position would result in a display of

```
ABCDEF
```

whereas a terminal that uses a character cell to store the attribute would display

```
ABC DEF
```

Furthermore, if the program then executed

```
DISPLAY @(3,0):'X'
```

the first terminal would display

```
ABCXEF
```

but the second would display

```
ABCXDEF
```

with the underline extending to the end of the screen or the next cell holding an attribute setting.

Value	**Token**	**Function**	**Argument**
-1	IT$CS	Clear screen	
-2	IT$CAH	Cursor home	
-3	IT$CLEOS	Clear to end of screen	
-4	IT$CLEOL	Clear to end of line	
-5	IT$SBLINK	Start flashing text	
-6	IT$EBLINK	End flashing text	
-9	IT$CUB	Backspace	No of characters (default 1)
-10	IT$CUU	Cursor up	No of lines (default 1)
-11	IT$SHALF	Start half brightness	
-12	IT$EHALF	End half brightness	
-13	IT$SREV	Start reverse video	
-14	IT$EREV	End reverse video	
-15	IT$SUL	Start underline	
-16	IT$EUL	End underline	
-17	IT$IL	Insert line	No of lines (default 1)
-18	IT$DL	Delete line	No of lines (default 1)
-19	IT$ICH	Insert character	No of characters (default 1)

-22	IT$DCH	Delete character	No of characters (default 1)
-23	IT$AUXON	Turn on printer	
-24	IT$AUXOFF	Turn off printer	
-29	IT$E80	Set 80 column mode	
-30	IT$E132	Set 132 column mode	
-31	IT$RIC	Reset inhibit cursor	
-32	IT$SIC	Inhibit cursor	
-33	IT$CUD	Cursor down	No of lines (default 1)
-34	IT$CUF	Cursor forward	No of characters (default 1)
-37	IT$FGC	Set foreground colour	Colour
-38	IT$BGC	Set background colour	Colour
-54	IT$SLT	Set line truncation	
-55	IT$RLT	Reset line truncation	
-58	IT$SBOLD	Set bold mode	
-59	IT$RBOLD	Reset bold mode	
-100 to -107	User definable via the u0 to u7 terminfo keys		
-108	IT$ACMD	Asynchronous command	Command to execute
-109	IT$SCMD	Synchronous command	Command to execute
-250	IT$STYLUS	Enable/disable stylus taps	0 = disable, 1 = enable (PDA)
-251	IT$KEYS	Display/hide screen keyboard	0 = hide, 1 = display (PDA)

Descriptions

IT$CS (Clear screen)
The screen is cleared to the current background colour. The cursor is positioned at the top left of the screen (position 0,0).

IT$CAH (Cursor home)
The cursor is positioned at the top left of the screen (position 0,0).

IT$CLEOS (Clear to end of screen)
All screen positions between the current cursor position and the end of the screen are cleared. Some terminal devices/emulators set the cleared character positions to have the current background colour.

IT$CLEOL (Clear to end of line)
All screen positions between the current cursor position and the end of the line are cleared. Some terminal devices/emulators set the cleared character positions to have the current background colour.

IT$CUB (Backspace)
The cursor moves left by the number of positions specified in the second argument which defaults to

one or until the left edge of the screen is reached.

IT$CUU (Cursor up)
The cursor moves up by the number of lines specified in the second argument which defaults to one or until the top line of the screen is reached.

IT$SHALF (Start half brightness)
Displays subsequent data in half brightness (dim) mode.

IT$EHALF (End half brightness)
Terminates half brightness (dim) mode.

IT$SREV (Start reverse video)
If not already in reverse video mode, the foreground and background colours are interchanged for subsequent output. Selecting this mode does not directly affect any data which is already displayed.

IT$EREV (End reverse video)
If in reverse video mode, this operation reverts to the normal display colours for subsequent text output.

IT$IL (Insert line)
The number of lines specified in the second argument (default value one) are inserted at the current cursor position. Data at the bottom of the screen will be lost. The newly inserted lines are set to the background colour.

IT$DL (Delete line)
The number of lines specified in the second argument (default value one) are deleted at the current cursor position. Blank lines are inserted at the bottom of the screen.

IT$ICH (Insert character)
The number of characters specified in the second argument (default value one) are inserted at the current cursor position. Data at the right of the screen will be lost.

IT$DCH (Delete character)
The number of characters specified in the second argument (default value one) are deleted at the current cursor position. Blanks are inserted at the right edge of the screen.

IT$AUXON (Turn on printer)
For terminals with attached printers, this mode directs output to the printer. The mc5 terminfo entry must be set correctly for this to work.

IT$AUXOFF (Turn off printer)
For terminals with attached printers, this mode turns off output to the printer. The mc4 terminfo entry must be set correctly for this to work.

IT$E80 (Set 80 column mode)
The display window is set to be 80 characters wide.

IT$E132 (Set 132 column mode)
The display window is set to be 132 characters wide.

IT$RIC (Reset inhibit cursor)
The cursor is displayed if it was previously inhibited.

IT$SIC (Inhibit cursor)
Display of the cursor is inhibited. All cursor positioning functions continue to work whilst the cursor is not visible.

IT$CUD (Cursor down)
The cursor moves down by the number of lines specified in the second argument which defaults to one or until the bottom line of the screen is reached.

IT$CUF (Cursor forward)
The cursor moves right by the number of positions specified in the second argument which defaults to one or until the right edge of the screen is reached.

IT$FGC (Set foreground colour)
The foreground colour is set according to the value of the second argument. This may be set using the tokens listed below from the KEYS.H record of the SYSCOM file.

IT$BLACK	0
IT$BLUE	1
IT$GREEN	2
IT$CYAN	3
IT$RED	4
IT$MAGENTA	5
IT$BROWN	6
IT$WHITE	7
IT$GREY	8
IT$BRIGHT.BLUE	9
IT$BRIGHT.GREEN	10
IT$BRIGHT.CYAN	11
IT$BRIGHT.RED	12
IT$BRIGHT.MAGENTA	13
IT$YELLOW	14
IT$BRIGHT.WHITE	15

Some terminal emulators provide the ability to map these colour values to an alternative colour palette. The terminfo COLOURMAP setting can be used to translate the internal QM values listed above to an alternative set relevant to a specific terminal emulator.

IT$BGC (Set background colour)
The background colour is set according to the value of the second argument. This may be set using the tokens from the KEYS.H record of the SYSCOM file as listed above.

IT$SLC (Set line truncation)
With this mode enabled, the cursor does not automatically move to a new line when data is displayed in the final column of the screen. Any further output on the line will overwrite the final character.

IT$RLT (Reset line truncation)
Clears line truncation mode so that the cursor automatically moves to a new line when data is displayed in the final column of the screen.

IT$ACMD (Asynchronous command)
Executes the given command on the client system without suspending the QM session. This operation depends on correct setting of the terminfo u8 token.

IT$SCMD (Synchronous command)
Executes the given command on the client system, suspending the QM session until the command completes. This operation depends on correct setting of the terminfo u9 token.

IT$STYLUS (Enable/disable stylus taps)
Applicable only to QM on a PDA, this operation allows an application to receive stylus taps via input operations. When enabled, a stylus tap appears as char(200) (K$MOUSE) followed by the column and row coordinates separated by a comma and terminated with a carriage return. Set the second argument to a non-zero value to enable stylus taps, zero to disable them. Stylus input is disabled by default when QM starts.

IT$KEYS (Display/hide screen keyboard)
Applicable only to QM on a PDA, this operation displays or hides the on screen keyboard. Set the second argument to a non-zero value to show the keyboard, zero to hide it.

Examples

```
DISPLAY @(IT$CS) : @(34,10) : "Please wait" :
```

This statement clears the screen and displays "Please wait" .

```
DISPLAY @(IT$FGC, IT$BRIGHT.RED) : "Error " : STATUS()
```

This statement displays the value of the **STATUS()** function in bright red. Further output to the display will continue to be in this colour until the foreground colour is reset.

ABORT

The **ABORT** statement terminates the current program, returning to the command prompt. **ABORTE** and **ABORTM** provide compatibility with other multivalue database products.

Format

ABORT {*print.list*}

where

print.list	evaluates to the message to be displayed. This is of the form described under the **DISPLAY** statement.

If an ON.ABORT paragraph is defined in the VOC, this will be executed before the command prompt is issued.

The program location at which the abort was generated will be reported unless the SUPPRESS.ABORT.MSG option has been set using the **OPTION** command.

Because **ABORT** terminates all active programs, menus, paragraphs, etc., it should only be used to handle error conditions.

The Pick syntax of ABORT can be enabled by including a line

```
$MODE PICK.ERRMSG
```

in the program before the first ABORT statement. In this syntax, the ABORT statement becomes

ABORT {*msg.id* {**,** *arg...*}}

where

msg.id	evaluates to the id of a record in the ERRMSG file which holds the message to be displayed. If this id is numeric, it will be copied to @SYSTEM.RETURN.CODE.
arg...	is an optional comma separated list of arguments to be substituted into the message.

See the **ERRMSG** statement for a description of the ERRMSG file message format.

The **ABORTE** statement always uses Pick style message handling and the **ABORTM** statement always uses Information style message handling, regardless of the setting of the PICK.ERRMSG option.

Examples

```
IF NO.OF.ENTRIES = 0 THEN ABORT
```

This statement aborts to the command prompt if the value of the variable NO.OF.ENTRIES is zero. No error message is printed. **ABORT** statements without error text messages can result in difficult diagnostic work to locate faults.

```
OPEN "STOCK.FILE" TO STOCK ELSE
   ABORT "Cannot open STOCK.FILE - Error " : STATUS()
END
```

This program fragment attempts to open a file named STOCK.FILE. If the open fails, the program displays an error message and aborts to the command prompt.

See also:
STOP

ABS()

The **ABS()** function returns the absolute (positive) value of a numeric expression.

The **ABSS()** function is similar to **ABS()** but operates on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

ABS(*expr***)**

where

expr evaluates to a number or a numeric array.

The **ABS()** function returns the absolute value of *expr*. If *expr* is positive or zero, the value of **ABS(***expr***)** is *expr*. If *expr* is negative, the value of **ABS(***expr***)** is -*expr*.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **ABS()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

Examples

```
DIFF = ABS(A - B)
```

This statement assigns DIFF to the difference in value of A and B. The result is positive regardless of which value is the greater.

A contains 11FM-2VM-8VM4

```
B = ABS(A)
```

B now contains 11FM2VM8VM4

ACCEPT.SOCKET.CONNECTION()

The **ACCEPT.SOCKET.CONNECTION()** function opens a data socket on a server to handle an incoming connection.

Format

ACCEPT.SOCKET.CONNECTION(*srvr.skt***,** *timeout***)**

where

srvr.skt is the server socket created by an earlier use of **CREATE.SERVER.SOCKET**.

timeout is the timeout period in milliseconds. A value of zero implies no timeout.

The **ACCEPT.SOCKET.CONNECTION()** function waits for an incoming connection on a previously created server socket and returns a new data socket for this connection.

If the action is successful, the function returns a socket variable that can be used to read and write data using the **READ.SOCKET()** and **WRITE.SOCKET()** functions. The **STATUS()**function will return zero.

If the socket cannot be opened, the **STATUS()** function will return an error code that can be used to identify the cause of the error. If no connection arrives before the *timeout* period expires, the error code will be ER$TIMEOUT as defined in the SYSCOM ERR.H include record.

Example

```
SRVR.SKT = CREATE.SERVER.SOCKET("", 0)
IF STATUS() THEN STOP 'Cannot initialise server socket'
SKT = ACCEPT.SOCKET.CONNECTION(SRVR.SKT, 0)
IF STATUS() THEN STOP 'Error accepting connection'
DATA = READ.SOCKET(SKT, 100, SKT$BLOCKING, 0)
CLOSE.SOCKET SKT
CLOSE.SOCKET SRVR.SKT
```

This program fragment creates a server socket, waits for an incoming connection, reads a single data packet from this connection and then closes the sockets.

See also:
CLOSE.SOCKET, **CREATE.SERVER.SOCKET()**, **OPEN.SOCKET()**, **READ.SOCKET()**, **SERVER.ADDR()**, **SET.SOCKET.MODE()**, **SOCKET.INFO()**, **WRITE.SOCKET()**

ACOS()

The **ACOS()** function returns the arc-cosine (inverse cosine) of a value.

Format

ACOS(*expr***)**

where

expr evaluates to a number or a numeric array.

The **ACOS()** function returns the arc-cosine of *expr*. Angles are measured in degrees.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **ACOS()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

Examples

```
ANGLE = ACOS(ADJ / HYP)
```

This statement finds the angle with cosine equal to the value of ADJ / HYP and assigns this to variable ANGLE.

See also:
ASIN(), **ATAN()**, **COS()**, **SIN()**, **TAN()**

ALPHA()

The **ALPHA()** function tests whether a string contains only alphabetic characters.

Format

ALPHA(*string***)**

where

string evaluates to the string to be tested.

The **ALPHA()** function returns true (1) if *string* contains only alphabetic characters (A to Z, a to z). The function returns false (0) for a null string or a string that contains non-alphabetic characters.

Use of **ALPHA()** is equivalent to using pattern matching against a pattern of "1A0A".

Example

```
LOOP
   DISPLAY "Enter surname ":
   INPUT NAME
WHILE NOT(ALPHA(NAME))
   PRINTERR "Name is invalid"
REPEAT
```

This program fragment prompts for and inputs a name. If the name is null or contains non-alphabetic characters, an error message is displayed and the prompt is repeated.

ANDS()

The **ANDS()** function performs a logical AND operation on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

ANDS(*expr1***,** *expr2***)**

where

expr1, *expr2* are the dynamic arrays to be processed.

The **ANDS()** function performs the logical AND operation between corresponding elements of the two dynamic arrays and constructs a similarly structured dynamic array of results as its return value. An element of the returned dynamic array is 1 if both of the corresponding elements of *expr1* and *expr2* are true. Any value other than zero or a null string is treated as true.

The **REUSE()** function can be applied to either or both expressions. Without this function, any absent trailing values are taken as false.

Examples

A contains 1VM1SM0VM0VM1FM0VM1
B contains 1VM0SM1VM0VM1FM1VM0

```
C = ANDS(A, B)
```

C now contains 1VM0SM0VM0VM1FM0VM0

See also:
EQS(), **GES()**, **GTS()**, **IFS()**, **LES()**, **LTS()**, **NES()**, **NOTS()**, **ORS()**, **REUSE()**

ARG ()

The **ARG()** function returns and argument value based on its position in the argument list. It is intended for use with subroutines declared with the VAR.ARGS option.

Format

ARG(*n***)**

where

n is the argument list position, numbered from one.

Subroutines declared with the VAR.ARGS option may have a variable number of arguments. Although each argument must have a name assigned to it in the **SUBROUTINE** statement, it is often useful to be able to process a series of arguments by indexing this list.

The **ARG()** function returns the value of argument *n*. The actual number of arguments passed may be determined using the **ARG.COUNT()** function. Use of an argument position value less than one or greater than the number of arguments causes the program to abort.

Example

```
FUNCTION AVG(A,B,C,D,E) VAR.ARGS
   TOTAL = 0
   FOR I = TO ARG.COUNT()
      TOTAL += ARG(I)
   NEXT I
   RETURN TOTAL / ARG.COUNT()
END
```

The above function returns the average of the supplied arguments. Because this function is declared with the VAR.ARGS option, the **ARG.COUNT()** function is used to determine the actual number of arguments and the **ARG()** function is used to access each argument by its position.

See also:
ARG.COUNT(), **SET.ARG**

ARG.COUNT()

The **ARG.COUNT()** function returns the number of arguments passed into the current subroutine. It is intended for use with subroutines declared with the VAR.ARGS option.

Format

ARG.COUNT()

When a program calls a subroutine that has been declared with the VAR.ARGS option, the actual number of arguments passed may be fewer than the number of argument variables in the subroutine definition. The unused argument variables will be left unassigned. The **ARG.COUNT()** function allows a subroutine to determine the number of arguments that have been passed. See the **ARG()** function for a way to access arguments by their position in the argument list.

When used in a function, the value returned by **ARG.COUNT()** excludes the hidden return argument.

Example

```
FUNCTION AVG(A,B,C,D,E) VAR.ARGS
   TOTAL = 0
   FOR I = TO ARG.COUNT()
      TOTAL += ARG(I)
   NEXT I
   RETURN TOTAL / ARG.COUNT()
END
```

The above function returns the average of the supplied arguments. Because this function is declared with the VAR.ARGS option, the **ARG.COUNT()** function is used to determine the actual number of arguments and the **ARG()** function is used to access each argument by its position.

See also:
ARG(), **SET.ARG**

ASCII()

The **ASCII()** function converts an EBCDIC string to ASCII.

Format

ASCII(*expr***)**

where

expr evaluates to the string to be converted.

The **ASCII()** function returns the ASCII equivalent of the supplied EBCDIC string. Characters that have no ASCII equivalent are returned as question marks.

See also:
EBCDIC()

ASIN()

The **ASIN()** function returns the arc-sine (inverse sine) of a value.

Format

ASIN(*expr***)**

where

expr evaluates to a number or a numeric array.

The **ASIN()** function returns the arc-sine of *expr*. Angles are measured in degrees.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **ASIN()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

Example

```
ANGLE = ASIN(OPP / HYP)
```

This statement finds the angle with sine equal to the value of OPP / HYP and assigns this to variable ANGLE.

See also:
ACOS(), **ATAN()**, **COS()**, **SIN()**, **TAN()**

ASSIGNED()

The **ASSIGNED()** function tests whether a variable is assigned.

Format

ASSIGNED(*var***)**

where

var is the variable to be tested.

All QMBasic variables except those in common blocks are initially unassigned. Any attempt to use the contents of the variable in an expression would cause a run time error until such time as a value has been stored in it. The **ASSIGNED()** function allows a program to test whether a variable has been assigned, returning true (1) if it is assigned or (0) if it is unassigned.

Example

```
SUBROUTINE VALIDATE(ACCOUNT.CODE, ERROR)
   IF ASSIGNED(ACCOUNT.CODE) THEN
      ERROR = 0
      …processing code…
   END ELSE
      ERROR = 1
   END
   RETURN
END
```

This program fragment validates an account code. The use of the **ASSIGNED()** function prevents an abort if the variable has not been assigned.

See also:
UNASSIGNED()

ATAN()

The **ATAN()** function returns the arc-tangent (inverse tangent) of a value.

Format

ATAN(*expr***)**

where

expr evaluates to a number or a numeric array.

The **ATAN()** function returns the arc-tangent of *expr*. Angles are measured in degrees.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **ATAN()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

Example

```
ANGLE = ATAN(OPP / ADJ)
```

This statement finds the angle with tangent equal to the value of OPP / ADJ and assigns this to variable ANGLE.

See also:
ACOS(), ASIN(), COS(), SIN(), TAN()

BEGIN TRANSACTION

The **BEGIN TRANSACTION** statement marks the start of a new transaction.

Format

> **BEGIN TRANSACTION**
> {*statements*}
> **COMMIT / ROLLBACK**
> **...**
> **END TRANSACTION**

A transaction is a group of updates that must either be performed in their entirety or not at all. The **BEGIN TRANSACTION** statement starts a new transaction. All updates until a corresponding **END TRANSACTION** are cached and only applied to the database when a **COMMIT** statement is executed. Execution of the program then continues at the statement following the **END TRANSACTION**.

The **ROLLBACK** statement discards any cached updates and continues at the statement following the **END TRANSACTION**. A rollback is implied if the program executes the **END TRANSACTION** directly.

Deletes and writes inside a transaction will fail unless the program holds an update lock on the record or the file. All locks obtained inside the transaction are retained until the transaction terminates and are then released. Locks already owned when the transaction begins will still be present after the transaction terminates, even if the record is updated or deleted within the transaction.

Closing a file inside a transaction appears to work in that the file variable is destroyed though the actual close is deferred until the transaction terminates and any updates have been applied to the file. Rolling back the transaction will not reinstate the file variable.

Access to indices using **SELECTINDEX**, **SELECTLEFT** or **SELECTRIGHT** inside a transaction will not reflect any updates within the transaction as these have not been committed.

Updates to sequential records opened using **OPENSEQ** are not affected by transactions.

Transactions may be nested. If the **BEGIN TRANSACTION** statement is executed inside an active transaction, the active transaction is stacked and a new transaction commences. Termination of the new transaction reverts to the stacked transaction.

The following operations are banned inside transactions:
CLEARFILE
PHANTOM

Example

```
BEGIN TRANSACTION
   READU CUST1.REC FROM CUST.F, CUST1.ID ELSE ROLLBACK
   CUST1.REC<C.BALANCE> -= TRANSFER.VALUE
```

```
      WRITE CUST1.REC TO CUST.F, CUST1.ID

      READU CUST2.REC FROM CUST.F, CUST2.ID ELSE ROLLBACK
      CUST2.REC<C.BALANCE> += TRANSFER.VALUE
      WRITE CUST2.REC TO CUST.F, CUST2.ID
      COMMIT
   END TRANSACTION
```

The above program fragment transfers money between two customer accounts. The updates are only committed if the entire transaction is successful.

BINDKEY()

The **BINDKEY()** function sets, removes, queries, saves or restores key bindings.

Format

BINDKEY(*key.string***,** *action***)**

where

key.string The character sequence for the key to be bound, unbound or queried.

action identifies the action to be performed:

>= 0	Bind key to this code (0 to 255)
-1	Remove binding for *key.string*.
-2	Query binding for *key.string*.
-3	Save bindings.
-4	Restore bindings from *key.string*.
-5	Disables lone Esc key handling in **KEYCODE()**.
-6	Re-enables lone Esc key handling in **KEYCODE()**.

The **BINDKEY()** function used with an *action* value in the range 0 to 255 binds the key sequence in *key.string* to the given *action* value. This is the underlying mechanism of the **KEYEDIT**, **KEYEXIT** and **KEYTRAP** statements used to set up keys for special handling by **INPUT@** and **INPUTFIELD**. If successful, the function returns true (1) and the **STATUS()** function would return zero. If an error occurs, the function returns false(0) and the **STATUS()** function can be used to find the cause of the error:

1 Invalid *key.string*
2 Invalid *action*
3 *Key.string* conflicts with an existing binding

An *action* value of -1 removes any defined binding for *key.string*. Used in this mode, the function always returns true (1) even if there was no binding for this *key.string*.

An *action* value of -2 returns the action number bound to the given *key.string*. If there is no binding, the function returns -1.

An *action* value of -3 returns a string that contains all defined key bindings. The value of *key.string* is ignored. Programs should make no assumption about the format of this string as it may change between releases of QM.

An *action* value of -4 restores the bindings define in a *key.string* that was returned by a previous call to **BINDKEY()** with an action of -3. This action also restores the state of lone Esc key handling to its setting at the time when the key bindings were saved.

Actions -5 and -6 control whether the **KEYCODE()** function returns char(27) on detection of an incoming Escape character that is not followed by further characters. When this mode is enabled (which is the default), the Esc is returned by **KEYCODE()**. When disabled, the Esc is always treated as the start of a control sequence. These two action codes return true (1) if lone Esc key handling was previously enabled, or false (0) if it was previously disabled.

Because retrieval of a key binding returns -1 if the key is not bound, it is easy to save and restore a single key binding:

```
OLD.BINDING = BINDKEY(KEY.STRING, -2)
IF BINDKEY(KEY.STRING, NEW.ACTION) THEN ...
```

To restore the original binding, unbinding the key if there was no previous binding:

```
X = BINDKEY(KEY.STRING, OLD.BINDING)
```

To save and subsequently restore all bindings:

```
SAVED.KEYS = BINDKEY('', -3)
...rebind some keys and do some processing...
X = BINDKEY(SAVED.KEYS, -4)
```

See also:
INPUT@, **INPUTFIELD**, **KEYCODE()**, **KEYEDIT**, **KEYEXIT**, **KEYTRAP**

BITAND()

The **BITAND()** function forms the bitwise logical AND of two integer values.

Format

BITAND(*expr1***,** *expr2***)**

where

expr1 and *expr2* evaluate to integers

The **BITAND()** function converts *expr1* and *expr2* to 32 bit integers and performs a bit-by-bit logical AND to form a new integer value as the result.

The value of each bit in the result is 1 if same bit position in both of *expr1* and *expr2* is 1.

Example

```
IF BITAND(N, 1) THEN N += 1
```

This statement adds one to N if the least significant bit is 1. The effect is to round N to an even integer.

See also:
BITNOT(), **BITOR()**, **BITRESET()**, **BITSET()**, **BITTEST()**, **BITXOR()**, **SHIFT()**

BITNOT()

The **BITNOT()** function forms the bitwise logical NOT of an integer value.

Format

BITNOT(*expr***)**

where

expr evaluates to an integer.

The **BITNOT()** function converts *expr* to a 32 bit integer and forms a result value by inverting each bit.

Example

```
N = BITNOT(A)
```

This statement sets N to the logical inverse of A.

See also:
BITAND(), BITOR(), BITRESET(), BITSET(), BITTEST(), BITXOR(), SHIFT()

BITOR()

The **BITOR()** function forms the bitwise logical OR of two integer values.

Format

BITOR(*expr1***,** *expr2***)**

where

expr1 and *expr2* evaluate to integers

The **BITOR()** function converts *expr1* and *expr2* to 32 bit integers and performs a bit-by-bit logical OR to form a new integer value as the result.

The value of each bit in the result is 1 if same bit position in one or both of *expr1* and *expr2* is 1.

Example

```
FLAGS = BITOR(FLAGS, 8)
```

This statement sets the bit with integer value 8 in the FLAGS variable.

See also:
BITAND(), **BITNOT()**, **BITRESET()**, **BITSET()**, **BITTEST()**, **BITXOR()**, **SHIFT()**

BITRESET()

The **BITRESET()** function turns off a specified bit in an integer value.

Format

BITRESET(*expr***,** *bit***)**

where

expr	evaluates to the value in which the bit is to be reset.
bit	evaluates to the bit position (0 to 31).

The **BITRESET()** function converts *expr* to a 32 bit integer and turns off (sets to 0) the bit identified by *bit* to form a new integer value as the result. Bits are numbered from 0 to 31 from the least significant end of the value. The effect of this function with a *bit* value outside this range is undefined.

Example

```
FLAGS = BITRESET(FLAGS, 2)
```

This statement turns off bit 2 in the FLAGS variable.
See also:
BITAND(), **BITNOT()**, **BITOR()**, **BITSET()**, **BITTEST()**, **BITXOR()**, **SHIFT()**

BITSET()

The **BITSET()** function turns on a specified bit in an integer value.

Format

BITSET(*expr***,** *bit***)**

where

expr	evaluates to the value in which the bit is to be set.
bit	evaluates to the bit position (0 to 31).

The **BITSET()** function converts *expr* to a 32 bit integer and turns on (sets to 1) the bit identified by *bit* to form a new integer value as the result. Bits are numbered from 0 to 31 from the least significant end of the value. The effect of this function with a *bit* value outside this range is undefined.

Example

```
FLAGS = BITSET(FLAGS, 2)
```

This statement turns on bit 2 in the FLAGS variable.

See also:
BITAND(), **BITNOT()**, **BITOR()**, **BITRESET()**, **BITTEST()**, **BITXOR()**, **SHIFT()**

BITTEST()

The **BITTEST()** function tests the state of a specified bit in an integer value.

Format

BITTEST(*expr***,** *bit***)**

where

expr evaluates to the value in which the bit is to be tested.

bit evaluates to the bit position (0 to 31).

The **BITTEST()** function converts *expr* to a 32 bit integer and tests the state of the bit identified by *bit*, returning true (1) if it is set and false (0) if it is reset. Bits are numbered from 0 to 31 from the least significant end of the value. The effect of this function with a *bit* value outside this range is undefined.

Example

```
IF BITTEST(FLAGS, 2) THEN DISPLAY(IT$CS) :
```

This statement clears the screen if bit 2 is set in the FLAGS variable.

See also:
BITAND(), **BITNOT()**, **BITOR()**, **BITRESET()**, **BITSET()**, **BITXOR()**, **SHIFT()**

BITXOR()

The **BITXOR()** function forms the bitwise logical exclusive-OR of two integer values.

Format

BITXOR(*expr1***,** *expr2***)**

where

expr1 and *expr2* evaluate to integers

The **BITXOR()** function converts *expr1* and *expr2* to 32 bit integers and performs a bit-by-bit logical exclusive-OR to form a new integer value as the result.

The value of each bit in the result is 1 if same bit position in one and only one of *expr1* and *expr2* is 1.

Example

```
FLAGS = BITXOR(FLAGS, 8)
```

This statement inverts the bit with integer value 8 in the FLAGS variable.

See also:
BITAND(), **BITNOT()**, **BITOR()**, **BITRESET()**, **BITSET()**, **BITTEST()**, **SHIFT()**

BREAK

The **BREAK** statement allows the action of the break key to be disabled during program execution.

Format

BREAK {**KEY**} **OFF**
BREAK {**KEY**} **ON**
BREAK {**KEY**} **CLEAR**
BREAK {**KEY**} *expr*

where

expr evaluates to a number.

QM maintains a break inhibit counter which is set to zero before the command prompt is first displayed. This counter is incremented by the **BREAK OFF** statement and decremented by **BREAK ON** though it cannot become negative. Use of the break key whilst the counter is non-zero will not cause a break action to occur. Instead, the break is remembered and will be handled when the counter returns to zero. Multiple use of the break key will not result in more than one break event being handled. The **BREAK CLEAR** statement cancels any deferred break event.

The **BREAK** *expr* format of this statement is equivalent to **BREAK OFF** if the value of *expr* is zero, **BREAK ON** if *expr* is positive and **BREAK CLEAR** if *expr* is negative.

Example

```
BREAK OFF
GOSUB UPDATE.FILES
BREAK ON
```

This program fragment inhibits use of the break key while the internal subroutine UPDATE.FILES is executed.

CALL, ENTER

The **CALL** statement calls a catalogued subroutine. The **ENTER** statement is a synonym for **CALL** unless the PICK.ENTER option of the **$MODE** directive is used.

Format

CALL *name* {(*arg.list*)}
CALL @*var* {(*arg.list*)}

where

name	is the name of the subroutine to be called.
@*var*	is the name of a variable holding the name of the subroutine to be called.
arg.list	is the list of arguments to the subroutine.

A subroutine with no arguments is equivalent to a program. A whole matrix can be passed as an argument by prefixing it with **MAT**.

Direct calls

Placing the subroutine name in the **CALL** statement is referred to as a **direct call**. QM will search for the subroutine as described below when any **CALL** statement referencing the subroutine is first executed in the program or subroutine. For **CALL** statements which occur within catalogued subroutines the search will take place every time the calling subroutine itself is called. QM includes an object code caching mechanism to minimise the performance impact of this repeated search.

Indirect calls

Executing a **CALL** statement using a variable to hold the subroutine name is referred to as an **indirect call**. In this case, QM will search for the subroutine as described below when the first **CALL** statement is executed. Indirect calls allow an application to call a subroutine where the name of the routine was not known at compile time. This might be of use, for example, in menu systems.

When an indirect call is executed, the variable containing the subroutine name is modified to become a subroutine reference. This can still be used as a string in the program but also contains a pointer to the memory resident copy of the subroutine. The subroutine will remain in memory so long as one or more subroutine references point to it. Overwriting the variable will destroy the subroutine link and may make the subroutine a candidate for removal from the object code cache.

One advantage of indirect calls is that, by placing the variable in a common block where it is accessible by all modules of the application and will not be discarded, the catalogue search need only be performed once even when the **CALL** is in a subroutine which itself may be called many times. A direct call works in a similar way but the variable in which the subroutine reference is placed is local to the program containing the **CALL** and is thus lost when the program terminates.

Searching for the subroutine

Subroutines to be executed using **CALL** must be placed in the catalogue using the **CATALOGUE** command or the equivalent automated cataloguing from within the QMBasic compiler.

Subroutine names must conform to the QMBasic name formats except that two special prefix characters are allow. An exclamation mark prefix character is used on all standard globally catalogued subroutines provided as part of QM that are intended for user use. An asterisk prefix may be used on user written globally catalogued subroutines for compatibility with other products.

Unless the subroutine name commences with one of the global catalogue prefix characters, QM goes through a series of steps when a **CALL** statement searches for a subroutine:

- The local catalogue is checked. This consists of a VOC record of the form
  Field 1 V
  Field 2 CS
  Field 3 Runfile pathname
- The private catalogue file is checked.
- The global catalogue is checked.

Note that subsequent calls to the same subroutine where the subroutine reference has not been reset will continue to use the original catalogued routine even if it has been deleted from the catalogue or replaced.

The argument list may contain up to 255 items. If a subroutine has no arguments, the brackets may be omitted.

Each argument is

A constant	`CALL SUB("MY.FILE")`
An expression	`CALL SUB(X + 7)`
A variable name	`CALL SUB(X)`
An indexed matrix element name	`CALL SUB(A(5,2))`
A matrix name prefixed by MAT	`CALL SUB(MAT A)`

Where the argument is a reference to a variable, a matrix element or a whole matrix, the subroutine may update the values in these variables. Except when passing a whole matrix, the calling program can effectively prevent this by forcing the argument to be passed by value rather than by reference by enclosing it in brackets, thus making the argument into an expression.

Pick Style ENTER

By default, the **ENTER** statement is a synonym for **CALL**. Use of the PICK.ENTER option of the **$MODE** compiler directive causes **ENTER** to behave in the same way as its equivalent in Pick style multivalue database products.

In this mode, use of **ENTER** terminates the current program and replaces it with the named program. This new program may not take arguments. If the **ENTER** statement is performed in a program that was started using the **EXECUTE** statement, or a subroutine called from such a program, the **ENTER** does not discard the program containing the **EXECUTE**.

Examples

```
COMMON /COM1/ INITIALISED, SUB1
IF NOT(INITIALISED) THEN
  SUB1 = "SUBR1"
  INITIALISED = @TRUE
END
```

This program fragment declares a common block to hold subroutine call references. When the program is first executed, the conditional statements will be performed as common block variables are initially zero. This path sets the name of the subroutine SUBR1 into common variable SUB1.

Later in the program, perhaps in a different subroutine from that in which the common was initialised, a statement of the form

```
CALL @SUB1(ARG1, ARG2)
```

will call the SUBR1, changing the common variable to be a subroutine reference for fast access on subsequent calls.

A statement of the form

```
CALL SUBR1(ARG1, ARG2)
```

would call the same subroutine but does not use the common block variable. If this call was in a subroutine, the catalogue search would be performed for the first call each time the calling subroutine is entered.

CASE

The **CASE** statement provides conditional execution dependant on the result of expression evaluation.

Format

BEGIN CASE
  CASE *expr*
    statement(s)
  CASE *expr*
    statement(s)
END CASE

where

expr	is an expression which can be resolved to a numeric value
statement(s)	is a group of QMBasic statements. There may be any number of statements in the group (including zero).

The expressions are evaluated in turn until one evaluates to true. The statements associated with that test expression are then executed and control passes to the statement following the **END CASE** . Only one of the statement groups is executed. If none of the test expressions evaluates to true, no statements are executed.

It is frequently useful to execute a default set of statements where no specific test expression results in non-zero result. This can be achieved by a case of the form

CASE 1

which makes use of the fact that 1 is the value of the boolean True. This must be the final element of the **CASE** statement.

Example

```
N = DCOUNT(ITEMS, @VM)
BEGIN CASE
   CASE N = 0
      DISPLAY "There are no items"
   CASE N = 1
      DISPLAY "There is 1 item"
   CASE 1
      DISPLAY "There are " : N : " items"
END CASE
```

This program fragment displays a message indicating the number of values in the ITEMS variable. Note the use of the CASE 1 construct.

CATALOGUED()

The **CATALOGUED()** function determines whether a subroutine can be found using the search process described for the CALL statement.

Format

CATALOGED(*name***)**

where

name is the calling name of the program

The **CATALOGUED()** function returns

0	the subroutine is not catalogued
1	the subroutine is catalogued locally as a V type VOC entry
2	the subroutine is catalogued privately
3	the subroutine is catalogued globally

Where a subroutine name appears in more than one catalogue form, the search order is as in the list above and the value returned reflects the first entry found.

The return value from the **CATALOGUED()** function can be treated as a boolean (true/false) value if the application merely wants to determine if a subroutine is catalogued and does not need to know in which format.

Example

```
IF NOT(CATALOGUED('MYPROG')) THEN DISPLAY 'Not catalogued'
```

This statement displays a message if MYPROG is not in the system catalogue.

See also:
CATALOGUE, CALL

CATS()

The **CATS()** function concatenates corresponding elements of a dynamic array.

Format

CATS(*string1***,** *string2***)**

where

string1 is the string to which *string2* is to be concatenated.

string2 is the concatenation string.

The **CATS()** function returns the result of concatenating corresponding dynamic array components (fields, values and subvalues) from the supplied strings.

The **REUSE()** function can be applied to either or both expressions. Without this function, any absent trailing values are taken as null strings.

Example

```
S1 = "ABC":@fm:"DEF"
S2 = "123":@vm:"456":@fm:"789"
X = CATS(S1,S2)
```

The above code fragment concatenates elements of the two strings yielding a result in X of "ABC123VM456FMDEF789"

CHAIN

The **CHAIN** statement terminates the current program and executes a command.

Format

CHAIN *expr*

where

expr evaluates to a command.

The current program terminates immediately, discarding local variables but retaining common variables. The command defined by *expr* is executed as though it replaced the sentence which invoked the program in which the **CHAIN** statement occurs. If this sentence is in a paragraph, the remainder of the paragraph will be executed when the **CHAIN**'ed program terminates.

The exact behaviour of **CHAIN** when executed from a program started by a PROC depends on the VOC record type of the target item referenced by *expr*. If this is a further PROC, any stacked PROCs leading up to the program that performed the **CHAIN** are discarded. If the target is not a PROC, control will return to the PROC that executed the program performing the **CHAIN** when the chained command terminates.

The unnamed common block is discarded on execution of a **CHAIN** unless the CHAIN.KEEP.COMMON mode of the **OPTION** command is active.

CHAIN is provided primarily for compatibility with other systems. The same effect can usually be better achieved using **EXECUTE**.

Examples

```
CHAIN "RUN PROGRAM2"
```

This program fragment terminates the current program and executes PROGRAM2 in its place.

CHANGE()

The **CHANGE()** function replaces occurrences of a substring within a string by another substring. The synonym **SWAP()** can be used.

Format

CHANGE(*string*, *old*, *new*{, *occurrence*{, *start*}}**)**

where

string	is the string in which the replacement is to occur.
old	evaluates to the substring to be replaced.
new	evaluates to the substring with which *old* is to be replaced.
occurrence	evaluates to the number of occurrences of *old* to be replaced. If omitted or specified as a value of less than one, all occurrences are replaced.
start	specifies the first occurrence to be replaced. If omitted or specified as a value of less than one it defaults to one.

The **CHANGE()** function replaces the specified occurrences of *old* within *string* by *new*.

If *old* is a null string, the function returns *string* unchanged. If *new* is a null string, all occurrences of *old* are removed.

If the **$NOCASE.STRINGS** compiler directive is used, matching of *old* against *string* is case insensitive.

Examples

```
PRINT CHANGE("ABRACADABRA", "A", "a", 3, 2)
```

This statement results in printing the string "ABRaCaDaBRA".

See also:
CONVERT()

CHAR()

The **CHAR()** function returns the character with a given ASCII value.

Format

CHAR(*seq***)**

where

seq evaluates to an integer in the range 0 to 255.

The **CHAR()** function returns a single character string containing the ASCII character with value *seq*. It is the inverse of the **SEQ()** function.

Only the least significant 8 bits of the integer value of *seq* are used. Values outside the range 0 to 255 may behave differently on other systems and should not be relied on.

Example

```
DISPLAY CHAR(7):
```

This statement outputs character 7 of the ASCII character set to the display. Character 7 is the BELL character and causes the audible warning to sound. This is similar to use of the @SYS.BELL variable except that CHAR(7) is not affected by use of the **BELL OFF** verb and will always work.

See also:
SEQ()

CLASS

The **CLASS** statement declares a class module.

Format

CLASS *name* {**MAX.ARGS** *limit*} {**INHERITS** *class.list*}

where

name	is the name of the module.
limit	is the maximum number of arguments allowed in public function and subroutines within the class module. This defaults to 32 and cannot exceed 255.
class.list	is a comma separated list of the catalogue names of classes to be inherited by this class. These should not be enclosed in quotes.

QMBasic programs should commence with a **PROGRAM**, **SUBROUTINE**, **FUNCTION** or **CLASS** statement. If none of these is present, the compiler behaves as though a **PROGRAM** statement had been used with *name* as the name of the source record.

The **CLASS** statement must appear before any executable statements. For more details, see Object Oriented Programming.

The *name* need not be related to the name of the source record though this eases program maintenance but it must comply with the QMBasic name format rules.

A class module contains the components of a QMBasic object. The general structure of this is

```
CLASS name
   PUBLIC A, B(3), C
   PRIVATE X, Y, Z

   PUBLIC SUBROUTINE SUB1(ARG1, ARG2) {VAR.ARGS}
      ...processing...
   END

   PUBLIC FUNCTION FUNC1(ARG1, ARG2) {VAR.ARGS}
      ...processing...
      RETURN RESULT
   END

   ...Other QMBasic subroutines...
END
```

The **MAX.ARGS** option can be used to increase the default limit on the number of arguments permitted in a public function or subroutine within the class module. This has a small effect on performance and should only be used where the default value of 32 needs to be exceeded.

The **INHERITS** option causes the named class or classes to be inherited automatically by this class

when it is instantiated.

See also:
Object oriented programming, **DISINHERIT**, **INHERIT**, **OBJECT()**, **PRIVATE**, **PUBLIC**.

CLEAR

The **CLEAR** statement sets all local variables to zero.

Format

CLEAR

All local variables, including all elements of matrices, are set to zero. Files associated with local file variables will be closed. The value of variables in common areas are not affected.

CLEARCOMMON

The **CLEARCOMMON** statement sets all variables in the unnamed common area to zero.

Format

CLEARCOMMON

CLEAR COMMON

All variables in the unnamed common area are set to zero. Other variables are not affected.

See also:
COMMON

CLEARDATA

The **CLEARDATA** statement clears any data stored by previous DATA statements or DATA verbs and not yet processed by INPUT statements.

Format

CLEARDATA

The data queue is cleared. Any keyboard type-ahead is not affected by this statement. The **CLEARDATA** statement is most useful when recovering from error situations where the data queue could cause problems.

Stored data is cleared automatically on return to command prompt.

Example

```
ERROR.LABEL:
   CLEARDATA
   ABORT "A fatal error has occurred"
```

This program fragment could be used to ensure that the data queue is empty when aborting at some error condition.

CLEARFILE

The **CLEARFILE** statement clears a file previously opened using the **OPEN** statement, deleting all records.

Format

CLEARFILE *file.var* {**ON ERROR** *statement(s)*}

where

file.var is a file variable for an open file.

The file associated with the file variable will be cleared. All records are deleted from the file, contracting the file to its minimum modulus size and releasing disk space.

The **ON ERROR** clause is executed if the file cannot be cleared for any reason. The **STATUS()** function may be used to find the cause of such an error.

Note that the **CLEARFILE** statement executes the clear file trigger function, not the delete trigger function if one is defined.

This statement may not be used inside a transaction.

Example

```
OPEN "STOCK.FILE" TO STOCK THEN
   CLEARFILE STOCK
   CLOSE STOCK
END
ELSE ABORT "Cannot open file"
```

This program fragment opens a file, clears it and then closes the file.

CLEARINPUT

The **CLEARINPUT** statement clears any keyboard data that has been entered but not yet processed by **INPUT** or **KEYIN()** statements.

The synonym **INPUTCLEAR** may be used in place of **CLEARINPUT**.

Format

CLEARINPUT

CLEAR INPUT

Any type-ahead data is cleared. Data stored by the **DATA** statement is not affected.

Example

```
ERROR.LABEL:
   CLEARINPUT
   ABORT "A fatal error has occurred"
```

This program fragment could be used to ensure that data entered at the keyboard is cleared when aborting at some error condition.

CLEARSELECT

The **CLEARSELECT** statement clears one or all select lists.

Format

CLEARSELECT {*list.no*}

CLEARSELECT ALL

where

list.no	evaluates to the number of the select list to be cleared. If omitted, select list zero is cleared.

Select lists are numbered from 0 to 10. Where no list number is specified, the default is to use select list 0.

The **CLEARSELECT** statement clears the select list if it was active. Use of the **ALL** keyword causes all select lists to be cleared.

Example

```
CLEARSELECT 2
```

This statement clears select list number 2.

CLOSE

The **CLOSE** statement closes a file previously opened using the **OPEN**or **OPENPATH** statement.

Format

CLOSE *file.var* {**ON ERROR** *statement(s)*}

where

file.var is a file variable for an open file.

The file associated with the file variable will be closed. Any other file variable which refers to the same file, either from a separate **OPEN** or from copying the file variable, will be unaffected.

The **ON ERROR** clause is provided for source program compatibility with other systems and will never be executed by QMBasic programs.

Files do not always need to be closed explicitly. Local variables are released when a program or subroutine returns and files associated with local file variables are closed automatically. File variables in common areas will not be affected.

Closing a file inside a transaction destroys the file variable but defers the actual close until the transaction ends. Rolling back the transaction will not reinstate the file variable.

Example

```
OPEN "STOCK.FILE" TO STOCK ELSE ABORT "Cannot open file"
...further statements...
CLOSE STOCK
```

This program fragment opens a file, processes it and then closes the file.

CLOSESEQ

The **CLOSESEQ** statement closes an item previously opened using **OPENSEQ**.

Format

CLOSESEQ *file.var* {**ON ERROR** *statement(s)*}

where

file.var	is the file variable previously associated with the directory file record or device by use of the **OPENSEQ** statement.
statement(s)	are statement(s) to be executed if the close action fails.

The directory file record or device is closed.

The **ON ERROR** clause is provided for source program compatibility with other systems and will never be executed by QMBasic programs.

The **CLOSESEQ** and **CLOSE** statements can be interchanged without adverse effect in QMBasic programs, however, care should be taken to use the correct statement if portability to other systems is required.

Example

```
CLOSESEQ STOCK.LIST
```

This statement closes a directory file record previously opened using **OPENSEQ** and associating it with STOCK.LIST as the file variable.

See also:
NOBUF, **OPENSEQ**, **READBLK**, **READSEQ**, **SEEK**, **WEOFSEQ** **WRITEBLK**, **WRITESEQ**, **WRITESEQF**

CLOSE.SOCKET

The **CLOSE.SOCKET** statement closes a socket.

Format

CLOSE.SOCKET *skt*

where

skt is the socket variable corresponding to the socket to be closed.

The socket previously opened using **ACCEPT.SOCKET.CONNECTION()**, **CREATE.SERVER.SOCKET()** or **OPEN.SOCKET()** is closed.

See also:
ACCEPT.SOCKET.CONNECTION, **CREATE.SERVER.SOCKET()**, **OPEN.SOCKET()**, **READ.SOCKET()**, **SERVER.ADDR()**, **SET.SOCKET.MODE()**, **SOCKET.INFO()**, **WRITE.SOCKET()**

COL1()

The **COL1()** function returns the character position immediately preceding the substring extracted by the last **FIELD()** function.

Format

COL1()

The **COL1()** function is used after a **FIELD()** function to find the character position of the character immediately preceding the extracted substring.

The value of the **COL1()** function is maintained on a per-program basis. If an external subroutine is called between the **FIELD()** and **COL1()** functions, the value returned relates to the last use of **FIELD()** in the current program. Any **FIELD()** functions executed by the subroutine will have no effect on the **COL1()** value.

COL1() returns zero if

No **FIELD()** function has been executed by this program

The last field extracted was at the start of the string

The delimiter to the last **FIELD()** function was a null string

The field number of the last **FIELD()** function was beyond the end of the string

Example

```
S = "A*BB*CCC*DDDD*EEEEE"
X = FIELD(S, "*", 3, 2)
N = COL1()
```

This program fragment extracts the string "CCC*DDDD" to variable X. The **COL1()** function returns 5 and assigns this to N.

See also:
COL2(), **FIELD()**

COL2()

The **COL2()** function returns the character position immediately following the substring extracted by the last **FIELD()** function.

Format

COL2()

The **COL2()** function is used after a **FIELD()** function to find the character position of the character immediately following the extracted substring.

The value of the **COL2()** function is maintained on a per-program basis. If an external subroutine is called between the **FIELD()** and **COL2()** functions, the value returned relates to the last use of **FIELD()** in the current program. Any **FIELD()** functions executed by the subroutine will have no effect on the **COL2()** value.

COL2() returns zero if

No **FIELD()** function has been executed by this program

The field number of the last **FIELD()** function was beyond the end of the string

Example

```
S = "A*BB*CCC*DDDD*EEEEE"
X = FIELD(S, "*", 3, 2)
N = COL2()
```

This program fragment extracts the string "CCC*DDDD" to variable X. The **COL2()** function returns 14 and assigns this to N.

See also:
COL1(), **FIELD()**

COMMON

The **COMMON** statement declares variables in a common block.

Format

COMMON {/*name*/} *var1* {**,***var2*...}

where

name	is the name of the common block
var1, etc	are variable names

The **COMMON** statement is used to define variables as being in common blocks, that is, memory areas that may be used to pass data between different programs and subroutines.

The variable names may extend over multiple lines by splitting the statement after a comma. For example

```
COMMON /VARS/ VAR1, VAR2,
              VAR3, VAR4
```

The same common block could be defined as

```
COMMON/VARS/ VAR1
COMMON/VARS/ VAR2
COMMON/VARS/ VAR3
COMMON/VARS/ VAR4
```

The compiler assumes that definitions of variables with the same common block name are a continuation of previous definitions in the same block.

Common blocks are identified by the *name* that is used in the **COMMON** statement. The name of a common block must conform to the same rules as a variable name. Multiple programs in the same process using the same name share the same variables. Named common blocks are created on the first reference to the name and remain in existence until exit from QM. There is also a common block with no name (**unnamed common**) which may be referred to by a **COMMON** statement of the form

```
COMMON var1, var2
```
or
```
COMMON // var1, var2
```

The unnamed common block is associated with a single command and is discarded on termination of the command that created it. Use of the **EXECUTE** statement saves and removes any current unnamed common and restores it on completion of the executed command.

A common block may contain any number of variables but the number of variables may not be increased by later redefinition. It is valid for a program to define fewer variables than in the original common block declaration. This is useful if a new item has been added at the end of a common block but not all programs have yet been recompiled.

Variables within a common block are referenced internally by position, not by name. Thus it would be possible (though not recommended) for different programs to use different names when accessing the same common block. Normally, the structure of a common block is best defined in an include record so that the same definition is used by all parts of the application.

By default, the variables in a common block are initialised to integer zero when the block is created. It is thus possible to include QMBasic code to perform further initialisation just once by statements of the form

```
COMMON /MYCOMMON/ INITIALISED,
                  VAR1,
                  VAR2,
                  VAR3,...etc...
IF NOT(INITIALISED) THEN
   ...do initialisation tasks...
   INITIALISED = @TRUE
END
```

For compatibility with some other systems, the UNASSIGNED.COMMON option of the $MODE compiler directive can be used to specify that common blocks are to be created with their component variables left unassigned instead of being set to zero. This directive only affects the program that actually creates the common block (i.e. the first program executed that references the common). It has no effect if the common has already been created. It is possible for an application to mix assigned and unassigned common by careful placement of the $MODE directive.

Common blocks may contain matrices. These are defined by including the row and column bounds in the **COMMON** statement, for example

```
COMMON /MYCOMMON/ MAT1(5,3)
```

QM supports two styles of matrix with different characteristics. The $MODE compiler directive can be used to select Pick style matrices.

The default style of matrix includes a zero element and is resizeable. A matrix of this type in a common block can be redimensioned by a later **DIM** statement.

Pick style matrices do not have a zero element and cannot be resized. A matrix of this type in a common block is equivalent to a series of simple variables. Thus, although not recommended, three programs could use very different views of the same five element common block.

```
COMMON A,B(3),C
COMMON X(2),Y,Z(2)
COMMON P,Q,R,S,T
```

COMPARE()

The **COMPARE()** function compares two strings using the same rules as the LOCATE statement and the SORT verb.

Format

COMPARE(*string1***,** *string2* {**,** *justification*}**)**

where

string1, *string2*	evaluate to the strings to be compared.
justification	evaluates to a string where the first character is "L" for left justified comparison or "R" for right justified comparison. If omitted or invalid, left justification is used.

The **COMPARE()** function compares the two strings and returns

1	*string1* is greater than *string2*
0	*string1* is equal to *string2*
-1	*string1* is less than *string2*

For a left justified comparison, characters are compared one by one and the function return value is determined by the relative ASCII character set positions of the characters at which the first mismatch occurs. If the strings are of different lengths and match up to the end of the shorter, the longer string is treated as the greater.

For a right justified comparison, the **COMPARE()** function behaves as though sufficient spaces were inserted at the start of the shorter string to match the length of the longer string. Characters are then compared one by one and the function return value is determined by the relative ASCII character set positions of the characters at which the first mismatch occurs.

The **COMPARE()** function is not affected by the setting of the $NOCASE.STRINGS compiler directive and can therefore be used to force a case sensitive comparison in otherwise case insensitive programs..

Examples

```
A = 0
B = '00'
DISPLAY A = B
DISPLAY COMPARE(A,B)
```

In the above example, use of the relational equals operator will see A and B as equal because both items can be treated as numbers. B is converted to a number (0) and a numeric comparison is performed. Use of the **COMPARE()** function always treats the items as character strings. A is converted to a string and the two items are compared as left aligned strings, reporting that they are unequal.

```
DIM ITEM(100)
ITEMS = 0
LOOP
   INPUT NEW.ITEM
WHILE LEN(NEW.ITEM)
   * Find position to insert new item
   I = 1
   LOOP
   WHILE I <= ITEMS
      IF COMPARE(NEW.ITEM, ITEM(I)) < 0 THEN EXIT
      I += 1
   REPEAT

   * Insert item at position I
   FOR J = ITEMS TO I STEP - 1
      ITEM(J + 1) = ITEM(J)
   NEXT J
   ITEM(I) = NEW.ITEM
   ITEMS += 1
REPEAT
```

This program fragment creates a matrix, ITEMS, and then enters a loop to read NEW.ITEM values from the keyboard until a blank line is entered. Each item read is inserted into the matrix in its correct position to maintain the matrix in ascending collating sequence order. Additional statements to detect and handle matrix overflow would be useful in a full application.

CONFIG()

The **CONFIG()** function returns the value of a configuration parameter.

Format

CONFIG(*param***)**

where

param is the name of the parameter to be retrieved.

The **CONFIG()** function can be used to retrieve the value of configuration parameters defined in the QM configuration file. The **STATUS()** function will return zero if successful.

If *param* is not recognised as a configuration parameter name, the function returns a null string and the **STATUS()** function will return ER$NOT.FOUND.

Example

```
GS = CONFIG("GRPSIZE")
```

This statement returns the value of the GRPSIZE configuration parameter, the default group size used when creating a dynamic file.

CONNECT.PORT()

The **CONNECT.PORT()** function converts a phantom process into an interactive session, using a serial port as its terminal device.

This function is only available on Windows.

Format

CONNECT.PORT(*port*, *baud*, *parity*, *bits*, *stop***)**

where

port	is the name of the serial port to be used (e.g. COM1).
baud	evaluates to the data rate (e.g. 9600).
parity	specifies the parity setting for the connection (0 = none, 1 = odd, 2 = even).
bits	specifies the number of bits per byte.
stop	specifies the number of stop bits (1 or 2).

The **CONNECT.PORT()** function enables an application to start a phantom process that then uses a serial port as though it were a terminal device. The function returns true (1) if successful, false (0) if it fails. The **STATUS()** function can be used to determine the cause of failure.

Once the connection has been created, the process changes from a phantom to an interactive session and can use the normal QMBasic terminal i/o statements such as **INPUT** and **PRINT** to access the port. If the program exits to the command processor, the connection can be used in exactly the same way as if the user had logged in over the serial port. To terminate the session from within a program, execute the **QUIT** command.

Because this function converts the phantom process into an interactive user, the process consumes a licence. The **CONNECT.PORT()** function will fail if the user limit has been reached.

Example

```
IF NOT(CONNECT.PORT('COM1', 9600, 0, 8, 1)) THEN
   STOP 'Cannot open COMO1 port'
END
```

This program fragment, used in a phantom process, connects to the device on the COM1 port as the command source, converting the process into an interactive session.

CONTINUE

The **CONTINUE** statement continues execution of the next cycle of a **LOOP/REPEAT** or **FOR/NEXT** structure.

Format

CONTINUE

The **CONTINUE** statement is equivalent to a jump to the **REPEAT** or **NEXT** statement of the innermost loop structure.

Example

```
LOOP
   REMOVE ITEM FROM STOCK SETTING DELIM
   ...processing statements...
WHILE DELIM
   IF ITEM[1,1] = "A" THEN CONTINUE
   ...further statements...
REPEAT
```

This program fragment processes items extracted from the STOCK dynamic array. If the value of ITEM commences with "A", the section marked ...further statements... is omitted.

See also:
EXIT, **FOR/NEXT**, **LOOP/REPEAT**

CONVERT

The **CONVERT** statement and **CONVERT()** function replace selected characters by others in a string. The **CONVERT** statement performs this conversion in-situ; the **CONVERT()** function leaves the source string unchanged and returns the modified value.

Format

CONVERT *from.string* **TO** *to.string* **IN** *var*

CONVERT(*from.string***,** *to.string***,** *source.string***)**

where

from.string	evaluates to a string containing the characters to be replaced.
to.string	evaluates to a string containing the replacement characters.
var	is the variable in which the replacement is to occur.
src.string	is the string in which replacement is to occur.

The statement

```
S = CONVERT(X, Y, S)
```

is equivalent to

```
CONVERT X TO Y IN S
```

Characters taken from the *from.string* and *to.string* define character translations to be performed. Each occurrence of a character from *from.string* in *var* (or *src.string*) is replaced by the character in the same position in *to.string*. If *to.string* is shorter than *from.string*, characters for which there is no replacement character are deleted. If *to.string* is longer than *from.string* the surplus characters are ignored.

If a character appears more than once in *from.string* only the first occurrence is used.

If the $NOCASE.STRINGS compiler directive is used, matching of *from.string* against *var* is case insensitive.

Examples

```
S = "ABCDEFGHIJK"
CONVERT "CGAGJ" TO "123" IN S
```

This program fragment replaces all occurrences of the letter "C" in S by "1", "G" by "2" and "A" by "3". The second occurrence of "G" in the *from.string* is ignored. The letter "J" is deleted from S. The result of this operation is to set S to "3B1DEF2HIK".

```
PRINT CONVERT(" ", "#", S)
```

This statement prints the string S with all spaces replaced by # characters.

```
LOOP
   INPUT ISBN,13_:
UNTIL CONVERT('0123456789X-', '', ISBN) = ''
   INPUTERR 'Invalid ISBN'
REPEAT
```

The loop above verifies that the data entered by the user contains only digits, the letter X and hyphens. The **CONVERT()** function is used to return a copy of the input data with all valid characters removed. If the result string is not null, it must contain an invalid character.

See also:
[CHANGE()]

COS()

The **COS()** function returns the cosine of a value.

Format

COS(*expr***)**

where

expr evaluates to a number or a numeric array.

The **COS()** function returns the cosine of *expr*. Angles are measured in degrees.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **COS()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

Example

```
ADJ = HYP * COS(ANGLE)
```

This statement finds the length of the adjacent side of a right angled triangle from the length of the hypotenuse and the angle between these two sides.

See also:
ACOS(), ASIN(), ATAN(), SIN(), TAN()

COUNT()

The **COUNT()** function counts occurrences of a substring within a string. The **COUNTS()** function is similar to **COUNT()** but operates on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

COUNT(*string***,** *substring***)**

COUNTS(*string***,** *substring***)**

where

string	evaluates to the string in which substrings are to be counted.
substring	evaluates to the substring to count.

The **COUNT()** function counts occurrences of *substring* within *string*. Substrings may not overlap, thus

```
S = "ABABABABABAB"
N = COUNT(S, "ABA")
```

sets N to 3.

If *substring* is null, **COUNT()** returns the length of *string*.

Programs compiled with the **$NOCASE.STRINGS** compiler directive use case insensitive string comparisons in the **COUNT()** and **COUNTS()** functions.

Example

```
MARKS = COUNT(REC, @FM)
```

This statement counts the field marks in REC.

See also:
DCOUNT()

CREATE

The **CREATE** statement creates an empty directory file record after a previous **OPENSEQ** has reported that the record did not exist.

Format

CREATE *file.var*
{**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

file.var	is the file variable associated with the record by a previous **OPENSEQ** statement.
statement(s)	are statement(s) to be executed depending on the outcome of the **CREATE** .

The **ON ERROR** clause is taken in the event of a fatal error that would otherwise cause the program to abort.

At least one of the **THEN** and **ELSE** clauses must be present. The **THEN** clause is executed if the operation is successful. The **ELSE** clause is executed if the **CREATE** operation fails.

Example

```
OPENSEQ 'AUDIT', DATE() TO SEQ.F ELSE
   IF STATUS() THEN ABORT 'Error opening audit record'
   CREATE SEQ.F ELSE ABORT 'Error creating audit record'
END ELSE
   SEEK SEQ.F, 0, 2
END
```

This program fragment attempts to open a sequential file record. If the **OPENSEQ** fails because the record does not exist, an empty record is created.

CREATE.FILE

The **CREATE.FILE** statement creates the operating system representation of a directory or dynamic hash file.

Format

CREATE.FILE *path* {**DIRECTORY** | **DYNAMIC**}
{**GROUP.SIZE** *grpsz*}
{**BIG.REC.SIZE** *bigrec*}
{**MIN.MODULUS** *minmod*}
{**SPLIT.LOAD** *split*}
{**MERGE.LOAD** *merge*}
{**VERSION** *ver*}
{**ON ERROR** *statement(s)*}

where

path evaluates to the pathname of the file to be created. The **DIRECTORY** or **DYNAMIC** keywords determine the type of file to be created. One and only one of these keywords must be present. The remaining options apply only to creation of a dynamic file and, where included, must appear in the order shown above.

grpsz is the group size (1 - 8) in multiples of 1024 bytes.

bigrec is the large record size in bytes.

minmod is the minimum modulus value.

split is the split load percentage.

merge is the merge load percentage.

ver is the file version.

The **CREATE.FILE** statement creates the operating system representation of a directory or dynamic hash file using the configuration information supplied via its optional parameters. Omitted parameters take their system defined default values. Note that this statement does not create a corresponding VOC entry.

Example

```
CREATE.FILE 'C:\MYFILE' DYNAMIC GROUP.SIZE 4
```

This statement creates a dynamic hash file with group size 4 (4096 bytes) as the C:\MYFILE directory.

CREATE.SERVER.SOCKET

The **CREATE.SERVER.SOCKET()** function creates a server socket on which a program may wait for incoming connections.

Format

CREATE.SERVER.SOCKET(*addr*, *port***)**

where

addr	is the address on which to listen for incoming connections. This may be an IP address or a host name. A null string implies listen on any local port.
port	is the port number on which to listen for incoming connections.

If the action is successful, this function returns the socket variable associated with the new server port and the **STATUS()** function returns zero.

If unsuccessful, the **STATUS()** function returns an error code that can be used to determine the cause of failure.

Example

```
SRVR.SKT = CREATE.SERVER.SOCKET("", 0)
IF STATUS() THEN STOP 'Cannot initialise server socket'
SKT = ACCEPT.SOCKET.CONNECTION(SRVR.SKT, 0)
IF STATUS() THEN STOP 'Error accepting connection'
DATA = READ.SOCKET(SKT, 100, SKT$BLOCKING, 0)
CLOSE.SOCKET SKT
CLOSE.SOCKET SRVR.SKT
```

This program fragment creates a server socket, waits for an incoming connection, reads a single data packet from this connection and then closes the sockets.

See also:
ACCEPT.SOCKET.CONNECTION, **CLOSE.SOCKET**, **OPEN.SOCKET()**, **READ.SOCKET()**, **SERVER.ADDR()**, **SET.SOCKET.MODE()**, **SOCKET.INFO()**, **WRITE.SOCKET()**

CROP()

The **CROP()** function removes redundant mark characters from a string.

Format

CROP(*string***)**

where

string evaluates to the string from which mark characters are to be removed.

The **CROP()** function removes redundant mark characters from *string*. These are all mark characters after the final non-mark character, trailing subvalue marks within each value and trailing value marks within each field.

Example

```
REC = CROP(REC)
```

This statement removes all redundant mark characters from REC.

CSVDQ()

The **CSVDQ()** function dequotes a CSV (comma separated variable) string.

Format

CSVDQ(*string* {**,** *delimiter*})

where

string	is the string to be processed.
delimiter	is the delimiter character separating the elements of the string. This defaults to a comma if omitted.

The **CSVDQ()** function dequotes a CSV string, removing outer double quotes, handling embedded quotes and returning the result as a dynamic array where each element of the original string is represented by a separate field.

Example

```
S = 'ABC,"DEF","GHI,JKL","MN""O"'
DISPLAY CSVDQ(S)
```

The above program fragment would display

```
ABCFMDEFFMGHI,JKLFMMN"O
```

ABC was unquoted and remains unchanged.
DEF was quoted. The quotes have been removed.
GHI,JKL contains a comma that has been preserved after removal of the quotes.
MN"O contains an embedded quote that has been preserved.

DATA

The **DATA** statement adds one or more items to the input data queue

Format

DATA *expr*{**,** *expr*...}

where

expr evaluates to the value to be added to the input data queue.

Where multiple *expr* clauses are present, they may be spread over successive lines by inserting a newline between a comma and the subsequent item. Any number of *expr* clauses may be present.

The **INPUT** statement takes data provided by **DATA** statements in preference to reading from the keyboard. Keyboard input is only used if there is no data from **DATA** statements remaining to be processed. The **KEYIN()** function always takes its input from the keyboard.

The data stream generated by successive **DATA** statements is held in the **@DATA.PENDING** variable which may be read by programs. This variable contains the individual data items separated by item marks. For this reason, **DATA** statement items should not include item marks as these will be taken as separators.

Example

```
DATA "123", "456"
DATA "789"
LOOP
   INPUT S
WHILE LEN(S)
   DISPLAY "'" : S : "'"
REPEAT
```

This program fragment would result in display of

```
123
456
789
```

and then echo data typed at the keyboard until a blank line is entered.

See also:
CLEARDATA

DATE()

The **DATE()** function returns the internal value of the current date.

Format

DATE()

The **DATE()** function returns the day number of the current date. Day numbers are defined such that 31 December 1967 is day zero. Date values representing dates earlier than this are negative.

Example

```
INVOICE.REC<7> = DATE()
```

This statement assigns field 7 of INVOICE.REC with the internal date value of the current day.

DCOUNT()

The **DCOUNT()** function counts delimited substrings within a string.

Format

DCOUNT(*string***,** *delimiter*)

where

string	evaluates to the string in which delimited substrings are to be counted.
delimiter	evaluates to the single character substring delimiter.

The **DCOUNT()** function counts substrings delimited by *delimiter* within *string*. Substrings may not overlap, thus

```
S = "ABABABABABABA"
N = DCOUNT(S, "BAB")
```

sets N to 4.

If *string* is null, **DCOUNT()** returns zero. In all other cases, **DCOUNT()** returns a value one greater than the **COUNT()** function applied to the same *string*.

If *substring* is null, **DCOUNT()** returns the length of *string*.

Programs compiled with the **$NOCASE.STRINGS** compiler directive use case insensitive string comparisons in the **DCOUNT()** function.

Example

```
FIELDS = DCOUNT(REC, @FM)
```

This statement counts the fields in REC.

See also:
COUNT()

DEBUG

The **DEBUG** statement enters the interactive debugger.

Format

DEBUG

The **DEBUG** statement enters debug mode for the program in which it was executed and all programs called by it. This statement causes a compile time warning but is otherwise ignored if the program is not complied with the **DEBUGGING** option or use of the **$DEBUG** compiler directive.

Example

```
IF @LOGNAME = 'mjones' THEN DEBUG
```

The above statement would enter the debugger if the user running the program is logged is as mjones.

See also:
QMBasic debugger

DECRYPT()

The **DECRYPT()** function decrypts data that has been encrypted for secure storage or transmission.

Format

DECRYPT(*data***,** *key***)**

where

data is the string to be decrypted.

key is the encryption key to be used.

The **DECRYPT()** function applies the AES 128 bit encryption algorithm to the supplied data and returns the decrypted text. The key string may be up to 64 characters in length and may contain any character. It is automatically transformed into a form that is useable by the AES algorithm. For optimum data security, the key should be about 16 characters.

The encrypted data is structured so that it can never contain characters from the C0 control group (characters 0 to 31) or the mark characters. As a result of this operation, the encrypted data is slightly longer than the resultant decrypted data.

Example

```
FUNCTION LOGIN()
   OPEN 'USERS' TO USR.F ELSE
      DISPLAY 'Cannot open USERS file'
      RETURN @FALSE
   END
   DISPLAY 'User name: ' :
   INPUT USERNAME, 20_:
   READ USER.REC FROM USR.F THEN
      FOR I = 1 TO 3
         DISPLAY 'Password: ' :
         INPUT PW,20_: HIDDEN
         IF PW = DECRYPT(USR.REC<1>, 'MySecretKey') THEN RETURN
@TRUE
         DISPLAY 'Password incorrect'
      NEXT I
   END
   RETURN @FALSE
END
```

The above function prompts for a user name and password, validating these against a record in the USERS file. The password field of this file is encrypted.

See also:
Data encryption, **ENCRYPT()**

DEFFUN

The **DEFFUN** statement defines a function.

Format

DEFFUN *name* {(*arg1* {,*arg2* ...})} {**CALLING "***subr***"** | **LOCAL**} {**VAR.ARGS**} {**KEY** *key*}

where

name	is the name of the function.
arg1, arg2...	are the function arguments.
subr	is the catalogue name of the subroutine if different from *name*.
key	is a key value to be passed into the subroutine as described below.

The **DEFFUN** statement defines a function that may be called from within the program. The **DEFFUN** statement must appear before the first reference to the function. If the function *name* matches the name of a built in function, any references to *name* before the **DEFFUN** will call the intrinsic function and references after the **DEFFUN** will call the declared function.

If the **LOCAL** keyword is not present, the function must correspond to a catalogued item. A call to this function call is effectively translated to a call to a subroutine with an additional hidden first argument through which the result is returned. The optional **CALLING** component of the **DEFFUN** statement allows the catalogue name of the function to be different from the *name* of the function itself.

Use of the **LOCAL** keyword indicates that this function is internal to the program module and will be defined later in the source by use of the **LOCAL FUNCTION** statement.

The argument names used in the **DEFFUN** statement are for documentation purposes only and have no significance within the program except that the compiler counts them to verify correct use of the function. The variables used in the actual call to the function are determined by the use of the function. An argument may be defined to be a whole matrix in which case it should be prefixed by the keyword **MAT** in the **DEFFUN** argument list.

The function is used in the same way as the intrinsic functions described in this manual. Although it is not recommended, a function can update its argument variables.

The **VAR.ARGS** option indicates that compiler should not check the number of arguments in calls to the function. It is of use with functions that take variable length argument lists. This option cannot be used with local function.

The **KEY** option passes the *key* value as an additional argument before the first one named in calls to the function. This enables construction of multiple functions that call a single catalogued item with a mode key as the first argument. The **!PCL()** function provided in the BP file of the QMSYS account uses this feature to implement the various PCL functions defined in the SYSCOM PCL.H include record.

Example

```
DEFFUN MATMAX(MAT A)
DIM VALUES(100)
...
MAX = MATMAX(MAT VALUES)
```

The program fragment above uses the MATMAX() function to find the maximum value of all the elements of matrix VALUES.

See also:
FUNCTION, LOCAL

DEL

The **DEL** statement and **DELETE()** function delete a field, value or subvalue from a dynamic array.

Format

DEL *dyn.array*<*field* {**,** *value* {**,** *subvalue*}}>

DELETE(*dyn.array***,** *field* {**,** *value* {**,** *subvalue*}})

where

dyn.array	is the dynamic array from which the item is to be deleted.
field	evaluates to the number of the field to be deleted.
value	evaluates to the number of the value to be deleted. If omitted or zero, the entire field is deleted.
subvalue	evaluates to the number of the subvalue to be deleted. If omitted or zero, the entire value is deleted.

The specified field, value or subvalue is deleted from the dynamic array. The **DEL** statement assigns the result to the *dyn.array* variable. The **DELETE()** function returns the result without modifying *dyn.array*.

Example

```
DEL ITEMS<1,N>
```

This statement deletes field 1, value N from dynamic array ITEMS.

```
S = DELETE(ITEMS, 1, N)
```

This statement is similar to the previous example except that the result is assigned to S, leaving ITEMS unchanged.

See also:
EXTRACT(), **FIND**, **FINDSTR**, **INS**, **INSERT()**, **LISTINDEX()**, **LOCATE**, **LOCATE()**, **REPLACE()**

DELETE

The **DELETE** statement deletes a record from an open file. The **DELETEU** statement is similar but it preserves locks.

Format

DELETE *file.var*, *record.id* {**ON ERROR** *statement(s)*}

DELETEU *file.var*, *record.id* {**ON ERROR** *statement(s)*}

where

file.var	is a file variable for an open file.
record.id	evaluates to the id of the record to be deleted.
statement(s)	are statements to be executed if the delete fails.

The specified record is deleted from the file. No error occurs if the record does not exist.

If the process performing the **DELETE** had a read or update lock on the record, the lock is released. The **DELETEU** statement preserves any lock. Within a transaction, the lock is retained until the transaction terminates and then released regardless of which statement is used. Attempting to delete a record in a transaction will fail if the process does not hold an update lock on the record or the file.

The **STATUS()** function can be used to determine the cause of execution of the **ON ERROR** clause. A fatal error occurring when no **ON ERROR** clause is present will cause an abort to occur.

Example

```
DELETE STOCK, ITEM.ID
```

This statement deletes the record whose id is in **ITEM.ID** from the file associated with file variable **STOCK**.

DELETELIST

The **DELETELIST** statement deletes a select list from the $SAVEDLISTS file.

Format

DELETELIST *name*

where

name is the name of the $SAVEDLISTS entry to be deleted.

The **DELETELIST** statement restores the previously saved select list identified by *name* from the $SAVEDLISTS file. No error occurs if the list does not exist.

DELETESEQ

The **DELETESEQ** statement deletes an operating system file.

Format

DELETESEQ *filename*, *id* {**ON ERROR** *statement(s)*} {**THEN** *statement(s)*} {**ELSE** *statement(s)*}

or

DELETESEQ *pathname* {**ON ERROR** *statement(s)*} {**THEN** *statement(s)*} {**ELSE** *statement(s)*}

where

filename	evaluates to the VOC name of the directory file holding the record to be deleted.
id	evaluates to the name of the record to be deleted.
pathname	evaluates to the operating system pathname of the record to be deleted.
statement(s)	are statement(s) to be executed depending on the outcome of the **DELETESEQ** statement.

At least one of the **THEN** and **ELSE** clauses must be present.

The **DELETESEQ** statement deletes the operating system file identified by *filename* and *id* or by *pathname*. It is primarily intended as a counterpart to **OPENSEQ** but can be used to delete any operating system file.

The **THEN** clause will be executed if the action is successful.

The **ELSE** clause will be executed for conditions that most likely relate to user or programming errors such as the item to delete not existing or not having access rights to delete it. The **STATUS()** function can be used to determine the cause of the error.

The **ON ERROR** clause will be executed if an internal error occurs during the delete and should only be included if the program needs to continue execution rather than taking the default action of aborting at such an error. The **STATUS()** function can be used to determine the cause of the error.

DELETESEQ cannot be used to delete a directory.

Note that **DELETESEQ** takes no part in the locking system. If locking is required, the directory containing the file to be deleted must be opened as a directory type file and standard file processing statements used.

DIMENSION

The **DIMENSION** statement is used to set the dimensions of a matrix. The short form **DIM** may be used in place of **DIMENSION**.

Format

DIMENSION *mat*(*rows* {**,** *cols*})

where

mat	is the name of the matrix.
rows	evaluates to the number of rows in the matrix.
cols	evaluates to the number of columns in a two dimensional matrix.

A matrix variable is a one or two dimensional array of values. Matrices must be declared by use of the **DIMENSION** statement. The **DIMENSION** statement must be executed at program run time before the variable is used in any other way.

A one dimensional matrix of ten elements is defined by a statement of the form

```
DIMENSION A(10)
```

For a two dimensional matrix with 5 rows of 8 columns this becomes

```
DIMENSION B(5,8)
```

By default, all matrices have an additional element, **the zero element**, which is used by some QMBasic statements. This is referred to as A(0) or B(0,0). The **$MODE** compiler directive can be used to select Pick style matrices which do not have a zero element.

The elements of a matrix may be of differing data types.

A matrix may be redimensioned at any time by a further **DIMENSION** statement though the number of dimensions cannot be changed. Existing values of matrix elements will be retained in the redimensioned matrix by copying elements on a row by row basis. If the matrix is enlarged , the newly created elements will be unassigned. If it is smaller than before, any values in the excess elements are discarded.

The **INMAT()** function may be used to check on the success of a **DIMENSION** statement. A sequence such as

```
DIMENSION A(N)
IF INMAT() THEN ABORT "Insufficient memory"
```

will cause the program to abort if there is insufficient memory to hold the matrix. The **INMAT()** function used in this way returns 0 if the **DIMENSION** statement was successful, 1 if it failed. With the memory sizes found on modern systems, this test is probably totally unnecessary.

The **INMAT()** function can also be used to find the current dimensions of a matrix.

Example

```
N = DCOUNT(REC, @FM)
DIM A(N)
MATPARSE A FROM REC, @FM
```

This program fragment creates an array with the correct number of elements to receive the result of a **MATPARSE** operation on dynamic array REC and then performs the **MATPARSE**.

DISINHERIT

The **DISINHERIT** statement used in a class module removes an inherited object.

Format

DISINHERIT *object*

where

object is the object variable previously used in an **INHERIT** statement.

The **DISINHERIT** statement removes a previously inherited object from the name search used when locating the variable or public function/subroutine for an object reference.

See also:
Object oriented programming, **CLASS**, **INHERIT**, **OBJECT()**, **PRIVATE**, **PUBLIC**.

DISPLAY

The **DISPLAY** statement sends data to the display. The synonym **CRT** can be used in place of **DISPLAY**.

Format

DISPLAY {*print.list*}

where

print.list is a list of items to be displayed.

The **DISPLAY** statement is equivalent to a **PRINT** statement directed to the display.

The *print.list* contains any number of items (including zero) but must all appear on a single source program line. The individual items are expressions which can be evaluated and represented as strings.

Where multiple items are present, they are separated by commas. The **DISPLAY** statement will replace the comma by a TAB character, causing display to align to the next horizontal tabulation column, initially set to columns 0, 10, 20, 30, etc. The same effect can be achieved by inserting TAB characters in the data to be displayed.

A colon as the final token on the source line is not treated as a concatenation operator but as a special symbol which causes the normal line feed and carriage return at the end of the **DISPLAY** action to be suppressed.

When data is output to the display, QM will pause at the end of the screen and ask for confirmation to continue.

```
Press RETURN to continue, A to abort, Q to Quit, S to suppress
pagination
```

Entering A will cause an abort to occur. Entering Q will quit from the current program or command. Entering S will continue display and suppress this prompt at the end of subsequent pages. Any other character causes display to continue up to the next prompt.

Pagination may be suppressed by use of any **@(x, y)** cursor positioning function. Note that this does not have to be sent to the screen; use of the function is sufficient. Thus a statement such as

```
DUMMY = @(0,0)
```

will suppress pagination even though nothing is displayed by this statement. Pagination may be turned on again by use of the **PRINTER RESET** statement.

Examples

```
DISPLAY "Error code " : STATUS()
```

This statement displays the literal string "Error code " and the value of the **STATUS()** function. The cursor is then positioned at the start of the next line.

```
DISPLAY "Enter product code " :
INPUT PRODUCT
```

This program fragment displays a prompt for a product code to be entered. Note the use of the trailing colon to suppress the line feed so that the cursor is left after the prompt ready for the INPUT statement.

```
FOR I = 1 TO 10
   DISPLAY I, RATE(I), TOTAL(I)
NEXT I
```

This example displays a three column table, lining up the columns with horizontal tabulation positions.

See also:
@(x,y), PRINT

DIR()

The **DIR()** function returns the contents of an operating system directory.

Format

DIR(*pathname***)**

where

pathname	identifies the operating system directory to be processed.

The **DIR()** function returns a dynamic array with one field per entry in the specified directory. Each field contains two items separated by value marks:

Value 1	The item name.
Value 2	The item type. This is F for a file or D for a directory.

The standard . and .. directory entries are not returned.

Applications should not assume that this structure will remain unchanged. Additional values may appear in future releases.

DIV()

The **DIV()** function returns the quotient from a division operation.

Format

DIV(*dividend***,** *divisor***)**

where

dividend evaluates to a number.

divisor evaluates to a number.

The **DIV()** function returns the quotient from dividing *dividend* by *divisor*.

DOWNCASE()

The **DOWNCASE()** function returns a string with all letters converted to lower case.

Format

DOWNCASE(*string***)**

where

string evaluates to the string in which substitution is to occur.

The **DOWNCASE()** function returns the value of *string* with all letters converted to lower case. If *string* is a variable rather than an expression, the value of the variable is not affected.

Example

```
REF.NO = "A12F635"
PRINT DOWNCASE(REF.NO)
```

This program fragment prints the string "a12f635".

See also:
UPCASE()

DPARSE and DPARSE.CSV

The **DPARSE** splits the elements of a delimited string into other variables. DPARSE.CSV is similar but unquotes strings according to the rules in the CSV standard.

Format

DPARSE *string*, *delimiter*, *var1*, *var2*,...

DPARSE.CSV *string*, *delimiter*, *var1*, *var2*,...

where

string	evaluates to the string to be processed.
delimiter	evaluates to the substring delimiter. If this is more than one character, only the first character is used.
var1,var2,...	is a list of variables to receive the elements extracted from *string*. These may be simple variables, matrix elements or field, value or subvalue references.

The **DPARSE** statement extracts successive elements delimited by *delimiter* within *string* into the listed variables. A statement such as

```
DPARSE S, ",", A, B, C
```

is equivalent to

```
A = FIELD(S, ",", 1)
B = FIELD(S, ",", 2)
C = FIELD(S, ",", 3)
```

DPARSE.CSV extends this action by removing quotes that have been applied to meet the CSV standard. CSV format allows optional double quotes around items and specifies that these must be present when the item contains the delimiting character or a double quote. In the latter case, the embedded double quote will be represented by two adjacent double quotes.

Examples

```
LOOP
   READSEQ LINE FROM SEQ.F ELSE EXIT
   STOCK.REC = ""
   DPARSE LINE, ",", PART.NO, STOCK.REC<1>, STOCK.REC<2>
   ...Processing...
REPEAT
```

This loop dismantles a comma separated string to extract three elements.

```
S = 'abc,"de""f"'
DPARSE S, ',', A, B
DISPLAY A,B
DPARSE.CSV S, ',', A, B
```

```
DISPLAY A,B
```

This program will print

```
abc        "de""f"
abc        def
```

showing the difference between the **DPARSE** and **DPARSE.CSV** statements.

DTX()

The **DTX()** function converts a number to hexadecimal.

Format

DTX(*expr* {**,** *expr*}**)**

where

expr	evaluates to the number to be converted.
min.width	specifies the minimum number of digits in the converted result.

The **DTX()** function converts the supplied *expr* value to hexadecimal. If the converted value is shorter than *min.width*, leading zeros are added.

Examples

In each example, the **DISPLAY** statement is followed by the output that it would produce. Note that **DTX()** treats the value as an unsigned 32 bit quantity and hence negative numbers will always appear as 8 hexadecimal digits.

```
DISPLAY DTX(87)
57

DISPLAY DTX(87,4)
0057

DISPLAY DTX(-21,4)
FFFFFFEB
```

See also:
XTD()

EBCDIC()

The **EBCDIC()** function converts an ASCII string to EBCDIC.

Format

EBCDIC(*expr***)**

where

expr evaluates to the string to be converted.

The **EBCDIC()** function returns the EBCDIC equivalent of the supplied ASCII string. The action of this function with non-ASCII characters is undefined.

See also:
[ASCII()]

ECHO

The **ECHO** statement enables or disables echoing of keyboard input.

Format

ECHO OFF

ECHO ON

ECHO *expr*

where

expr evaluates to a number.

Keyboard input is normally echoed to the display when it is processed by an **INPUT** statement. Use of **ECHO OFF** will suppress this echo until a subsequent **ECHO ON** statement. Typically, **ECHO OFF** is used to prevent display of passwords, etc.

The **ECHO** *expr* format of this statement is equivalent to **ECHO ON** if the value of *expr* is non-zero and **ECHO OFF** if *expr* is zero.

Example

```
DISPLAY "Enter password " :
ECHO OFF
INPUT PASSWORD
ECHO ON
```

This program fragment requests entry of a password with echoing inhibited.

ENCRYPT()

The **ENCRYPT()** function encrypts data for secure storage or transmission.

Format

ENCRYPT(*data***,** *key***)**

where

data	is the string to be encrypted.
key	is the encryption key to be used.

The **ENCRYPT()** function applies the AES 128 bit encryption algorithm to the supplied data and returns the encrypted text. The key string may be up to 64 characters in length and may contain any character. It is automatically transformed into a form that is useable by the AES algorithm. For optimum data security, the key should be about 16 characters.

The encrypted data is post-processed so that it can never contain characters from the C0 control group (characters 0 to 31) or the mark characters. As a result of this operation, the encrypted data is slightly longer than the original source data.

Example

```
FUNCTION LOGIN()
   OPEN 'USERS' TO USR.F ELSE
      DISPLAY 'Cannot open USERS file'
      RETURN @FALSE
   END
   DISPLAY 'User name: ' :
   INPUT USERNAME, 20_:
   READ USER.REC FROM USR.F THEN
      FOR I = 1 TO 3
         DISPLAY 'Password: ' :
         INPUT PW,20_: HIDDEN
         IF ENCRYPT(PW, 'MySecretKey') = USR.REC<1> THEN RETURN
@TRUE
         DISPLAY 'Password incorrect'
      NEXT I
   END
   RETURN @FALSE
END
```

The above function prompts for a user name and password, validating these against a record in the USERS file. The password field of this file is encrypted.

See also:
Data encryption, **DECRYPT()**

END

The **END** statement terminates a program, subroutine or a block of statements conditioned by the **THEN**, **ELSE**, **LOCKED** or **ON ERROR** keywords.

Format

END

When used to terminate a program or subroutine, the **END** statement may not be followed by any further executable statements; only comments and blank lines are allowed. An **END** statement is not mandatory at the end of a program, subroutine or function but lack of an **END** will cause a warning message to be displayed as this may be symptomatic of a structural problem elsewhere in the program.

The compiler will generate a **RETURN** statement at the end of the program or subroutine which will be executed if there is no **RETURN** or other program flow control statement immediately prior to the **END**.

The **END** statement is also used to terminate a group of conditional statements. For details of the use of **END** in this way, see the description of the QMBasic statement to which the conditional element applies.

Example

```
READ REC FROM STOCK.FILE, ITEM THEN
   DISPLAY "Stock item " : ITEM
   GOSUB PROCESS.ITEM
END
```

This program fragment reads a record from a file, displays its record id and calls an internal subroutine to process the record. The two indented statements are both conditioned so that they only occur if the read was successful.

ENV()

The **ENV()** function retrieves an operating system environment variable.

Format

ENV(*var.name***)**

where
var.name is the name of the variable to be retrieved.

The **ENV()** function retrieves the named operating system environment variable, returning its value. If the variable is not defined or *var.name* is invalid a null string is returned.

This function always returns a null string on the PDA version of QM.

EQS()

The **EQS()** function processes two dynamic arrays, returning a similarly structured result array indicating whether corresponding elements are equal.

Format

EQS(*expr1***,** *expr2***)**

where

expr1 and *expr2* are the dynamic arrays to be compared.

The **EQS()** function compares corresponding elements of the dynamic arrays *expr1* and *expr2*, returning a similarly structured dynamic array of true / false values indicating the results of the comparison.

The **REUSE()** function can be applied to either or both expressions. Without this function, any absent trailing values are taken as false.

Example

A contains 11FM0VM14VMABCFM2
B contains 12FM0VM14VMACBFM2

```
C = EQS(A, B)
```

C now contains 0FM1VM1VM0FM1

See also:
ANDS(), **GES()**, **GTS()**, **IFS()**, **LES()**, **LTS()**, **NES()**, **NOTS()**, **ORS()**, **REUSE()**

EQUATE

The **EQUATE** statement defines a symbolic name to represent a constant or reference to a matrix element.

Format

> **EQUATE** *name* **TO** *value*
>
> **EQUATE** *name* **TO** *variable*
>
> **EQUATE** *name* **TO** *matrix*(*index1* {**,** *index2*)
>
> **EQUATE** *name* **TO CHAR**(*seq*)

where

name	is the name to be attached to the value or matrix reference.
value	is a number or a quoted string.
variable	is the name of a variable (scalar or matrix) or an @-variable.
matrix	is the name of a matrix.
index1	is a number representing the first index to matrix.
index2	is a number representing the second index to a two dimensional matrix.
seq	is a character sequence number.

The first form of the **EQUATE** statement creates a symbolic *name* that can be used in place of the constant *value*. The **EQUATE** statement can be used to eliminate constants for state variables, etc from the main body of a program. Subsequent changes to the *value* thus only require a single amendment and recompilation of all programs using *name*. A similar function can be performed using the **$DEFINE** compiler directive.

The **EQUATE** statement can also be used to give names to specific elements of a *matrix*. Declaration and dimensionality of the *matrix* are only checked when a reference to *name* is encountered during program compilation. The matrix index values index1 and index2 must be numbers. Reference to the zero element of a two dimensional matrix must include both index values. The **$DEFINE** compiler directive cannot be used to define names for matrix elements.

The fourth form allows **EQUATE** to be used to assign names to specific (usually non-printing) characters.

Multiple tokens may be equated on a single line by separating each definition by a comma. For example:

```
EQUATE LOW TO 12, HIGH TO 20
```

Examples

```
EQUATE ADDRESS TO 1
EQUATE TEL.NO TO 2
...
READ REC FROM DATA.FILE, ID THEN
   PRINT "Address: " : REC<ADDRESS>
```

```
      PRINT "Telephone: " : REC<TEL.NO>
   END
```

The above program fragment attaches name to two fields of a data record and then uses these when the data is extracted for printing.

```
EQUATE ADDRESS TO REC(1)
EQUATE TEL.NO TO REC(2)
DIM REC(10)
...
MATREAD REC FROM DATA.FILE, ID THEN
   PRINT "Address: " : ADDRESS
   PRINT "Telephone: " : TEL.NO
END
```

This program fragment achieves the same as the previous example but uses the **MATREAD** statement to separate the fields of the record read from the file into the elements of matrix REC. The names defined in the **EQUATE** statements are then used to reference elements of this matrix

See also:
$DEFINE

ERRMSG

The **ERRMSG** statement displays a Pick style message from the ERRMSG file.

Format

ERRMSG *msg.id* {, *arg*...}

where

msg.id — evaluates to the id of a record in the ERRMSG file which holds the message to be displayed. If this id is numeric, it will be copied to @SYSTEM.RETURN.CODE.

arg... — is an optional comma separated list of arguments to be substituted into the message.

A standard Pick ERRMSG file is supplied with QM. Many of the messages in this file are irrelevant on QM. Users may modify this to add new messages or to change existing ones. QM only uses this file through **ERRMSG**, **STOP** or **ABORT** statements in user written programs.

The ERRMSG file entry consists of one or more fields, each prefixed by an action code. The message is built up and displayed by processing each code in turn. The codes are:

A{*n*} — Display the next argument left aligned in a field of *n* characters. If *n* is omitted, the argument is displayed without any additional spaces.

B — Sound the terminal "bell".

D — Outputs the system date in the form *dd mmm yyyy*.

E — Outputs the *msg.id* enclosed in square brackets.

H*text* — Outputs the given *text*.

L{*n*} — Outputs *n* newlines. The value of *n* defaults to 1 if omitted.

R{*n*} — Display the next argument right aligned in a field of *n* characters. If *n* is omitted, the argument is displayed without any additional spaces.

S*n* — Displays *n* spaces.

T — Outputs the system time in the form *hh:mm:ss*.

The component parts of the message are output with no insertion of newlines except as explicitly specified in the ERRMSG entry.

EXECUTE

The **EXECUTE** statement enables a QMBasic program to execute any command. The synonym **PERFORM** can be used in place of **EXECUTE**.

Format

EXECUTE *expr* {**TRAPPING ABORTS**}
{**CAPTURING** *var*}
{**PASSLIST** {*src.list* }}
{**RTNLIST** *tgt.list* }
{**SETTING** *status.var*} or {**RETURNING** *status.var*}

where

expr evaluates to the command(s) to be executed. Multiple commands are separated by field marks.

var is a variable to receive captured output.

src.list is a select list variable holding a list to be passed into the executed command as list 0. For compatibility with other multivalue environments, the **PASSLIST** clause is ignored if *src.list* is omitted.

tgt.list is a variable to receive a returned select list. This variable may be used in a subsequent **READNEXT** to extract items from the list.

status.var is a variable to receive the value of @SYSTEM.RETURN.CODE after the command is executed.

The **EXECUTE** statement creates a new command level by starting a new version of the command processor and passing it the command line to be executed. On completion of the command, the command processor returns control to the calling program.

The value in *expr* may contain several commands delimited by field marks. These will be processed as a paragraph and may include **DATA** and **LOOP** constructs, etc.

An abort occurring in the command(s) processed by the **EXECUTE** statement is normally trapped at the highest command processor level that took its command input from the keyboard or **PHANTOM**ed paragraph. The **TRAPPING ABORTS** qualifier to the **EXECUTE** statement causes aborts to return to the program issuing the **EXECUTE** without execution of the optional ON.ABORT paragraph. The @ABORT.CODE variable may be used to determine whether the command caused an abort to occur. This variable is initially zero and is reset to zero only by the **EXECUTE** statement.

The **CAPTURING** clause captures output that would otherwise have gone to the terminal or phantom log file, saving it in the named variable with field marks in place of newlines.

The **PASSLIST** clause passes the list in the named select list variable into the executed command as list 0.

The **RTNLIST** clause returns the content of the default select list in the named variable, removing the active numbered select list.

The **SETTING** or **RETURNING** clause copies the value of @SYSTEM.RETURN.CODE to the named variable after the command has been executed.

The unnamed common area is saved by the **EXECUTE** statement and the new command level may define a new structure for this area. On return from the **EXECUTE** statement, the original unnamed common area is restored. Named common areas are not affected by the **EXECUTE** statement.

Application designers should carefully consider the possible impact of **EXECUTE** inside a transaction.

Example

```
EXECUTE "LIST STOCK.FILE ITEMS QUANTITY"
```

This statement performs the **LIST** command from within the calling program. Control is returned to the program once the **LIST** command is complete.

EXIT

The **EXIT** statement terminates execution of a **LOOP**/**REPEAT** or **FOR/NEXT** structure.

Format

EXIT

The **EXIT** statement is equivalent to a jump to the statement following the **REPEAT** or **NEXT** statement of the innermost loop structure.

Example

```
LOOP
   REMOVE ITEM FROM STOCK SETTING DELIM
   ...processing statements...
WHILE DELIM
   IF ITEM[1,1] = "A" THEN EXIT
   ...further statements...
REPEAT
```

This program fragment processes items extracted from the STOCK dynamic array. If the value of ITEM commences with "A", the program exits from the loop.

See also:
CONTINUE, **FOR/NEXT**, **LOOP/REPEAT**, **WHILE**, **UNITL**

EXP()

The **EXP()** function returns the exponential (the natural anti-log) of a value.

Format

EXP(*expr***)**

where

expr evaluates to a number or a numeric array.

The **EXP()** function returns the exponential of *expr*, that is, the mathematical constant e raised to the power *expr*. The value of e is about 2.71828.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **EXP()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

Example

```
N = EXP(X)
```

This statement finds the natural anti-log of X and assigns this to N.

EXTRACT()

The **EXTRACT()** function extracts a field, value or subvalue from a dynamic array.

Format

EXTRACT(*dyn.array***,** *field* {**,** *value* {**,** *subvalue*}}**)**

where

dyn.array	is the dynamic array from which the item is to be extracted.
field	evaluates to the number of the field to be extracted.
value	evaluates to the number of the value to be extracted. If omitted or zero, the entire field is extracted.
subvalue	evaluates to the number of the subvalue to be extracted. If omitted or zero, the entire value is extracted.

The specified field, value or subvalue is extracted from the dynamic array and returned as the result of the **EXTRACT()** function. This function is identical in effect to the alternative syntax of

```
dyn.array<field {, value {, subvalue}}>
```

Example

```
AMOUNT.DUE = EXTRACT(INVOICE.REC, 3)
```

This statement extracts field 3 from INVOICE.REC, assigning the result to variable AMOUNT.DUE.

See also:
DEL, DELETE(), FIND, FINDSTR, INS, INSERT(), LISTINDEX(), LOCATE, LOCATE(), REPLACE()

FIELD()

The **FIELD()** function returns one or more delimited substrings from a string. The **FIELDS()** function is similar to **FIELD()** but operates on a multi-valued *string*, returning a similarly structured dynamic array of results.

Format

FIELD(*string***,** *delimiter***,** *occurrence* {**,** *count*}**)**

where

string	is the string from which substrings are to be extracted.
delimiter	evaluates to the delimiter character.
occurrence	evaluates to the position of the substring to be extracted. If less than one, the first substring is extracted.
count	evaluates to the number of substrings to be extracted. If omitted or less than one, one substring is extracted.

The **FIELD()** function extracts *count* substrings starting at substring *occurrence* from *string*. Substrings within *string* are delimited by the first character of *delimiter*. If *delimiter* is a null string, the entire *string* is returned.

If the value of *occurrence* is greater than the number of delimited substrings in *string*, a null string is returned.

If the value of *count* is greater than the number of delimited substrings in *string* starting at substring *occurrence*, the remainder of *string* is returned. Additional delimiters are not inserted.

The **COL1()** and **COL2()** functions can be used to find the character positions of the extracted substring.

Use of the $NOCASE.STRINGS compiler directive makes the *delimiter* case insensitive.

Example

```
A = "1*2*3*4*5"
S = FIELD(A, '*', 2, 3)
```

This program fragment assigns the string "2*3*4" to variable S.

See also:
COL1(), **COL2()**, **FIELDSTORE()**

FIELDSTORE()

The **FIELDSTORE()** function provides delimited substring assignment.

Format

FIELDSTORE(*string***,** *delimiter***,** *i***,** *n***,** *rep.string***)**

where

string	evaluates to the string in which replacement is to occur. If *string* is a variable name, the contents of this variable are not changed unless it also appears on the left hand side of the assignment statement in which the **FIELDSTORE()** function appears.
delimiter	evaluates to a string, the first character of which is used as the delimiter separating the substrings within *string*. A null *delimiter* string will cause a run time error.
i	evaluates to the position of the first substring to be replaced. Substring positions are numbered from one.
n	evaluates to the number of substrings to be replaced.
rep.string	evaluates to the new data to be inserted in *string*.

The value returned by the **FIELDSTORE()** function is the result of the replacement.

A statement of the form

```
S = FIELDSTORE(S, d, i, n, rep.string)
```

is equivalent to the delimited substring assignment operation

```
S[d, i, n] = rep.string
```

The action of **FIELDSTORE()** depends on the values of *i* and *n* and the number of substrings within *rep.string*.

If the value of the position expression, *i*, is less than one, a value of one is assumed. If there are fewer than *i* delimited substrings present in *string*, additional delimiters are added to reach the required position.

If the value of the number of substrings expression, *n*, is positive, *n* substrings are replaced by the same number of substrings from *rep.string*. If *rep.string* contains fewer than *n* substrings, additional delimiters are inserted.

If the value of the number of substrings expression, *n*, is zero or negative, *n* substrings are deleted from *string* and the whole of *rep.string* is inserted regardless of the number of substrings that it contains.

Use of the $NOCASE.STRINGS compiler directive makes the *delimiter* case insensitive.

Example

```
S = 1*2*3*4*5
A = FIELDSTORE(S, "*", 2, 3, "A*B")
B = FIELDSTORE(S, "*", 2, 3, "A*B*C")
C = FIELDSTORE(S, "*", 2, 3, "A*B*C*D")
D = FIELDSTORE(S, "*", 2, 0, "A*B")
E = FIELDSTORE(S, "*", 2, -3, "A*B")
```

This program fragment performs the **FIELDSTORE()** function on the string S using different values for *rep.string* and *n*. The results are

`A = 1*A*B**5`	Note inserted delimiter as *rep.string* has only 2 substrings
`B = 1*A*B*C*5`	*rep.string* replaces substrings 2 to 5
`C = 1*A*B*C*5`	Final substring of *rep.string* is not inserted
`D = 1*A*B*2*3*4*5`	No substrings are deleted as *n* is zero
`E = 1*A*B*5`	Three substrings are deleted and *rep.string* is inserted

See also:
FIELD()

FILE

The **FILE** statement provides a way to reference data in files using field names defined in the dictionary.

This statement is provided for compatibility with other systems and is not recommended.

Format

FILE *name*, ...

where

name is a comma separated list of files to be processed

The **FILE** statement opens the named files for processing in the current program. The QMBasic compiler will process the associated dictionary to allow use of field names as described below. Note that any change to the dictionary may require the program to be recompiled.

Note that the **FILE** statement has no error handling clause. If the file cannot be opened, any subsequent access to it will fail.

After a file has been opened using the **FILE** statement, a record can be read using a modified form of the **READ** statement:

```
READ name FROM id
```

where *name* is the file name in the **FILE** statement and *id* is the key of the record to be read. This form of the **READ** statement take the same optional clauses as a normal **READ**. The locking variants (**READL** and **READU**) are also supported.

After a record has been read, data from that record can be accessed using a construct:

```
name(field)
```

where *name* is the file name and *field* is a field name defined in the dictionary. Note that QMBasic restricts this construct such that *field* must be a D-type item or an A or S-type item with no correlative. Calculated values are not supported.

Records may be written to the file using a modified form of the **WRITE** (or **WRITEU**) statement:

```
WRITE name TO id
```

where *name* is the file name in the **FILE** statement and *id* is the key of the record to be written.

Apart from the above special cases, use of *name* in a file handling statement or function refers to the file variable associated with the file. Use of *name* in any other context refers to the dynamic array that will be used implicitly by **READ** or **WRITE** statements.

Use of the **FILE** statement is not recommended in new developments as it requires that the file is opened separately in every program that will access it rather than using a file variable in a common block for best performance. The syntax of the associated statements is also likely to be confusing as the same name references either the file variable or the data depending on its context.

Example

```
FILE 'ORDERS'
READ ORDERS FROM ORDER.NO THEN
   DISPLAY ORDERS(CUSTOMER.NO)
END
```

This program fragment opens the ORDERS file, reads the record for a given order number and displays the customer number from this record.

FILEINFO()

The **FILEINFO()** function returns information about an open file.

Format

FILEINFO(*file.var***,** *key***)**

where

file.var	is the file variable associated with the file.
key	identifies the action to be performed.

Values for the *key* to the **FILEINFO()** function are defined in the KEYS.H record in the SYSCOM file. These are

0	FL$OPEN	Check if file is open. Returns true (1) if *file.var* is associated with an open file, false (0) if it is not.
1	FL$VOCNAME	Returns the VOC name used to open the file.
2	FL$PATH	Returns pathname of open file.
3	FL$TYPE	File type. Returns one of FL$TYPE.DH (3) - Dynamic file FL$TYPE.DIR (4) - Directory file FL$TYPE.SEQ (5) - Sequential file FL$TYPE.VFS (6) - Virtual file system
5	FL$MODULUS	File modulus (dynamic files only)
6	FL$MINMOD	Minimum modulus (dynamic files only)
7	FL$GRPSIZE	Group size (dynamic files only)
8	FL$LARGEREC	Large record size (dynamic files only)
9	FL$MERGE	Merge load percentage (dynamic files only)
10	FL$SPLIT	Split load percentage (dynamic files only)
11	FL$LOAD	Current load percentage (dynamic files only)
13	FL$AK	File has AK indices (dynamic files only)
14	FL$LINE	Line to read or write next (sequential files only)
1000	FL$LOADBYTES	Current load bytes (dynamic files only)
1001	FL$READONLY	Returns true (1) is file is read-only
1002	FL$TRIGGER	Returns trigger function name, null if none
1003	FL$PHYSBYTES	Returns total size of file, excluding indices
1004	FL$VERSION	Internal file version (dynamic files only)
1005	FL$STATS.QUERY	Returns true (1) if file statistics gathering is enabled
1006	FL$SEQPOS	File position (sequential files only)
1007	FL$TRG.MODES	Returns mode flags for trigger function

1008	FL$NOCASE	Returns true (1) if the file uses case insensitive ids.
1009	FL$FILENO	Returns the internal file number for *file.var*.
1011	FL$AKPATH	Returns the pathname of the alternate key index directory. This is a null string in the indices are in their default location.
1012	FL$ID	Returns the id of the last record read from the file. Used with a dynamic file that is configured for case insensitive record ids, this will return the actual id as stored in the file, which may differ in casing from that supplied in the associated **READ** statement.
1013	FL$STATUS	Returns a dynamic array as for the **STATUS** statement.
1014	FL$MARK.MAPPING	Returns true if mark mapping is enabled, false if not (directory files).
1015	FL$RECORD.COUNT	Returns a count of the number of records in the file (dynamic files only). This count may be incorrect if the file was not closed in the event of an abnormal process termination such as a system failure. The counter will be corrected by use of a select operation during which there were no updates to the file or by use of the QMFix utility. The value will be returned as -1 until the count is set or for non-dynamic files.
1016	FL$PRI.BYTES	Physical size of the primary subfile in bytes (dynamic files only). This figure will include space previously used by groups that have been discarded as the result of a merge operation.
1017	FL$OVF.BYTES	Physical size of the overflow subfile in bytes (dynamic files only). This figure will include space previously used by overflow blocks that are no longer active and are retained for future use.
1018	FL$NO.RESIZE	Is resizing inhibited on this file? See the description of dynamic files for more information.
1019	FL$UPDATE	Returns the file update counter. This counter, shared across all users of the file, is initially set to 1 when a file is first opened and is incremented by every write, delete or clear file operation. It can be used to detect whether a file has been updated by another process.
1020	FL$ENCRYPTED	Returns true if the file uses encryption, false otherwise.

Example

```
IF FILEINFO(FVAR, FL$TYPE) # FL$TYPE.DH THEN
   ABORT "Dynamic file required"
END
```

This program fragment checks whether a file variable is associated with a dynamic file and, if not, aborts.

See also:
STATUS

FILELOCK

The **FILELOCK** statement sets a file lock on a file.

Format

FILELOCK *file.var* {**ON ERROR** *statement(s)*} {**LOCKED** *statement(s)*}

where

file.var	is the file variable associated with the file.
statement(s)	are statements to be executed depending on the outcome of the operation.

The **FILELOCK** statement sets a file lock which prevents other users from obtaining read or update locks on records within the file or a file lock on the whole file. File access operations that do not obtain locks are can still be performed by other users. These are **CLEARFILE**, **DELETE**, **DELETEU**, **MATREAD**, **MATWRITE**, **MATWRITEU**, **READ**, **READV**, **WRITE**, **WRITEU**, **WRITEV** and **WRITEVU**. Correct application design avoids accidental deletion or overwriting of locked records.

A file lock does not prevent access by the user that owns the lock.

The **LOCKED** clause is executed if another user holds a file lock or a read or update lock on any record in the file. The **STATUS()** function will return the user id of a process holding a lock. If the **LOCKED** clause is omitted, the program will wait for any lock to be released.

Example

```
FILELOCK STOCK
SELECT STOCK
TOTAL = 0
LOOP
   READNEXT ID ELSE EXIT
   READ REC FROM STOCK, ID ELSE ABORT "Cannot read " : ID
   TOTAL += REC<QTY>
REPEAT
FILEUNLOCK STOCK
```

This program fragment obtains a file lock on the file open as STOCK and then reads all records from the file, forming a total of the values in the QTY field. The lock prevents other users obtaining update locks when they might be updating this field in some record. The lock ensures that the total value represents a true picture of the file when the file lock was obtained. The lock is released on leaving the main processing loop.

See also:
Locking, FILEUNLOCK

FILEUNLOCK

The **FILEUNLOCK** statement releases a file lock previously obtained using the **FILELOCK** statement.

Format

FILEUNLOCK *file.var* {**ON ERROR** *statement(s)*}

where

file.var	is the file variable associated with the file.
statement(s)	are statements to be executed depending on the outcome of the operation.

The **FILEUNLOCK** statement releases a file lock, making the file available to other users. Read and update locks on records from the file are not affected.

The **ON ERROR** clause is executed in the event of a fatal error. The **STATUS()** function will return an error code giving the cause of the error.

Where the **ON ERROR** clause is not taken, the **STATUS()** function returns 0 if the file was previously locked by this user, ER$LCK if the lock is held by another user or ER$NLK if no user holds the lock.

Example

```
FILELOCK STOCK
SELECT STOCK
TOTAL = 0
LOOP
   READNEXT ID ELSE EXIT
   READ REC FROM STOCK, ID ELSE ABORT "Cannot read " : ID
   TOTAL += REC<QTY>
REPEAT
FILEUNLOCK STOCK
```

This program fragment obtains a file lock on the file open as STOCK and then reads all records from the file, forming a total of the values in the QTY field. The lock prevents other users obtaining update locks when they might be updating this field in some record. The lock ensures that the total value represents a true picture of the file when the file lock was obtained. The lock is released on leaving the main processing loop.

See also:
Locking, **FILELOCK**

FIND

The **FIND** statement searches a dynamic array for a given string in any position.

Format

FIND *string* **IN** *dyn.array* {**,** *occurrence*} **SETTING** *field*{**,** *value* {**,** *subvalue*}}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

string	evaluates to the item to be located.
dyn.array	is the dynamic array in which searching is to occur.
occurrence	is the occurrence of *string* to be found. If omitted, the first occurrence is located.
field	is the variable to receive the field number at which *string* is found.
value	is the variable to receive the value number at which *string* is found. If omitted, only the field position is returned
subvalue	is the variable to receive the subvalue number at which *string* is found. If omitted, only the field and, optionally, value positions are returned
statement(s)	are statements to be executed depending on the outcome of the **FIND** action.

At least one of the **THEN** and **ELSE** clauses must be present.

The **FIND** statement searches *dyn.array* for a field, value or subvalue equal to *string*. If found, the position of *string* within *dyn.array* is returned in the *field*, *value*, and *subvalue* variables and the **THEN** clause is executed. If not found or *dyn.array* is a null string, the *field*, *value*, and *subvalue* variables are unchanged and the **ELSE** clause is executed.

Use of the $NOCASE.STRINGS compiler directive makes the comparison case insensitive.

Example

Variable X contains AFMBVMCVMDFMEVMFSMG

```
FIND 'D' IN X SETTING F, V, S
```

The above FIND would return F = 2, V = 3, S = 1

See also:
DEL, **DELETE()**, **EXTRACT()**, **FINDSTR**, **INS**, **INSERT()**, **LISTINDEX()**, **LOCATE**,

LOCATE(), REPLACE()

FINDSTR

The **FINDSTR** statement searches a dynamic array for a given substring in any position.

Format

FINDSTR *string* **IN** *dyn.array* {**,** *occurrence*} **SETTING** *field*{**,** *value* {**,** *subvalue*}}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

string	evaluates to the item to be located.
dyn.array	is the dynamic array in which searching is to occur.
occurrence	is the occurrence of *string* to be found. If omitted, the first occurrence is located.
field	is the variable to receive the field number at which *string* is found.
value	is the variable to receive the value number at which *string* is found. If omitted, only the field position is returned
subvalue	is the variable to receive the subvalue number at which *string* is found. If omitted, only the field and, optionally, value positions are returned
statement(s)	are statements to be executed depending on the outcome of the **FINDSTR** action.

At least one of the **THEN** and **ELSE** clauses must be present.

The **FINDSTR** statement searches *dyn.array* for a field, value or subvalue containing *string*. This need not be the entire field, value or subvalue. If found, the position of *string* within *dyn.array* is returned in the *field*, *value*, and *subvalue* variables and the **THEN** clause is executed. If not found or *dyn.array* is a null string, the *field*, *value*, and *subvalue* variables are unchanged and the **ELSE** clause is executed.

Use of the $NOCASE.STRINGS compiler directive makes the comparison case insensitive.

Example

Variable X contains ABCFMDEFVMGHIVMJKLFMMNOVMPQRSMSTU

```
FINDSTR 'KL' IN X SETTING F, V, S
```

The above FINDSTR would return F = 2, V = 3, S = 1

See also:

DEL, DELETE(), EXTRACT(), FIND, INS, INSERT(), LISTINDEX(), LOCATE, LOCATE(), REPLACE()

FLUSH

The **FLUSH** statement flushes the internal buffers for a directory file record previously opened for sequential access.

Format

FLUSH *file.var*
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

file.var	is the file variable associated with the record by a previous **OPENSEQ** statement.
statement(s)	are statement(s) to be executed depending on the outcome of the **FLUSH**.

At least one of the **THEN** and **ELSE** clauses must be present. The **THEN** clause is executed if the operation is successful. The **ELSE** clause is executed if the **FLUSH** operation fails.

The sequential file buffers are automatically flushed periodically during file usage and on closing the file. The **FLUSH** statement allows the programmer to ensure that data is flushed to disk at a given point in the program

The **WRITESEQF** statement is the equivalent of a **WRITESEQ** followed by a **FLUSH**. Flushing the buffers after every write may result in poor performance.

Example

```
LOOP
   LINE = REMOVE(LIST, CODE)
   WRITESEQ LINE TO SEQ.F ELSE ABORT "Write error"
WHILE CODE
REPEAT
FLUSH SEQ.F ELSE ABORT "Flush error"
```

This program fragment writes a series of text lines extracted from LIST to a sequential file and then flushes the buffers to verify that the data has been written to disk.

See also:
CLOSESEQ, **NOBUF**, **READBLK**, **READCSV**, **READSEQ**, **SEEK**, **WEOFSEQ**, **WRITEBLK**, **WRITECSV**, **WRITESEQ**, **WRITESEQF**

FMT()

The **FMT()** function performs data formatting according to a format template. It is typically used to convert data for display or printing. The **FMTS()** function is identical to **FMT()** except that it works on each element of a dynamic array in turn, returning the result in a similarly delimited dynamic array.

Format

FMT(*expr***,** *fmt.spec***)**

FMTS(*expr***,** *fmt.spec***)**

where

expr	evaluates to the data to be formatted
fmt.spec	evaluates to the format specification.

The **FMT()** function sets the **STATUS()** function value to indicate whether the operation was successful. Possible values are

0	Successful formatting.
1	Data to format was too long or invalid for the format specification.
2	The format specification was invalid.

Operations that result in a non-zero **STATUS()** value return *expr* as the function result.

Shortform Notation

The **FMT()** function action can also be performed in QMBasic programs (but not in I-type dictionary entries) by use of a shortform notation in which the *expr* and *fmt.spec* are simply written next to each other with no operator in between.

Thus
```
X = FMT(A, '8R')
```
can be written as
```
X = A '8R'
```

FOLD() and FOLDS()

The **FOLD()** function breaks a string into field mark delimited sections no longer than a given width, placing breaks on spaces where possible.

Format

FOLD(*string***,** *width* {**,** *delim*}**)**

FOLDS(*string***,** *width* {**,** *delim*}**)**

where

string	evaluates to the string to be formatted
width	evaluates to the maximum length for each fragment.
delim	evaluates to the delimiter character to appear between each fragment.

The **FOLD()** function breaks *string* into sections, placing the *delim* character between each section. Each section is at most *width* characters in length with the break from one section to the next occurring at a space where possible.

The *width* argument may be multivalued. In this case, the first value specifies the width for the first fragment of the result, the second value specifies the width for the second fragment of the result and so on. If there are more fragments in the result than there are width specifications, the final width is used for the remaining data.

The *delim* argument is optional. If omitted, a field mark is used by default. Specifying *delim* as a null string uses a value mark as the delimiter.

The **FOLDS()** function is similar to **FOLD()** but works on each field, value or subvalue of *string* separately, returning a similarly structured dynamic array of folded strings

Example

```
S = 'The quick brown fox jumps over the lazy dog'
X = FOLD(S, 10)
LOOP
   CRT REMOVE(X, CODE)
WHILE CODE
REPEAT
```

The above program fragment prints

```
The quick
brown fox
jumps over
the lazy
dog
```

FOOTING

The **FOOTING** statement defines text to be printed or displayed at the foot of each page of output.

Format

FOOTING {**ON** *print.unit*} *text*

where

print.unit	identifies the logical print unit in the range -1 to 255 to which the footing text is to be applied. If omitted, the default print unit (unit 0) is used.
text	is the footing text. This may include control tokens as described below.

The **FOOTING** statement defines the text of a page footing and, optionally, control information determining the manner in which the text is output. A page footing is output whenever the bottom of the page is reached or on execution of a **PAGE** statement to terminate the current page.

The footing *text* may include the following control tokens enclosed in single quotes. Multiple tokens may appear within a single set of quotes.

C Centres text on the line.

D Inserts the date. The default format is dd mmm yyyy (e.g. 24 Aug 2005) but can be changed using the **DATE.FORMAT** command.

G Insert a gap. Spaces are inserted in the footing line at the position of each G control token such that the overall length of the line is the same as the printer unit width. A single use of the G token will right justify the subsequent text. Multiple G tokens will distribute spaces as evenly as possible.

When a footing line uses both G and C, the footing is considered as a number of elements separated by the G control options. The element that contains the C option will be centered. The items either side of the centered element are processed separately when calculating the number of spaces to be substituted for each G option.

H*n* Sets horizontal position (column) numbered from one. Use of H with C or with a preceding G token may have undesired results.

L Start a new line

N Inhibit automatic display pagination

O Reverses the elements separated by G tokens in the current line on even numbered pages. This is of use when printing double sided reports.

P*n* Insert page number. The page number is right justified in *n* spaces, widening the field if necessary. If omitted, *n* defaults to four.

S*n* Insert page number. The page number is left justified in *n* spaces, widening the field if

necessary. If omitted, *n* defaults to one.

T Inserts the time and date in the form hh:mm:ss dd mmm yyyy. The format of the date component can be changed using the **DATE.FORMAT** command.

Unrecognised control tokens are ignored. A quotation mark may be inserted in the printed text by using two adjacent quotation marks in the *text* string.

There is no limit to the length of a footing text. Each line will be truncated at the width of the print unit. The effect of using a footing which will not fit on to the physical page is undefined.

See also:
HEADING

FOR / NEXT

The **FOR** / **NEXT** statement defines a group of statements to be executed with an iterative control variable.

Format

FOR *var* = *start.expr* **TO** *limit.expr* {**STEP** *step.expr*}
  statement(s)
NEXT {*var*}

where

var	is the loop control variable.
start.expr	evaluates to the value to be placed in *var* for the first iteration of the loop.
limit.expr	evaluates to the value beyond which *var* must not pass.
step.expr	evaluates to the value by which *var* should be incremented between iterations of the loop. If omitted, *step.expr* defaults to one.
statement(s)	are statement(s) to be executed within the loop.

The **FOR** / **NEXT** statement executes *statement(s)* for values of *var* from *start.expr* to *limit.expr* in increments of *step.expr*. If *step.expr* is positive, the loop continues while the value of *var* is less than or equal to *limit.expr*. If *step.expr* is negative, the loop continues while the value of *var* is greater than or equal to *limit.expr*. The value of *var* on leaving the loop is the last value for which the loop was executed or *start.expr* if the initial value was already out of range.

The value of *var* should not be changed within the loop as this may lead to unexpected results.

Use of non-integer values for *start.expr*, *limit.expr* and *step.expr* is not recommended where rounding errors in incrementing *var* and the loop termination comparison may lead to unexpected effects.

For best performance, *limit.expr* and *step.expr* should be constants or simple variable references as they are evaluated for every iteration of the loop.

If *var* is present in the **NEXT** statement it must be the same *var* as in the **FOR** statement at the head of the loop. Use of *var* in the **NEXT** statement aids program readability and is checked by the compiler for correct matching of **FOR** and **NEXT** statements.

The **WHILE**, **UNTIL** and **EXIT** statements can be used with the **FOR** / **NEXT** loop to provide another loop termination control. The **CONTINUE** statement causes a jump to the start of the next iteration.

FOR / **NEXT** loops may be nested to any depth.

The FOR.STORE.BEFORE.TEST option of the **$MODE** compiler directive can be used to modify the behaviour of FOR/NEXT constructs to store the new value of the control variable before testing

for the end condition.

Examples

```
FOR I = 1 TO 10 STEP 2
   DISPLAY I
NEXT I
```

This program fragment displays the values 1, 3, 5, 7 and 9. The final value of I on leaving the loop is 9.

```
FOR I = 1 TO 20
UNTIL A(I) < 0
   DISPLAY A(I)
NEXT I
```

This program fragment displays elements of matrix A. The loop terminates if an element is found with a negative value.

See also:
CONTINUE, **EXIT**, **LOOP/REPEAT**, **WHILE**, **UNITL**

FORMLIST

The **FORMLIST** statement creates a select list from a dynamic array.

Format

FORMLIST *dyn.array* {**TO** *list.no*}

where

dyn.array	evaluates to the list of items to form the select list.
list.no	evaluates to the select list number. If omitted, select list zero is created.

Any existing select list *list.no* is cleared and a new list is created from the elements of *dyn.array*. This list may be separated by field marks, item marks or a mixture of both.

Example

```
READ LIST FROM ACCOUNTS, "OVERDUE" THEN FORMLIST LIST
```

This program fragment reads a list from record OVERDUE of file ACCOUNTS and creates select list zero from the elements of this list.

FUNCTION

The **FUNCTION** statement introduces a user written.

Format

FUNCTION *name*{(*arg1* {**,** *arg2*...}) {**VAR.ARGS**}}

where

name	is the name of the function.
arg1, etc	are the names of the arguments to the function.

QMBasic programs should commence with a **PROGRAM**, **SUBROUTINE**, **FUNCTION** or **CLASS** statement. If none of these is present, the compiler behaves as though a **PROGRAM** statement had been used with *name* as the name of the source record.

A function is a special form of subroutine. It returns a value to the calling program and can be referenced in a QMBasic statement in the same way as the intrinsic functions described in this manual, without the need for an explicit **CALL** statement. The **FUNCTION** statement is equivalent to a **SUBROUTINE** statement with an additional hidden argument at the start which is used to return the result.

The number of arguments in calls to the function must be the same as in the **FUNCTION** statement unless the function is declared with the **VAR.ARGS** option. When **VAR.ARGS** is used, any arguments not passed by the caller will be unassigned. The **ARG.COUNT()** function can be used to determine the actual number of arguments passed, excluding the hidden return argument.

Function arguments are normally passed by reference such that changes made to the argument variable inside a subroutine will be visible in the caller's variable referenced by that argument. A function call allows arguments to be passed by value by enclosing them in brackets. The **FUNCTION** statement also supports this dereferencing syntax. For example

```
FUNCTION CREDIT(P, (Q))
```

The **FUNCTION** statement must appear before any executable statements. The brackets are optional if there are no arguments. The **FUNCTION** statement may be split over multiple lines by breaking after a comma.

The name used in a **FUNCTION** statement need not be related to the name of the source record though this eases program maintenance. The name must comply with the QMBasic name format rules.

An argument may refer to a whole matrix. In this case the argument variable name must be preceded by the keyword **MAT** and there must be a **DIM** statement following the function declaration to indicate whether this is a one or two dimensional matrix. Alternatively, the dimensions may be given after the variable name in the **FUNCTION** statement. In either case, the actual dimension values are counted by the compiler but otherwise ignored. Use of a dimension value of one emphasises to readers of the program that the value is meaningless. A matrix passed as an argument cannot be redimensioned in the function.

Programs that use the function must include a **DEFFUN** statement to define the function template.

Example

```
FUNCTION MATMAX(MAT A)
   DIM A(1)
   MAX = A(1)
   N = INMAT(A)
   FOR I = 1 TO N
      IF A(I) > MAX THEN MAX = A(I)
   NEXT I

   RETURN MAX
END
```

This function scans a one dimensional matrix and passes back the value of the largest element. The first two lines could alternatively be written as

```
FUNCTION MATMAX(MAT A(1))
```

See also:
DEFFUN

GES()

The **GES()** function processes two dynamic arrays, returning a similarly structured result array indicating whether elements of the first array are greater than or equal to corresponding elements of the second array.

Format

GES(*expr1***,** *expr2***)**

where

expr1 and *expr2* are the dynamic arrays to be compared.

The **GES()** function compares corresponding elements of the dynamic arrays *expr1* and *expr2*, returning a similarly structured dynamic array of true / false values indicating the results of the comparison.

The **REUSE()** function can be applied to either or both expressions. Without this function, any absent trailing values are taken as zero.

Example

A contains 11FM0VM14VMABCFM2
B contains 12FM0VM14VMACBFM2

```
C = GES(A, B)
```

C now contains 0FM1VM1VM1FM1

See also:
ANDS(), EQS(), GTS(), IFS(), LES(), LTS(), NES(), NOTS(), ORS(), REUSE()

GETLIST

The **GETLIST** statement restores a select list from the $SAVEDLISTS file.

Format

GETLIST *name* {**TO** *list.no*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

name	is the name of the $SAVEDLISTS entry to be restored.
list.no	is the select list number to which it is to be restored. If omitted, this defaults to zero.
statement(s)	are statements to be executed depending on the outcome of the operation.

The **GETLIST** statement restores the previously saved select list identified by *name* from the $SAVEDLISTS file. The disk copy is not removed by this operation.

The @SELECTED variable can be examined to determine the number of items in the list.

At least one of the **THEN** and **ELSE** clauses must be present. If the list is successfully restored, the **THEN** clause is executed. If the list does not exists or cannot be restored for any other reason, the **ELSE** clause is executed.

GET.MESSAGES()

The **GET.MESSAGES()** function returns any messages currently queued for display.

Format

GET.MESSAGES()

The **GET.MESSAGES()** function allows an application to retrieve messages queued by the **MESSAGE** command and display these in a convenient form. The returned string contains one field for each message, in chronological order of message generation. Each field has two values; the message text and the message origin header. The second value may not be present in all messages.

GETNLS()

The **GETNLS()** function returns the value of a national language support parameter.

Format

GETNLS(*key***)**

where

key identifies the parameter to be returned.

The **GETNLS()** function returns the value of the named national language support parameter. NLS parameter name tokens are defined in the KEYS.H include record.

Available parameters are:

Parameter	Key	Meaning
1	NLS$CURRENCY	Default currency symbol. Maximum 8 characters.
2	NLS$THOUSANDS	Default thousands separator character.
3	NLS$DECIMAL	Default decimal separator character.

GET.PORT.PARAMS()

The **GET.PORT.PARAMS()** function retrieves the communications parameters for a serial port. This function is not available on the PDA version of QM.

Format

GET.PORT.PARAMS(*fvar***)**

where

fvar	is the file variable from the **OPENSEQ** statement that was used to open the port.

The **GET.PORT.PARAMS()** function returns a dynamic array containing the following data:

Field 1	Port name
Field 2	Baud rate
Field 3	Parity mode (0 = off, 1 = odd, 2 = even)
Field 4	Bits per byte
Field 5	Stop bits
Field 6	State of CTS (clear to send)
Field 7	State of DSR (data set ready)
Field 8	State of RING
Field 9	State of DCD (carrier detect)

Programs should be written to allow for the possibility of additional fields being added in future releases.

Example

```
DISPLAY 'Baud rate = ' : GET.PORT.PARAMS(port)<2>
```

GETPU()

The **GETPU()** function gets the characteristics of a print unit.

Format

GETPU(*key***,** *unit***)**

where

key identifies the parameter to retrieved. This may be:

1	PU$MODE	Print unit mode
2	PU$WIDTH	Characters per line
3	PU$LENGTH	Lines per page
4	PU$TOPMARGIN	Top margin size
5	PU$BOTMARGIN	Bottom margin size
6	PU$LEFTMARGIN	Left margin size
7	PU$SPOOLFLAGS	Various print unit flags
9	PU$FORM	Form name (not used by all spoolers)
10	PU$BANNER	Banner page text
11	PU$LOCATION	Printer / file name
12	PU$COPIES	Number of copies to print
15	PU$PAGENUMBER	Current page number
1002	PU$LINESLEFT	Lines left on page
1003	PU$HEADERLINES	Lines occupied by header
1004	PU$FOOTERLINES	Lines occupied by footer
1005	PU$DATALINES	Lines between header and footer
1006	PU$OPTIONS	Options to be passed to the spooler
1007	PU$PREFIX	Pathname of file holding prefix data to be added to the start of the output
1008	PU$SPOOLER	Spooler to be used (ignored on Windows)
1009	PU$OVERLAY	Catalogued overlay subroutine name (see **SETPTR**)
1010	PU$CPI	Characters per inch (may be non-integer value)
1011	PU$PAPER.SIZE	Paper size. See SYSCOM PCL.H
1012	PU$LPI	Lines per inch
1013	PU$WEIGHT	Font stroke weight. See SYSCOM PCL.H
1014	PU$SYMBOL.SET	Symbol set. See SYSCOM PCL.H
1015	PU$STYLE	Query processor style. See the Query processor **STYLE** option for details.

unit evaluates to the print unit number.

The **GETPU()** function returns the print unit characteristic specified by *key*. It is closely related to the **!GETPU()** subroutine.

Example

```
MODE = GETPU(PU$MODE, 3)
```

The above statement gets the mode of print unit 3, storing it in MODE.

GETREM()

The **GETREM()** function returns the remove pointer position into a string.

Format

GETREM(*string***)**

where

string is the string for which the remove pointer position is to be returned.

The **GETREM()** function returns the offset of the remove pointer into string. It is typically used with **SETREM** to save and restore the remove pointer position. The remove pointer is positioned on the mark character preceding the next fragment to be extracted. It is reset to zero when a new value is assigned to the string.

Example

```
RMV.PTR = GETREM(S)
GOSUB PROCESS.DATA
SETREM RMV.PTR ON S
```

The above code fragment saves the remove pointer associated with string S and restores it after execution of subroutine PROCESS.DATA which might change this remove pointer.

See also:
REMOVE, **SETREM**

GOSUB

The **GOSUB** statement calls an internal subroutine.

Format

GOSUB *label*{**:**}

GOSUB *label*{**:**}(*args*)

where

label	is the label attached to the statement at the start of the internal subroutine.
args	is a comma separated list of arguments to a subroutine defined with the **LOCAL SUBROUTINE** statement.

The optional colon after the *label* has no effect on the action of the statement.

The program continues execution at the given *label*, saving the location of the **GOSUB** for a later **RETURN** which will resume execution at the statement following the **GOSUB**. See also the **RETURN TO** statement for details of alternate returns.

QMBasic defines two styles of internal subroutine. A conventional internal subroutine, as found in other multivalue database products, has no formal start or end. The *label* may be any label defined within the program or subroutine. It is the programmer's responsibility to ensure that internal subroutines return correctly. Variables referenced in the internal subroutine are accessible across the entire program module, requiring great care from the programmer to ensure that data in one part of the module is not accidentally altered elsewhere by use of the same name. Loop counters in **FOR/NEXT** loops are a good example of where this frequently happens. Calling this style of internal subroutine recursively is possible but of limited use because the variables in one invocation will be overwritten by the next.

The second style, referred to in QMBasic terminology as a local subroutine, is introduced by the **LOCAL** statement and is terminated by **END**. Local subroutines may have arguments and may have private local variables that are not visible outside the subroutine which are stacked if the subroutine is called recursively.

Examples

```
IF STOCK.LEVEL <= REORDER.LEVEL THEN GOSUB REORDER
```

This program fragment checks if the value of STOCK.LEVEL has fallen to the REORDER.LEVEL and, if so, calls internal subroutine REORDER.

```
LOCAL SUBROUTINE UPDATE.STOCK(PROD.NO, CHANGE)
   PRIVATE STOCK.REC
   READU STOCK.REC FROM STOCK.F, PROD.NO THEN
      STOCK.REC<STK.QOH> += CHANGE
      WRITE STOCK.REC TO STOCK.F, PROD.NO
```

```
      END
      RETURN
   END
```

The above local subroutine takes a record id and the amount by which a field is to be updated, reads the corresponding record and applies the update. A real program would include statements to handle the case where the record is not found.

GOTO

The **GOTO** statement continues program execution at a given label.

Format

> **GOTO** *label*{**:**}
> **GO** {**TO**} *label*{**:**}

where

label	is the label attached to the statement at which execution is to continue.

The trailing colon is optional and has no effect on the action of the statement.

The program continues execution at the given *label*. The *label* may be any label defined within the program or subroutine. Excessive use of **GOTO** and labels in place of other language constructs (e.g. **LOOP/REPEAT**) can make programs difficult to maintain.

Example

```
IF REC[1,1] # "A" THEN GOTO ERROR
```

This program fragment checks if the first character of REC is "A". If not, it jumps to label ERROR.

GTS()

The **GTS()** function processes two dynamic arrays, returning a similarly structured result array indicating whether elements of the first array are greater than corresponding elements of the second array.

Format

GTS(*expr1***,** *expr2***)**

where

expr1 and *expr2* are the dynamic arrays to be compared.

The **GTS()** function compares corresponding elements of the dynamic arrays *expr1* and *expr2*, returning a similarly structured dynamic array of true / false values indicating the results of the comparison.

The **REUSE()** function can be applied to either or both expressions. Without this function, any absent trailing values are taken as zero.

Example

A contains 11FM0VM14VMABCFM2
B contains 12FM0VM14VMACBFM2

```
C = GTS(A, B)
```

C now contains 0FM0VM1VM1FM0

See also:
ANDS(), EQS(), GES(), IFS(), LES(), LTS(), NES(), NOTS(), ORS(), REUSE()

HEADING

The **HEADING** statement defines text to be printed or displayed at the top of each page of output.

Format

HEADING {**NO.EJECT**} {**ON** *print.unit*} *text*

where

print.unit	identifies the logical print unit in the range -1 to 255 to which the heading text is to be applied. If omitted, the default print unit (unit 0) is used.
text	is the heading text. This may include control tokens as described below.

The **HEADING** statement defines the text of a page heading and, optionally, control information determining the manner in which the text is output. A page heading is output whenever the first line of output on a page is about to be printed or displayed. The **HEADING** statement normally causes subsequent output to appear on a new page. The **NO.EJECT** option defers the new heading until the start of the next page.

The heading *text* may include the following control tokens enclosed in single quotes. Multiple tokens may appear within a single set of quotes.

C Centres text on the line.

D Insert the current date in the form dd mmm yyyy (e.g. 25 MAR 2006)

G Insert a gap. Spaces are inserted in the heading line at the position of each G control token such that the overall length of the line is the same as the printer unit width. A single use of the G token will right justify the subsequent text. Multiple G tokens will distribute spaces as evenly as possible.

When a heading line uses both G and C, the heading is considered as a number of elements separated by the G control options. The element that contains the C option will be centered. The items either side of the centered element are processed separately when calculating the number of spaces to be substituted for each G option.

H*n* Sets horizontal position (column) numbered from one. Use of H with C or with a preceding G token may have undesired results.

L Start a new line

N Inhibit automatic display pagination

O Reverses the elements separated by G tokens in the current line on even numbered pages. This is of use when printing double sided reports.

P*n* Insert page number. The page number is right justified in *n* spaces, widening the field if necessary. If omitted, *n* defaults to four.

S*n* Insert page number. The page number is left justified in *n* spaces, widening the field if necessary. If omitted, *n* defaults to one.

T Insert current date and time in the form hh:mm:ss mm/dd/yy

Unrecognised control tokens are ignored. A quotation mark may be inserted in the printed text by using two adjacent quotation marks in the *text* string.

There is no limit to the length of a heading text. Each line will be truncated at the width of the print unit. The effect of using a heading which does not leave sufficient space for at least one line of text is undefined.

See also:
FOOTING

HUSH

The **HUSH** statement enables or disables display output.

Format

HUSH OFF {**SETTING** *var*}

HUSH ON {**SETTING** *var*}

HUSH *expr* {**SETTING** *var*}

where

expr	evaluates to a number.
var	is a variable to receive the previous state of display output control.

The **HUSH ON** statement causes all output sent to the display by **CRT**, **DISPLAY** or **PRINT** statements to be suppressed. The **HUSH OFF** statement re-enables display.

The **HUSH** *expr* format of this statement is equivalent to **HUSH ON** if the value of *expr* is non-zero and **HUSH OFF** if *expr* is zero.

The optional **SETTING** clause saves the previous state of display output control in *var* which can be used later to revert to that state. Alternatively, the previous state can be obtained using the **STATUS()** function immediately after the **HUSH** statement. In either case, the value is 1 if output was suppressed or 0 if it was enabled.

Example

```
HUSH ON
EXECUTE "SELECT STOCK.FILE WITH QTY > 50"
HUSH OFF
```

This program fragment suppresses display while the SELECT statement is executed.

ICONV()

The **ICONV()** function performs input conversion. Data is converted from its external representation to the internal form. This function is typically used to convert data entered at the keyboard. The **ICONVS()** function is identical to **ICONV()** except that it works on each element of a dynamic array, returning the result in a similarly delimited dynamic array.

Format

ICONV(*expr***,** *conv.spec***)**

ICONVS(*expr***,** *conv.spec***)**

where

expr	evaluates to the data to be converted.
conv.spec	evaluates to the conversion specification. This may be a multi-valued string containing more than one conversion code separated by value marks. Each conversion will be carried out in turn on the result of the previous conversion.

The **ICONV()** function converts the value of *expr* to its internal representation according to the conversion codes in *conv.spec*. The result of **ICONV()** is stored internally as a string regardless of whether the value is a number or not except for the MO and MX conversions which always produce an integer value.

The **ICONV()** function sets the **STATUS()** function value to indicate whether the conversion was successful. Possible values are

0	Successful conversion.
1	Data to convert was invalid for the conversion specification. A null string is returned.
2	The conversion code was invalid. A null string is returned.
3	The day number in a date conversion was beyond the end of the month. The returned value will be extended into the following month (e.g. 31 June becomes 1 July). This feature can be suppressed using the NO.DATE.WRAPPING option.

See also:
Conversion codes, **OCONV()**

IDIV()

The **IDIV()** function divides one integer by another and returns an integer result.

Format

IDIV(*dividend***,** *divisor***)**

where

dividend	evaluates to the integer to be divided.
divisor	evaluates to the integer by which it is to be divided.

Both arguments to the **IDIV()** function are converted to integers. The function returns the result of the division as an integer rounded towards zero.

A zero value of *divisor* will cause a run time error.

Integer division can also be performed using the // operator.

Example

```
X = 7
Y = 2
Z1 = X / Y
Z2 = IDIV(X, Y)
```

This program fragment shows the difference between the division operator and the **IDIV()** function. Z1 will be set to 3.5 and Z2 will be set to 3.

See also:
[RDIV()]

IF /THEN / ELSE

The **IF** statement provides conditional execution of one or more statements.

Format

IF *expr*
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

expr	is an expression which can be resolved to a numeric value
statement(s)	are statements to be executed depending on the value of *expr*.

At least one of the **THEN** and **ELSE** clauses must be present. If both are used, the **THEN** clause must be first.

The newline before the **THEN** and **ELSE** clauses is optional.

The *statement(s)* under the **THEN** clause are executed if the value of *expr* is non-zero. The *statement(s)* under the **ELSE** clause are executed if the value of *expr* is zero.

Where the keyword **THEN** or **ELSE** is followed by an executable statement on the same line, the condition applies to that statement. If there is nothing else or only a comment on the line, the conditioned *statement(s)* must appear on subsequent lines terminated by an **END** statement. For example:

```
IF QTY > 99 THEN
   LARGE.ORDER = @TRUE
   DISCOUNT = 0.1
END
```

Alternatively, this could be written using semicolons to separate the conditioned statements:

```
IF QTY > 99 THEN LARGE.ORDER = @TRUE ; DISCOUNT = 0.1
```

Use of this format is discouraged as the semantics differ across multivalue database products.

```
IF QTY > QOH THEN
   DISPLAY 'Insufficient stock'
END ELSE
   QOH -= QTY
   DISPLAY 'Order confirmed'
END
```

The above program fragment might be used to compare the quantity in an order (QTY) with the quantity on hand (QOH), taking different paths dependant on whether there is sufficient stock. Note the need for the END to terminate the THEN clause as, unlike some other programming languages, the END pairs up with the THEN or ELSE and not with the IF.

IFS()

The **IFS()** function returns a dynamic array constructed from elements chosen from two other dynamic arrays depending on the content of a third dynamic array.

Format

IFS(*control.array***,** *true.array***,** *false.array***)**

where

control.array	is a dynamic array of true / false values.
true.array	holds values to be returned where the corresponding element of *control.array* is true.
false.array	holds values to be returned where the corresponding element of *control.array* is false.

The **IFS()** function examines successive elements of *control.array* and constructs a result array where elements are selected from the corresponding elements of either *true.array* or *false.array* depending on the *control.array* value.

Example

A contains 1VM0VM0VM1VM1VM1VM0
B contains 11VM22VM3VM4VM91VM36VM7
C contains 14VM61VM2VM0VM35VM18VM3

```
D = IFS(A, B, C)
```

D now contains 11VM61VM2VM4VM91VM36VM3

See also:
ANDS(), **EQS()**, **GES()**, **GTS()**, **LES()**, **LTS()**, **NES()**, **NOTS()**, **ORS()**, **REUSE()**

IN

The **IN** statement reads a single byte from the terminal with an optional timeout.

Format

IN *var* {**FOR** *timeout* {**THEN** *statement(s)*} {**ELSE** *statement(s)*}}

where

var	is the variable to receive the input character value. This is the ASCII character number, not the character itself.
timeout	is the timeout period in tenths of a second.

The **IN** statement reads a single byte from the terminal, returning the character value in *var*. Unless the character is a non-printing control code, it is echoed to the terminal.

If a *timeout* is specified, the program will continue execution if no input is received after this period. The *var* will be set to zero if a timeout occurs.

The optional **THEN** and **ELSE** clauses can be used with the timeout to determine whether input was received.

See also:
INPUT, KEYIN(), KEYREADY()

INDEX()

The **INDEX()** function returns the position of a specified occurrence of a substring within a string. The **INDEXS()** function is similar to **INDEX()** but operates on each element of a dynamic array element separately, locating the required occurrence of *substring* and returning a similarly structured dynamic array of results.

Format

INDEX(*string*, *substring*, *occurrence***)**

where

string	is the string in which the search is to occur.
substring	evaluates to the substring to be located.
occurrence	evaluates to the position of the occurrence of the substring to be located.

The **INDEX()** function locates the specified *occurrence* of *substring* within *string* and returns its character position.

If *occurrence* is less than one or the desired *occurrence* of *substring* is not found, the **INDEX()** function returns zero.

If *substring* is null, the value of *occurrence* is returned.

Use of the **$NOCASE.STRINGS** compiler directive makes the comparison case insensitive.

Examples

```
N = INDEX(S, "*", 3)
```

This statement assigns N with the character position of the third asterisk in variable S.

```
S = "ABABABABABAB"
N = INDEX(S, "ABA", 2)
```

sets N to 5.

INDICES()

The **INDICES()** function returns information about alternate key indices.

Format

INDICES(*file.var***)** To retrieve a list of indices

INDICES(*file.var***,** *index.name***)** To retrieve information for a specific index

where

file.var	is the file variable associated with an open file.
index.name	is the name of the index to be examined.

The first form of the **INDICES()** function returns a field mark delimited list of alternate key index names for the file referenced via *file.var*.

The second form of the **INDICES()** function returns a dynamic array resembling a dictionary record for the index named by the *index.name* argument. This dynamic array corresponds to the original dictionary record used to create the index except that field 1 is extended to include additional flags as a multivalued list.

Value 1	Index type (D, I, A, S or C)
Value 2	Set to 1 if the index needs to be built, otherwise null
Value 3	Set to 1 if the index is null-suppressed by use of the NO.NULLS option to **CREATE.INDEX**, otherwise null
Value 4	Set to 1 if updates are enabled, otherwise null
Value 5	Internal AK numbers
Value 6	The key sort mode within each index entry (L or R), null for indices created prior to release 2.2-16.

Example

```
INDEX.NAMES = INDICES(FVAR)
NUM.INDICES = DCOUNT(INDEX.NAMES, @FM)
FOR I = 1 TO NUM.INDICES
   NAME = INDEX.NAMES<I>
   CRT NAME : '    Type ' : INDICES(FVAR, NAME)[1,1]
NEXT I
```

The above program displays a list of alternate key index names and their type.

INHERIT

The **INHERIT** statement used in a class module makes the public variables, functions and subroutines of another object visible as part of this object.

Format

INHERIT *object*

where

object is an object variable returned from a previous use of the **OBJECT()** function.

The process of searching for a public variable, function or subroutine scans the object referenced in the statement that initiated the scan and then all inherited objects in the order in which they were inherited. Where an inherited object has itself inherited other objects, the scan treats these inherited names as part of the directly inherited object.

See also:
Object oriented programming, **CLASS**, **DISINHERIT**, **OBJECT()**, **PRIVATE**, **PUBLIC**.

INMAT()

The **INMAT()** function provides qualifying information after certain statements are executed.

Format

INMAT({*mat*}**)**

where

mat is the name of a matrix.

Used without a *mat* matrix name, the **INMAT()** function returns information relating to the last use of the following statements

DIMENSION	0 if successful, 1 if insufficient memory.
MATPARSE	The number of elements assigned. Zero if overflows.
MATREAD	The number of elements assigned. Zero if overflows.
MATREADL	The number of elements assigned. Zero if overflows.
MATREADU	The number of elements assigned. Zero if overflows.
OPEN	The modulus of a dynamic file.

Further details of the information returned by **INMAT()** in each case is documented with the relevant statement.

Used with a matrix name, the **INMAT()** function returns the current dimensions of the matrix. If *mat* is a single dimensional matrix, **INMAT()** returns the number of elements, excluding the zero element. If *mat* is a two dimensional matrix, **INMAT()** returns the number of rows and columns as two values separated by a value mark.

Examples

```
DIM A(N)
IF INMAT() THEN ABORT "Insufficient memory"
```

This program fragment dimensions matrix A and tests whether it was successful. If not, the program aborts.

```
N = INMAT(A)
FOR I = 1 TO N
   A(I) += 1
NEXT I
```

This program fragment adds one to each element of matrix A. The **INMAT()** function is used because the matrix was dimension elsewhere and hence its size is not known.

INPUT

The **INPUT** statement enables entry of data from the keyboard or from previously stored **DATA** statements.

Format

INPUT *var* {**,** *length*} {_} {**:**} {**TIMEOUT** *wait*} {**HIDDEN**} {**UPCASE**}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

var	is the variable in which the data is to be stored.
length	is the maximum length of data to be allowed.
HIDDEN	echoes characters back to the screen as asterisks for password type fields.
TIMEOUT *wait*	Sets a timeout period in seconds. If input is not received in this time, the **INPUT** terminates, leaving *var* unchanged. The keywords **FOR** or **WAITING** can be used in place of **TIMEOUT** for compatibility with other environments.
UPCASE	converts input data to uppercase.

The optional **THEN** and **ELSE** clauses used with **TIMEOUT** allow a program to determine whether the input timed out. Successful input executes the **THEN** clause. A timeout will execute the **ELSE** clause.

The **INPUT** statement reads data from the **DATA** queue or, if there is no stored data, from the keyboard.

Keyboard Input

When taking input from the keyboard, the current prompt character will be displayed prior to reading data. The values stored for printing characters are the ASCII characters associated with the key. Non-printing characters result in other stored character values.

If no *length* expression is included, data characters are stored until the return key is pressed.

If *length* is specified, up to that number of characters may be entered after which input is automatically terminated as though the return key had been pressed, any subsequent key entries being retained for the next **INPUT** statement. The return key is not stored as part of the input data.

The optional underscore component of the statement suppresses the automatic input termination when *length* characters have been entered. Any number of characters may be entered but only *length* characters will be displayed.

The optional colon causes the carriage return and line feed output when the return key is used or on reaching the input length limit to be suppressed.

The **INPUT** statement recognises the backspace key, allowing this to be used to correct data entry errors. The terminfo system allows the code sent by the backspace key to be redefined from its default char(8). If an alternative, single byte definition is used, **INPUT** will honour this, otherwise char(8) is used as the backspace.

DATA Queue Input

Where the data queue is not empty, the **INPUT** statement reads the item at the head of this queue, copying it verbatim to *var* with no processing of any embedded control characters. The *length* expression is ignored. The item is displayed as though it had been typed.

Testing for Input

The **INPUT** statement may be used to test whether there are characters waiting to be read from the keyboard or the data queue by using a negative *length* value. For example, the statement

```
INPUT S, -1
```

will set S to 1 if there is data waiting, 0 if no data is waiting.

Use of Pipes

QM recognises input from pipes as a special case. Programs that process data from a pipe can read the data using the same QMBasic statements and functions as for keyboard input. If the end of the data is reached, a subsequent **INPUT** will return a null string. The **STATUS()** function will return ER$EOF.

Examples

```
INPUT ACCOUNT.NO, 10
```

This statement reads data into ACCOUNT.NO with a maximum length of 10 characters.

```
DISPLAY @(0,24) :"Continue?" :
INPUT S:
```

This program fragment displays a query message on the bottom line of the screen and reads a response. Note the trailing colon in the **INPUT** statement to suppress the line feed which would cause the screen to roll up as output was to the bottom line of the display.

INPUT @

The **INPUT @** statement enables entry of data from the keyboard at a specific screen position or from previously stored **DATA** statements.

Format

INPUT @(*x*, *y*) {**,**} {**:**} *var* {**,** *length*} {**_**} {**:**} {*format*} {*modes*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

x, *y*	are the screen position (column and line) at which input is to occur.
var	is the variable in which the data is to be stored.
length	is the maximum length of data to be allowed. Because of a potential syntactic ambiguity in the language, this must be enclosed in brackets if it is an expression.
format	is the format specification to the used for initial display of *var* and to redisplay the data on completion of input.
modes	are any combination of the following keywords:

APPEND	Position the cursor at the end of the data. Use of this keyword also implies **EDIT** mode.
EDIT	Starts in "edit" mode, suppressing the normal clearance of the input field if the first character entered by the user is a data character rather than an edit character.
HIDDEN	echoes characters back to the screen as asterisks for password type fields.
OVERLAY	Starts in "overlay" mode where data entered by the user replaces the character under the cursor rather than being inserted.
PANNING	Allows entry of an unlimited number of characters in a field width of the given *length* by panning the data if it is longer than the display width. Use of this option requires *length* to be specified and implies the presence of the underscore.
TIMEOUT *wait*	Sets a timeout period in seconds. If input is not received in this time, the **INPUTFIELD** terminates, leaving *var* unchanged. The keywords **FOR** or **WAITING** can be used in place of **TIMEOUT** for compatibility with other environments.
UPCASE	converts the input data to uppercase.

The comma after the cursor position is optional and has no effect on the operation of the statement.

The optional **THEN** and **ELSE** clauses used with **TIMEOUT** allow a program to determine whether the input timed out. Successful input executes the **THEN** clause. A timeout will execute the **ELSE** clause.

The **INPUT @** statement reads data from the **DATA** queue or, if there is no stored data, from the keyboard.

Keyboard Input

When reading from the keyboard, the current prompt character will be displayed to the left of the given input position. No prompt is displayed if the input column position, *x*, is zero or if the prompt has been disabled using the **PROMPT** statement. The prompt character will be removed from the screen on completion of the input.

If the colon character before *var* is present, the original contents or *var* are displayed in the input area and entry commences in overlay mode. If the colon character before *var* is not present, entry commences in insert mode with a blank field.

The user has three options:
- Pressing the return key retains the original content of *var*.
- Typing a data character replaces the original content of *var*, clearing any old displayed data (unless the **EDIT** option is used).
- Using an edit key (see below) allows the old data to be edited.

The values stored for printing characters are the ASCII characters associated with the key. Non-printing characters result in stored character values as listed under Character Values for Terminal Input.

If no *length* expression is included, data characters are stored until the return key is pressed.

If *length* is specified, up to that number of characters may be entered after which input is automatically terminated as though the return key had been pressed, any subsequent key entries being retained for the next **INPUT** statement. The return key is not stored as part of the input data.

The **INPUT @** statement may not behave correctly if the *length* of the input field causes it to extend over multiple lines and the terminal in use does not automatically wrap from one line to the next when displaying long text output.

The optional underscore component of the statement suppresses the automatic input termination when *length* characters have been entered. Any number of characters may be entered but only *length* characters will be displayed.

The optional colon causes the carriage return and line feed output when the return key is used or on reaching the input length limit to be suppressed.

In all cases, the following editing keys are available.

Ctrl-A	Home	Position the cursor at the start of the input data

Ctrl-B	Cursor left	Move the cursor left one character
Ctrl-D	Delete	Delete character under cursor
Ctrl-E	End	Position the cursor at the end of the input data
Ctrl-F	Cursor right	Move the cursor right one character
Ctrl-H	Backspace	Backspace one character
Ctrl-K		Delete all characters after the cursor
	Insert	Toggle insert/overlay mode. When overlay mode is enabled, data entered by the user replaces the character under the cursor rather than being inserted before this character. Unless the **OVERLAY** option is used, the input begins in insert mode.

These editing keys can be modified using the **KEYEDIT** statement.

When the return key is pressed to terminate input, if a format is specified, the data is redisplayed using this mask to apply format rules such as right justification.

DATA Queue Input

Where the data queue is not empty, the **INPUT @** statement reads the item at the head of this queue, copying it verbatim to *var* with no processing of any embedded control characters. The *length* expression is ignored. The item is displayed as though it had been typed.

Use of the **STATUS()** function after an **INPUT @** statement returns zero unless input was terminated by a key defined using the **KEYEXIT** or **KEYTRAP** statements.

Use of Pipes

QM recognises input from pipes as a special case. Programs that process data from a pipe can read the data using the same QMBasic statements and functions as for keyboard input. If the end of the data is reached, a subsequent **INPUT @** will return a null string. The **STATUS()** function will return ER$EOF.

Examples

```
DISPLAY @(0,10) : "Account " :
PROMPT ""
INPUT @(8, 10) : ACCOUNT.NO, 16
```

This program fragment displays the current value of ACCOUNT.NO with a suitable annotation and accepts input. Pressing the RETURN key alone will retain the original value as displayed. The **PROMPT** statement has been used to suppress display of the prompt character.

```
INPUT @(10, 5) : PRICE, 10 '10R'
```

This program fragment inputs a value for the PRICE variable, redisplaying it right justified on completion of input.

See also:
BINDKEY(), **INPUTFIELD**, **KEYCODE()**, **KEYEDIT**, **KEYEXIT**, **KEYTRAP**

INPUTCSV

The **INPUTCSV** statement enables entry of CSV format data from the keyboard or from previously stored **DATA** statements.

Format

INPUTCSV *var1***,** *var2***,** ...

where

*var1 var2***,** ... are the variables to receive the input data.

The **INPUTCSV** statement reads CSV format data from the **DATA** queue or, if there is no stored data, from the keyboard. This data is then parsed into the named variables.

If there are insufficient data items entered to populate all the named variables, any unused variables are set to null strings. If there are more data items entered than the number of variables, the excess data is discarded.

Keyboard Input

When taking input from the keyboard, the current prompt character will be displayed prior to reading data. The values stored for printing characters are the ASCII characters associated with the key. Non-printing characters result in other stored character values.

The **INPUTCSV** statement recognises the backspace key, allowing this to be used to correct data entry errors. The terminfo system allows the code sent by the backspace key to be redefined from its default char(8). If an alternative, single byte definition is used, **INPUTCSV** will honour this, otherwise char(8) is used as the backspace.

DATA Queue Input

Where the data queue is not empty, the **INPUTCSV** statement reads the item at the head of this queue, copying it verbatim to *var* with no processing of any embedded control characters. The item is displayed as though it had been typed.

Example

```
INPUTCSV PROD.NO, QTY
```

This statement parses the entered data into the PROD.NO and QTY variables.

See also:
PRINTCSV, **READCSV**, **WRITECSV**

INPUTFIELD

The **INPUTFIELD** statement enables entry of data from the keyboard at a specific screen position or from previously stored **DATA** statements. It differs from **INPUT @** in that it terminates on entry of any control character not recognised as an editing key. This allows application software to capture and handle control and function keys.

Format

INPUTFIELD @(*x*, *y*) {,} {:} *var*, *length* {_} {:} {*format*} {*modes*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

x, *y*	are the screen position (column and line) at which input is to occur.
var	is the variable in which the data is to be stored.
length	is the maximum length of data to be allowed. Because of a potential syntactic ambiguity in the language, this must be enclosed in brackets if it is an expression.
format	is the format specification to the used for initial display of *var* and to redisplay the data on completion of input.
modes	are any combination of the following keywords:

APPEND	Position the cursor at the end of the data. Use of this keyword also implies **EDIT** mode.
EDIT	Starts in "edit" mode, suppressing the normal clearance of the input field if the first character entered by the user is a data character rather than an edit character.
HIDDEN	echoes characters back to the screen as asterisks for password type fields.
OVERLAY	Starts in "overlay" mode where data entered by the user replaces the character under the cursor rather than being inserted.
PANNING	Allows entry of an unlimited number of characters in a field width of the given *length* by panning the data if it is longer than the display width. Use of this option requires *length* to be specified and implies the presence of the underscore.
TIMEOUT *wait*	Sets a timeout period in seconds. If input is not received in this time, the **INPUTFIELD** terminates, leaving *var* unchanged. The keywords **FOR** or **WAITING** can be used in place of **TIMEOUT** for compatibility with other environments.

UPCASE converts the input data to uppercase.

The comma after the cursor position is optional and has no effect on the operation of the statement.

The optional **THEN** and **ELSE** clauses used with **TIMEOUT** allow a program to determine whether the input timed out. Successful input executes the **THEN** clause. A timeout will execute the **ELSE** clause.

The **INPUTFIELD** statement reads data from the **DATA** queue or, if there is no stored data, from the keyboard.

The **INPUTFIELD** statement works similarly to the **INPUT @** statement except that entry of any control character not recognised as an editing function (see **INPUT @**) terminates data entry. The **STATUS()** function can be used to determine the key that caused exit. This will return zero for the return key and the internal key code for any other key.

When the return key is pressed to terminate input, if a format is specified, the data is redisplayed using this mask to apply format rules such as right justification.

Keyboard Input

When reading from the keyboard, the current prompt character will be displayed to the left of the given input position. No prompt is displayed if the input column position, *x*, is zero or if the prompt has been disabled using the **PROMPT** statement. The prompt character will be removed from the screen on completion of the input.

If the colon character before *var* is present, the original contents or *var* are displayed in the input area and entry commences in overlay mode. If the colon character before *var* is not present, entry commences in insert mode with a blank field.

The user has three options:

- Pressing the return key retains the original content of *var*.
- Typing a data character replaces the original content of *var*, clearing any old displayed data (unless the **EDIT** option is used).
- Using an edit key (see below) allows the old data to be edited.

The values stored for printing characters are the ASCII characters associated with the key. Non-printing characters result in stored character values as listed under Character Values for Terminal Input.

If no *length* expression is included, data characters are stored until the return key is pressed.

If *length* is specified, up to that number of characters may be entered after which input is automatically terminated as though the return key had been pressed, any subsequent key entries being retained for the next **INPUT** statement. The return key is not stored as part of the input data.

The **INPUTFIELD** statement may not behave correctly if the *length* of the input field causes it to extend over multiple lines and the terminal in use does not automatically wrap from one line to the next when displaying long text output.

The optional underscore component of the statement suppresses the automatic input termination when *length* characters have been entered. Any number of characters may be entered but only

length characters will be displayed.

The optional colon causes the carriage return and line feed output when the return key is used or on reaching the input length limit to be suppressed.

DATA Queue Input

Where the data queue is not empty, the **INPUT @** statement reads the item at the head of this queue, copying it verbatim to *var* with no processing of any embedded control characters. The *length* expression is ignored. The item is displayed as though it had been typed.

See also:
BINDKEY(), **INPUT@**, **KEYCODE()**, **KEYEDIT**, **KEYEXIT**, **KEYTRAP**

INS

The **INS** statement and **INSERT()** function insert a field, value or subvalue into a dynamic array.

Format

INS *string* **BEFORE** *dyn.array*<*field* {**,** *value* {**,** *subvalue*}}>

INSERT(*dyn.array***,** *field* {**,** *value* {**,** *subvalue*}} **,** *string***)**

where

string	is the string to be inserted.
dyn.array	is the dynamic array into which the item is to be inserted.
field	evaluates to the number of the field before which insertion is to occur.
value	evaluates to the number of the value before which insertion is to occur. If omitted or zero, value 1 is assumed.
subvalue	evaluates to the number of the subvalue before which insertion is to occur. If omitted or zero, subvalue 1 is assumed.

The *string* is inserted before the specified field, value or subvalue of the dynamic array. The **INS** statement assigns the result to the *dyn.array* variable. The **INSERT()** function returns the result without modifying *dyn.array*.

A negative value of *field*, *value* or *subvalue* causes the next item at this level to be appended. For example,

```
INS X BEFORE S<3, -1>
```

appends X as a new value at the end of field 3 of S. See the description of the S<*f*,*v*,*sv*> assignment operator for a discussion of how QM appends items.

Additional delimiters will be added to reach the specified field, value and subvalue unless the *string* to be inserted is null. Absent fields, values and subvalues are assumed to be null so there is no need to insert additional marks in this case.

Example

```
LOCATE PART.NO IN PARTS<1> BY "AL" SETTING I ELSE
   INS PART.NO BEFORE PARTS<I>
END
```

This program fragment locates PART.NO in a sorted list PARTS and, if it is not already present, inserts it.

See also:

DEL, DELETE(), EXTRACT(), FIND, FINDSTR, LISTINDEX(), LOCATE, LOCATE(), REPLACE()

INT()

The **INT()** function returns the integer part of a value.

Format

INT(*expr***)**

where

expr evaluates to a number or a numeric array.

The **INT()** function returns the integer part of *expr*. Any fractional part after rounding in accordance with the **INTPREC** configuration parameter is discarded such that **INT**(1.9), for example, evaluates to 1.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **INT()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

Example

```
N = INT(A / B)
```

This statement finds the integer part of the quotient of A / B and assigns this to N. The **IDIV()** function provides an alternative way to achieve this but is specific to QMBasic.

ITYPE()

The **ITYPE()** function executes a compiled I or C-type dictionary record or an A or S-type with a correlative.

Format

ITYPE(*itype***)**

where

itype is a previously compiled record read from a dictionary.

The **ITYPE()** function evaluates expression compiled as part of the given dictionary record and returns its result. The working environment for the **ITYPE()** function must be established by setting **@ID** to the key of the record being processed and **@RECORD** to the record data if these are used by the expression.

The dictionary record must have been compiled before the **ITYPE()** function is used.

If the byte ordering of the object code in the *itype* variable is not the same as that of the machine on which it is being executed, it will be converted automatically and the *itype* variable will be modified to contain the converted object code so that a subsequent call to the **ITYPE()** function will not repeat the conversion.

The **ITYPE()** function can be used to evaluate D-type items and A or S type items that do not include a correlative. Although the performance of this use of the function will be significantly lower than simple field extraction in the calling program, it may allow some programs that do not require best performance to adopt a generalised interface for all dictionary record types that return data item values.

Example

```
READ IREC FROM DICT.FILE, "AGE" THEN
   @RECORD = REC
   AGE = ITYPE(IREC)
END
```

This program fragment reads dictionary record "AGE" to IREC. This might, perhaps, be an I-type to calculate a person's age from their date of birth. The **@RECORD** variable is set to the data to be processed and the **ITYPE()** function is used to execute the I-type.

KEYCODE()

The **KEYCODE()** function reads a single keystroke from the keyboard.

Format

KEYCODE({*timeout*}**)**

The **KEYCODE()** function pauses program execution until a key is pressed. The character associated with that key is returned as the value of the function. The character is not echoed to the display.

KEYCODE() does not take data from the **DATA** statement queue.

The optional *timeout* parameter specifies a period in seconds after which the function will return if no input is received. In this case the returned value is a null string and the **STATUS()** function will return ER$TIMEOUT.

A null string is also returned when taking input from a pipe if the piped data stream is exhausted. In this case the **STATUS()** function will return ER$EOF. The value returned by the **STATUS()** function is not significant unless **KEYCODE()** has returned a null string.

The **KEYCODE()** function differs from **KEYIN()** in that it uses the terminfo database to identify certain special keys and returns the character representing the internal representation of that key as defined in the KEYIN.H include record in the SYSCOM file. The special keys recognised by this function are:

Function keys F1 to F12
Left, right, up and down cursor keys
Page up and Page down keys
Home and End
Insert and Delete
Backtab
Mouse

Use of the Escape key will return char(27) if no further characters are received within 200mS. This mechanism can be disabled using the **BINDKEY()** function.

Mouse Input on AccuTerm

The mouse code is returned when the mouse control prefix sequence defined in the terminfo database is detected. The way in which mouse clicks are handled varies considerably between different terminal emulators and will almost certainly require device specific programming. The following code sample works for the AccuTerm emulator in its vt100 mode if the terminfo kmous key is defined as "\E[101~".

```
C = KEYCODE()
IF SEQ(C) = K$MOUSE THEN
   S = ''
   LOOP
      C = KEYIN()
```

```
   UNTIL C = 'R'
      S := C
   REPEAT
   ROW = MATCHFIELD(S, '0X0N;0N', 2)
   COL = MATCHFIELD(S, '0X0N;0N', 4)
END
```

The above program fragment is for QM version 2.1-0 upwards as earlier versions used a different terminfo entry. Note that AccuTerm numbers rows and columns from one.

Stylus Input on a PDA

Stylus taps are enabled on a PDA using the @(IT$STYLUS) function. When enabled, a stylus tap sends char(200) (K$MOUSE) followed by the column and row coordinates, separated by a comma and terminated by a carriage return. The following function extends KEYCODE to recognise stylus taps, returning the mouse code to the caller and leaving the screen coordinates in a common block.

```
FUNCTION KEY()
   $CATALOGUE KEY

   $INCLUDE KEYS.H
   $INCLUDE KEYIN.H

   COMMON /STYLUS/STYLUS.ROW, STYLUS.COL

   DISPLAY @(IT$STYLUS,1):
   K = KEYCODE()
   DISPLAY @(IT$STYLUS,0):
   IF SEQ(K) = K$MOUSE THEN
      ECHO OFF
      INPUT S          ;* Get coordinate data
      HUSH OFF
      STYLUS.COL = MATCHFIELD(S, '0N","0N', 1)
      STYLUS.ROW = MATCHFIELD(S, '0N","0N', 3)
   END

   RETURN K
END
```

KEYEDIT

The **KEYEDIT** statement defines editing keys for use with **INPUT @**.

Format

KEYEDIT (*action*, *key***), (***action*, *key***), ...**

where

action identifies the editing action to be performed when the key is pressed. This may be:

- 2 Cursor left
- 3 Return
- 4 Backspace
- 6 Cursor right
- 7 Insert character (treated as action 13)
- 8 Delete character
- 13 Toggle insert mode

A negative *action* value removes the key binding specified by *key*.

key identifies the key to be bound to the given *action*. This is specified as a numeric value:

- 1 to 31 Use the control key with this character value. Ctrl-A is 1, Ctrl-B is 2, etc.
- 32 to 159 Use the Escape key followed by the key with this character value (e.g. Esc-A is 65).
- 160+ Use a sequence of up to four characters constructed from the bytes of (*key* + 160) starting from the low order byte.

The **KEYEDIT** statement adds user defined alternative key bindings to the standard set used by the **INPUT @** statement. These may validly replace default bindings. The newly bound keys remain in effect until either they are rebound by a further **KEYEDIT** statement or the process returns to the command prompt.

The **INPUT @** statement checks for keys bound via the terminfo system or **KEYEDIT** before using the standard default bindings.

See also:
BINDKEY(), **INPUT@**, **INPUTFIELD**, **KEYCODE()**, **KEYEXIT**, **KEYTRAP**

KEYEXIT

The **KEYEXIT** statement defines exit keys for use with **INPUT @**.

Format

KEYEXIT (*action*, *key***), (***action*, *key***), ...**

where

action is a user defined value in the range 1 to 255 to be returned by the **STATUS()** function following an **INPUT @** that is terminated by use of the key defined by *key*.

A negative *action* value removes the key binding specified by *key*.

key identifies the key to be bound to the given *action*. This is specified as a numeric value:

1 to 31	Use the control key with this character value. Ctrl-A is 1, Ctrl-B is 2, etc.
32 to 159	Use the Escape key followed by the key with this character value (e.g. Esc-A is 65).
160+	Use a sequence of up to four characters constructed from the bytes of (*key* 160) starting from the low order byte.

The **KEYEXIT** statement defines one or more keys that will terminate an **INPUT @** statement. When any of these keys in pressed the **INPUT @** returns with the input data as entered up to the moment when this key was used. The **STATUS()** function will return the value defined by *action* for the key.

See the **KEYTRAP** statement for a method to return the original data.

See also:
BINDKEY(), **INPUT@**, **INPUTFIELD**, **KEYCODE()**, **KEYEDIT**, **KEYTRAP**

KEYIN()

The **KEYIN()**, **KEYINC()** and **KEYINR()** functions read a single keystroke from the keyboard.

Format

KEYIN({*timeout*}**)**
KEYINC({*timeout*}**)**
KEYINR({*timeout*}**)**

The **KEYIN()** function pauses program execution until a key is pressed. The character associated with that key is returned as the value of the function. The character is not echoed to the display.

The **KEYINC()** function is identical except that the case of alphabetic characters is inverted in case inversion has been enabled.

The **KEYINR()** function reads a single character with no internal processing. In particular, null characters are not removed and char(10) and char(13) are passed through without any special handling.

The KEYINR() function is redundant from release 2.1-8 as QM now honours the setting of the telnet binary mode parameter. The function will be retained as a synonym for KEYIN() for the foreseeable future.

KEYIN(), **KEYINC()** and **KEYINR()** do not take data from the **DATA** statement queue.

The optional *timeout* parameter specifies a period in seconds after which the function will return if no input is received. In this case the returned value is a null string and the **STATUS()** function will return ER$TIMEOUT. The timeout value may be fractional to specify timeouts of less than one second. Values less than 10mS or greater than 24 hours may not behave correctly.

A null string is also returned when taking input from a pipe if the piped data stream is exhausted. In this case the **STATUS()** function will return ER$EOF. The value returned by the **STATUS()** function is not significant unless **KEYIN()** has returned a null string.

Character Values

The printing characters and control characters are all represented by their normal ASCII characters. Other keystrokes such as the function keys, ALT sequences and special keys (Home, Delete, cursor moves, etc) are represented by characters with values of 128 and upwards. Click here for a table of key code values.

See also:
IN, **KEYCODE()**, **KEYREADY()**

KEYREADY()

The **KEYREADY()** function tests for data entered at the keyboard.

Format

KEYREADY()

The **KEYREADY()** function tests whether characters have been typed at the keyboard, returning true if characters are waiting to be processed, false if not. It differs from use of the **INPUT** statement with a negative length value in that **KEYREADY()** checks the keyboard only whereas **INPUT** checks the keyboard and the **DATA** statement queue.

KEYREADY() always returns true when using piped input. The end of file condition can only be determined by a subsequent attempt to read data from the pipe.

Data detected by **KEYREADY()** may be read by a subsequent use of either **KEYIN()** or **INPUT**.

See also:
IN, **KEYIN()**

KEYTRAP

The **KEYTRAP** statement defines trap keys for use with **INPUT @**.

Format

KEYTRAP (*action*, *key*), (*action*, *key*), ...

where

action is a user defined value in the range 1 to 255 to be returned by the **STATUS()** function following an **INPUT @** that is terminated by use of the key defined by *key* .

A negative *action* value removes the key binding specified by *key*.

key identifies the key to be bound to the given *action*. This is specified as a numeric value:

1 to 31	Use the control key with this character value. Ctrl-A is 1, Ctrl-B is 2, etc.
32 to 159	Use the Escape key followed by the key with this character value.
160+	Use a sequence of up to four characters constructed from the bytes of (*key* 160) starting from the low order byte.

The **KEYTRAP** statement defines one or more keys that will terminate an **INPUT @** statement. When any of these keys in pressed the **INPUT @** returns with the original value of the input variable. The **STATUS()** function will return the value defined by *action* for the key.

See the **KEYEXIT** statement for a method to return the input data as entered up to the moment when this key was used.

See also:
BINDKEY(), **INPUT@**, **INPUTFIELD**, **KEYCODE()**, **KEYEDIT**, **KEYEXIT**

LEN()

The **LEN()** function returns the length of a string. The **LENS()** function is similar to **LEN()** but operates on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

LEN(*string***)**

where

string is the string for which the length is to be returned.

The **LEN()** function returns the length of *string* including any trailing spaces.

Example

```
LOOP
   DISPLAY "Enter account number: "
   INPUT ACCOUNT.NO
WHILE LEN(ACCOUNT.NO) # 6
   PRINTERR "Invalid account number"
REPEAT
```

This program fragment prompts for and inputs an account number. If it is not six characters in length, an error is displayed and the prompt is repeated.

LES()

The **LES()** function processes two dynamic arrays, returning a similarly structured result array indicating whether elements of the first array are less than or equal to corresponding elements of the second array.

Format

LES(*expr1***,** *expr2***)**

where

expr1 and *expr2*	are the dynamic arrays to be compared.

The **LES()** function compares corresponding elements of the dynamic arrays *expr1* and *expr2*, returning a similarly structured dynamic array of true / false values indicating the results of the comparison.

The **REUSE()** function can be applied to either or both expressions. Without this function, any absent trailing values are taken as zero.

Example

A contains 11FM0VM14VMABCFM2
B contains 12FM0VM14VMACBFM2

```
C = LES(A, B)
```

C now contains 1FM1VM0VM0FM1

See also:
ANDS(), **EQS()**, **GES()**, **GTS()**, **IFS()**, **LTS()**, **NES()**, **NOTS()**, **ORS()**, **REUSE()**

LISTINDEX()

The **LISTINDEX()** function returns the position of an item in a delimited list.

Format

LISTINDEX(*list***,** *delimiter***,** *item***)**

where

list	is the list to search.
delimiter	is the single character delimiter separating items in the list.
item	is the item to find.

The **LISTINDEX()** function returns the position of item in the delimited list. If it is not found, the function returns zero.

See the **LOCATE** statement for a more powerful way of dynamic arrays.

Examples

```
SUFFIX = FIELD(DOC.NAME, ".", DCOUNT(DOC.NAME, "."))
IF LISTINDEX("TXT,DOC,PDF", ",", SUFFIX) THEN
   DISPLAY DOC.NAME
END
```

This program fragment extracts the suffix from a Windows style file name and checks whether it is TXT, DOC or PDF. If so, the document name is displayed.

```
LISTINDEX(PROD.NO, @VM, PART); IF @ THEN QTY<1,@> ELSE ""
```

Used as an expression in a dictionary I-type item, this example searches field PROD.NO for an entry containing PART and extracts the corresponding entry from the QTY field. If the item is not found, a null string is returned.

See also:
DEL, **DELETE()**, **EXTRACT()**, **FIND**, **FINDSTR**, **INS**, **INSERT()**, **LOCATE**, **LOCATE()**, **REPLACE()**

LN()

The **LN()** function returns the natural log of a value.

Format

LN(*expr***)**

where

expr evaluates to a number or a numeric array.

The **LN()** function returns the natural log of *expr*. It is the inverse of the **EXP()** function.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **LN()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

Example

```
N = LN(X)
```

This statement finds the natural log of X and assigns this to N.

LOCAL

The **LOCAL** statement introduces an internal function or subroutine that may have private local variables.

Format

> **LOCAL** {**FUNCTION** | **SUBROUTINE**} *name*{(*args*)}
> **PRIVATE** *vars*
> *...statements...*
> **END**

where

name is the name of the function subroutine.

args is the comma separated list of arguments to the function or subroutine. An argument may reference a whole matrix by prefixing it with **MAT**. The variable names used for the arguments are visible only to the one function or subroutine and do not prevent use of the same name in other parts of the program module to reference a different variable.

Further local variables that are private to the function or subroutine may be defined by immediately following the **LOCAL** statement by one or more **PRIVATE** statements. These contain a comma separated list of variable names which may be simple scalar items or matrices where the dimension values are numeric constants. Any variables referenced in the local function or subroutine but not declared as private are considered as having scope across the entire program module.

Functions and subroutines declared using **LOCAL** must be terminated with an **END** statement. The private variables declared using the **PRIVATE** statement have scope from the **LOCAL** statement until the corresponding **END** statement. Variables referenced in the main body of the program and in conventional internal subroutines are accessible unless they have the same name as a locally defined variable.

A local function must be defined using the **DEFFUN** statement with the **LOCAL** option before its first use in the program.

All labels within the local subroutine are private. It is not possible to jump into a subroutine declared with **LOCAL** except by using a **GOSUB** or **ON GOSUB** to its unique entry point. Similarly, it is not possible to jump to a label outside the local subroutine. Use of the **RETURN TO** statement is prohibited within a local subroutine.

If a local subroutine is called recursively, either directly or indirectly via some other intermediate subroutine, the local variables are stacked and the new invocation has its own private local variables.

There is a small performance cost by comparison to use of conventional internal subroutines due to the dynamic allocation of variables but this should be negligible in most applications.

When using the QMBasic debugger, local variables have a name formed from the subroutine name and variable name separated by a colon.

Examples

```
LOCAL SUBROUTINE SCAN.LIST
   PRIVATE I, N, REC
   N = DCOUNT(LIST, @FM)
   FOR I = 1 TO N
      READV REC FROM STOCK.F, LIST<I> , 0 ELSE
         DISPLAY LIST<I> : ' is not in stock file'
      END
   NEXT I
   RETURN
END
```

The above program fragment represents a local subroutine that scans a list, checking that each entry corresponds to a record in a file. By using **LOCAL** and three local variables, all risk of overwriting valuable data in variables of the same names in the main body of the program is removed.

```
LOCAL FUNCTION NEXT.ID(FILENAME)
   PRIVATE DICT.F, ID
   OPEN 'DICT', FILENAME TO DICT.F THEN
      READU ID FROM DICT.F, 'NEXT.ID' THEN
         WRITE ID+1 TO DICT.F, 'NEXT.ID'
         RETURN ID
      END
   END
   RETURN ''
END
```

The above local function takes a file name as its argument and gets the next sequential record id from a record stored in the corresponding dictionary, returning this as the value of the function. The dictionary will automatically be closed when the DICT.F variable is discarded on return from the function.

LOCATE

The **LOCATE** statement searches a dynamic array for a given field, value or subvalue. The **LOCATE()** function provides similar capabilities and is particularly suited to use in dictionary I-type items.

Format

> **LOCATE** *string* **IN** *dyn.array*<*field* {**,***value* {**,** *subvalue*}}> {**BY** *order*} **SETTING** *var*
> {**THEN** *statement(s)*}
> {**ELSE** *statement(s)*}
>
> **LOCATE(***string***,** *dyn.array*{**,** *field* {**,***value* }}**;** *var* {**;** *order*}**)** Pick style syntax
>
> **LOCATE(***string***,** *dyn.array***,** *field* {**,***value* {**,** *subvalue* }} {**;** *order*}**)** Function syntax

where

string	evaluates to the item to be located.
dyn.array	is the dynamic array in which searching is to occur.
field	is the field at which searching is to commence.
value	is the value at which searching is to commence. If omitted or zero, searching occurs at the field level.
subvalue	is the subvalue at which searching is to commence. If omitted or zero, searching occurs at the value level.
order	evaluates to the ordering string as described below. If omitted, no ordering is assumed.
var	is the variable to receive the position value.
statement(s)	are statements to be executed depending on the outcome of the **LOCATE** action.

At least one of the **THEN** and **ELSE** clauses must be present.

The **LOCATE** statement searches for fields, values or subvalues. If only *field* is specified, **LOCATE** searches for a field that matches *string*. If only *field* and *value* are specified, **LOCATE** searches for a value within the specified field that matches *string*. If *field*, *value* and *subvalue* are specified, **LOCATE** searches for a subvalue within the specified field and value that matches *string*.

Searching commences at the starting position defined in the **IN** clause. If a match is found, *var* is set to its field, value or subvalue position as appropriate to the level of the search. If no match is found, *var* is set to the position at which a new item should be inserted. For an unordered **LOCATE** this will be such that it would be appended.

The optional **BY** clause allows selection of an ordering rule. The *order* must evaluate to a two character string, which is

AL Ascending, left justified. Items are considered to be sequenced in ascending collating sequence order.

AR Ascending, right justified. Items are considered to be sequenced in ascending collating sequence order. Where the item being examined is not of the same length as the *string* being located, the shorter of the two is right aligned within the length of the longer prior to comparison. Integer numeric data is treated as a special case and is sorted into correct numeric sequence.

DL Descending, left justified. Similar to **AL** except that the list is held in descending collating sequence.

DR Descending, right justified. Similar to **AR** except that the list is held in descending collating sequence.

The ordering string must be in upper case. Left aligned ordering is faster than right aligned and should be used for textual data. Right aligned ordering is useful for numeric data such as internal format dates where the left aligned ordering would lead to sequencing problems (for example, 17 May 1995 is day 9999, 18 May 1995 is day 10000. Use of a left aligned ordering would place these dates out of calendar order).

The **THEN** clause is executed if the *string* is found in *dyn.array*. The **ELSE** clause is found if the *string* is not found.

The **LOCATE()** function returns as its result the position at which the item was found, zero if it was not found. Although the order argument can be used to specify the expected ordering and has the impact described above for numeric data, this function does not provide a way to identify where an item should be inserted if it is not found. The **LOCATE()** function is particularly suited to use in dictionary I-type items.

The result of a **LOCATE** statement or **LOCATE()** function with a specific ordering when applied to a dynamic array which does not conform to that ordering is undefined and likely to lead to misbehaviour of the program at run time.

Use of the $NOCASE.STRINGS compiler directive makes the comparison case insensitive. When used with a **BY** clause, the sorting is effectively as though both *string* and *dyn.array* are in uppercase.

Examples

```
LOCATE PART.NO IN PARTS<1> BY "AL" SETTING I ELSE
   INS PART.NO BEFORE PARTS<I>
END
```

This program fragment locates PART.NO in a sorted list PARTS and, if it is not already present, inserts it.

```
I = LOCATE(PART.NO, PARTS, 1; "AL")
```

This statement performs the same search as the previous example but can only be used to find the position of an existing item, not to determine where a new item should be inserted to maintain the correct sort order.

Alternative Formats

QM supports two alternative formats of **LOCATE** for compatibility with other database products.

The UniVerse database running in Ideal or Reality flavour uses the **IN** clause to identify the item to be searched, not the starting position. The starting position is assumed to be the first item in the data but may specified explicitly in the command.

LOCATE *string* **IN** *dyn.array{<field* {**,***value* }>} {**,** *start*} {**BY** *order*} **SETTING** *var*
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

This format of **LOCATE** can be selected by including a line

$MODE UV.LOCATE

in the program on a line preceding the **LOCATE** statement. This mode setting has no effect on the operation of the **LOCATE()** function.

The Pick database uses a very different syntax which does not permit the search to start part way through the region of the dynamic array being searched.

LOCATE(*string***,** *dyn.array*{**,***field* {**,***value* }}**;** *var* {**;** *order*}**)**
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

This format can be used in QM without any special mode settings. Note that despite the presence of brackets, this is a statement and should not be confused with the **LOCATE()** function described above.

See also:
DEL, **DELETE()**, **EXTRACT()**, **FIND**, **FINDSTR**, **INS**, **INSERT()**, **LISTINDEX()**, **REPLACE()**

LOCK

The **LOCK** statement obtains one of 64 system wide task locks.

Format

LOCK *lock.num* {**THEN** *statement(s)*} {**ELSE** *statement(s)*}

where

lock.num	evaluates to the lock number in the range 0 to 63.
statement(s)	are statements to be performed depending on the outcome of the **LOCK** operation.

The **THEN** and **ELSE** clauses are both optional. Neither is required.

Task locks provide a means of synchronising the activities of multiple processes without using locks on records in data files. The **LOCK** statement attempts to acquire the lock identified by *lock.num*.

The **THEN** clause is executed if the lock was available or was already held by this process.

The **ELSE** clause is executed if the lock is held by another process. If no **ELSE** clause is present, the **LOCK** statement waits for the lock to become available. This wait can be interrupted by using the break key.

The **STATUS()** function returns zero if the lock was free when the **LOCK** statement was executed. Otherwise it returns the user number of the process that held the lock. This will be the user number of the current process if it already owned the lock.

There is no means for a program to determine which task locks are held by the user except by attempting to acquire each lock in turn and checking the value of the **STATUS()** function. Beware that unlike read, update and file locks, task locks are only automatically released on leaving QM, not on return to the command prompt.

Examples

```
LOCK 7 THEN
    ...processing statements...
   UNLOCK 7
END
ELSE ABORT "Cannot obtain task lock"
```

This program fragment obtains task lock 7, performs some critical processing and then releases the lock. The program aborts if the lock is not available.

```
LOCK 7
```

This statement attempts to obtain task lock 7 but, unlike the previous example, waits for the lock to become free if it is owned by another user.

LOGMSG

The **LOGMSG** statement adds a line to the system error log. This statement has no effect on the PDA version of QM.

Format

LOGMSG *text*

where

text is the message to be logged.

QM includes the option to maintain a log of system error messages in a file named errlog in the QMSYS account. The **LOGMSG** statement can be used by application software to write messages into this file. If the error log is disabled, the **LOGMSG** statement will be ignored.

Although programs can write to this file using the sequential file handling statements, the internal buffering mechanism used by these statements is likely to result in loss of messages. Programs should, therefore, use on the **LOGMSG** statement to write messages.

Example

```
READ ORDER.NO FROM @VOC, 'NEXT.ORDER' ELSE
   LOGMSG 'NEXT.ORDER record not found'
   RETURN
END
```

The above program fragment logs a message in the system error log if the NEXT.ORDER record cannot be found in the VOC

See also:
LOGMSG command

LOOP / REPEAT

The **LOOP** statement introduces a sequence of statements to be executed repeatedly.

Format

LOOP
  {*statement(s)*}
{**WHILE** *expr*}
{**UNTIL** *expr*}
  {*statement(s)*}
REPEAT

where

statement(s)	are statements to be executed within the loop.
expr	is an expression which can be resolved to a numeric value

There may be any number of **WHILE** or **UNTIL** statements within the loop appearing at any position relative to other statements.

Execution of the statements within the loop continues repeatedly until either the expression associated with a **WHILE** statement evaluates to zero or the expression associated with an **UNTIL** statement evaluates to a non-zero value.

The loop may also be terminated by an **EXIT** statement as detailed in its own description.

The **CONTINUE** statement may be used to commence the next iteration of the loop without execution of any intervening statements.

Example

```
LOOP
   REMOVE ITEM FROM ITEM.LIST SETTING DELIMITER
   DISPLAY "Item id " : ITEM
WHILE DELIMITER
REPEAT
```

This program fragment displays the elements of the dynamic array ITEM.LIST.

See also:
CONTINUE, **EXIT**, **FOR/NEXT**, **WHILE**, **UNITL**

LOWER()

The **LOWER()** function converts mark characters in a string to the next lower level mark.

Format

LOWER(*string***)**

where

string evaluates to the string in which mark characters are to be converted.

The **LOWER()** function replaces mark characters according to the following table:

Original	Replacement
Item mark	Field mark
Field mark	Value mark
Value mark	Subvalue mark
Subvalue mark	Text mark
Text mark	Text mark (unchanged)

Example

```
READLIST LIST THEN REC<4> = LOWER(LIST)
```

This statement reads active select list zero to LIST and then saves it in field 4 of REC. Because a select list contains field marks, the **LOWER()** function is used to demote each mark character to the next lowest mark.

See also:
RAISE()

LTS()

The **LTS()** function processes two dynamic arrays, returning a similarly structured result array indicating whether elements of the first array are less than corresponding elements of the second array.

Format

LTS(*expr1***,** *expr2***)**

where

expr1 and *expr2*	are the dynamic arrays to be compared.

The **LTS()** function compares corresponding elements of the dynamic arrays *expr1* and *expr2*, returning a similarly structured dynamic array of true / false values indicating the results of the comparison.

The **REUSE()** function can be applied to either or both expressions. Without this function, any absent trailing values are taken as zero.

Example

A contains 11FM0VM14VMABCFM2
B contains 12FM0VM14VMACBFM2

```
C = LTS(A, B)
```

C now contains 1FM0VM0VM0FM0

See also:
ANDS(), EQS(), GES(), GTS(), IFS(), LES(), NES(), NOTS(), ORS(), REUSE()

MARK.MAPPING

The **MARK.MAPPING** statement determines how field marks are handled when reading or writing from a directory file.

Format

MARK.MAPPING *file.var*, **OFF**

MARK.MAPPING *file.var*, **ON**

MARK.MAPPING *file.var*, *expr*

where

file.var	is the file variable for a previously opened file.
expr	evaluates to a number.

Data written to directory files usually has field marks translated to newlines. On reading, the reverse translation is performed to recover the original data. Records storing binary information may contain bytes that appear to be field marks and these will be translated, possibly causing data corruption.

Use of **MARK.MAPPING** *file.var*, **OFF** will suppress this mark mapping process until a subsequent **MARK.MAPPING** *file.var*, **ON** statement or the file is closed.

The **MARK.MAPPING** *file.var*, *expr* format of this statement is equivalent to **MARK.MAPPING** *file.var*, **ON** if the value of *expr* is non-zero and **MARK.MAPPING** *file.var*, **OFF** if *expr* is zero.

Example

```
MARK.MAPPING FILE.VAR, OFF
READ REC FROM FILE.VAR, ID ELSE STOP 'NOT FOUND'
```

This program fragment reads a record with mark translation suppressed.

MAT

The **MAT** statement assigns a value to all elements of a matrix or copies one matrix to another.

Format

MAT *matrix* = *expr*

MAT *matrix* = **MAT** *src.matrix*

where

matrix	is the name of a previously dimensioned matrix to which values are to be assigned
expr	evaluates to the value to be stored in each matrix element.
src.matrix	is the name of a previously dimensioned matrix which is to be copied to *matrix*.

The first format of this statement copies the value of *expr* into all elements of *matrix*. The zero element is set to a null string.

The second format copies elements from *src.matrix* to *matrix* row by row. If the number of columns differs, the copy behaves as depicted below.

Source:

	1	**2**
1	A	B
2	C	D
3	E	F

Target:

	1	**2**	**3**
1	A	B	C
2	D	E	F

The zero element of *src.matrix* is copied to the zero element of *matrix*.

If *src.matrix* has more elements than *matrix*, the excess elements are ignored. If *src.matrix* has fewer elements than *matrix*, the remaining elements of *matrix* are unchanged.

A single dimensional matrix can be copied to a two dimensional matrix and vice versa.

Examples

```
DIM A(25)
MAT A = 0
```

This program fragment dimensions matrix A to have 25 elements and sets them all to zero.

```
DIM A(5,5), B(25)
... statements that set values in matrix A...
MAT B = MAT A
```

This program fragment dimensions two matrices, sets values into matrix A and then creates a single

dimensional copy of A in matrix B.

MATBUILD

The **MATBUILD** statement constructs a dynamic array from the elements of a matrix.

Format

MATBUILD *var* **FROM** *mat* {**,** *start.expr* {**,** *end.expr*} {**USING** *delimiter*}

where

var	is the variable to receive the dynamic array.
mat	is the matrix from which data is to be taken.
start.expr	evaluates to the index of the first matrix element to be used. If omitted or less than one, this defaults to one.
end.expr	evaluates to the index of the last matrix element to be used. If omitted or less than one, this defaults to the number of elements in the matrix.
delimiter	evaluates to the delimiter to be used between elements of *mat*. This may be more than one character. If omitted, this defaults to the field mark.

The **MATBUILD** statement constructs a dynamic array by concatenating elements of *mat* from element *start.expr* to the last non-null element before element *end.expr*. The *delimiter* is inserted between each element. With the default style of matrix, if the zero element of *mat* is non-null, a *delimiter* followed by the content of the zero element is appended to the end of the resultant dynamic array. Pick style matrices do not have a zero element. See the **COMMON** and **DIMENSION** statements for more details.

Example

```
MATBUILD REC FROM A USING @VM
```

This statement constructs dynamic array REC from the elements of matrix A, separating each element by a value mark.

See also:
MATPARSE

MATCHFIELD

The **MATCHFIELD()** function extracts a portion of a string that matches a pattern element.

Format

MATCHFIELD(*string*, *pattern*, *element*)

where

string	evaluates to the string in which the pattern is to be located.
pattern	evaluates to a template as described below.
element	evaluates to an integer indicating which pattern element of *string* is to be returned.

The **MATCHFIELD()** function matches *string* against *pattern* and returns the portion of *string* that matches the *element*'th component of *pattern*.

The *pattern* string consists of one or more concatenated items from the following list.

...	Zero or more characters of any type
0X	Zero or more characters of any type
*n*X	Exactly *n* characters of any type
n-*m*X	Between *n* and *m* characters of any type
0A	Zero or more alphabetic characters
*n*A	Exactly *n* alphabetic characters
n-*m*A	Between *n* and *m* alphabetic characters
0N	Zero or more numeric characters
*n*N	Exactly *n* numeric characters
n-*m*N	Between *n* and *m* numeric characters
"*string*"	A literal string which must match exactly. Either single or double quotation marks may be used. Unlike the **MATCHES** operator, *string* must be enclosed in quotes otherwise each character is treated as a separate component.

The values *n* and *m* are integers with any number of digits. *m* must be greater than or equal to *n*.

The 0A, *n*A, 0N, *n*N and "*string*" patterns may be preceded by a tilde (~) to invert the match condition. For example, ~4N matches four non-numeric characters such as ABCD (not a string which is not four numeric characters such as 12C4).

A null string matches patterns ..., 0A, 0X, 0N, their inverses (~0A, etc) and "".

The 0X and *n*-*m*X patterns match against as few characters as necessary before control passes to the next pattern. For example, the string ABC123DEF matched against the pattern 0X2N0X matches the pattern components as ABC, 12 and 3DEF.

The 0N, *n-m*N, 0A, and *n-m*A patterns match against as many characters as possible. For example, the string ABC123DEF matched against the pattern 0X2-3N0X matches the pattern components as ABC, 123 and DEF.

The *pattern* string may contain alternative templates separated by value marks. The **MATCHFIELD()** function tries each template in turn until one is a successful match against *string*.

The *element* argument determines which component of *string* is returned as the **MATCHFIELD()** function result. For example,

```
MATCHFIELD("ABC123DEF", "0X2N0X", 2)
```

returns the string "12".

The **MATCHFIELD()** function returns a null string if no component of *pattern* matches *string*.

Example

```
TEL.NO = "01604-709200"
LOCAL.NO = MATCHFIELD(TEL.NO, "0N'-'0N", 3)
```

This program fragment extracts the local part of a telephone number (709200 in this case). Note that the literal element counts as a component of the string when identifying each element.

If the delimiter is multiple characters but not quoted, each character is counted as a separate element:

```
MATCHFIELD("123--456", "0N'--'0N", 1)   returns  123
MATCHFIELD("123--456", "0N'--'0N", 2)   returns  --
MATCHFIELD("123--456", "0N'--'0N", 3)   returns  456

MATCHFIELD("123--456", "0N--0N", 1)     returns  123
MATCHFIELD("123--456", "0N--0N", 2)     returns  -
MATCHFIELD("123--456", "0N--0N", 3)     returns  -
MATCHFIELD("123--456", "0N--0N", 4)     returns  456
```

See also:
Pattern Matching

MATPARSE

The **MATPARSE** statement breaks a delimited string into component substrings, assigning each to an element of a matrix.

Format

MATPARSE *mat* **FROM** *string*, *delimiter*
MATPARSE *mat* **FROM** *string* **USING** *delimiter*

where

mat	is the matrix into which the substrings are to be assigned. This matrix must already have been dimensioned.
string	is the string to be parsed.
delimiter	evaluates to the delimiter that separates substrings within *string*.

The **MATPARSE** statement operates in one of three ways depending on the length of the *delimiter* string.

If *delimiter* is a null string, each character of *string* is assigned to a separate element of *mat*. If both *string* and *delimiter* are null, no elements are assigned.

If *delimiter* is a one character string, each substring of *string* delimited by *delimiter* is assigned to a separate element of *mat*. The delimiter character is not stored in *mat*.

If *delimiter* is more than one character long, each substring of *string* delimited by any character of *delimiter* is assigned to a separate element of *mat*. The next element is assigned the character that delimited the items. Where two or more occurrences of the same delimiter character occur within *string* with no other intervening characters, only a single element of *mat* is used to receive the multiple delimiters.

If *mat* is two dimensional, its elements are assigned row by row.

In all cases, the **INMAT()** function will return the number of elements assigned. Unused elements are set to null strings.

With the default style of matrix, where there are insufficient elements in *mat* to receive the parsed *string*, the remaining unparsed data is stored in the zero element of *mat*. In this case, the **INMAT()** function will return zero.

Pick style matrices do not have a zero element. Any excess data is stored in the final element of the matrix and the **INMAT()** function returns zero to indicate this condition. See the **COMMON** and **DIMENSION** statements for more details.

Example

```
DIM A(30)
```

```
MATPARSE A FROM S, @FM
```

This program fragment assigns successive fields of string S to elements of matrix A. If there are more than 30 fields, the remaining fields and delimiting mark characters are stored in A(0).

See also:
MATBUILD

MATREAD

The **MATREAD** statement reads a record from a file, assigning each field to an element of a matrix.

The **MATREADL** statement is similar to **MATREAD** but sets a read lock on the record. The **MATREADU** statement sets an update lock on the record.

Format

MATREAD *mat* **FROM** *file.var*, *record.id* {**ON ERROR** *statement(s)*}
{**LOCKED** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

mat	is the matrix into which fields are to be assigned. This matrix must already have been dimensioned.
file.var	is the file variable associated with the file.
record.id	evaluates to the key of the record to be read.
statement(s)	are statements to be executed depending on the outcome of the operation.

The **LOCKED** clause is not valid with the **MATREAD** statement. At least one of the **THEN** and **ELSE** clauses must be present.

Each field of the record is assigned to a separate element of *mat*. If *mat* is two dimensional, its elements are assigned row by row. The **INMAT()** function will return the number of elements assigned. Unused elements are set to null strings.

With the default style of matrix, where there are fewer elements in *mat* than the number of fields in the record, the remaining data is stored in the zero element of *mat*. In this case, the **INMAT()** function will return zero.

Pick style matrices do not have a zero element. Any excess data is stored in the final element of the matrix and the **INMAT()** function returns zero to indicate this condition. See the **COMMON** and **DIMENSION** statements for more details.

The **MATREAD** statement is equivalent to a **READ** followed by a **MATPARSE**.

```
READ REC FROM file.var, record.id
ON ERROR statement(s)
LOCKED statement(s)
THEN MATPARSE mat FROM REC, @FM
ELSE statement(s)
```

Example

```
DIM ITEMS(30)
MATREAD ITEMS FROM ITEM.FILE, "ITEM.LIST" ELSE
   ABORT "ITEM.LIST record not found"
END
IF INMAT() THEN DISPLAY INMAT() : " items read"
ELSE ABORT "Too many items"
```

This program fragment reads a record from a file, assigning fields to elements of matrix ITEMS. If there are more than 30 fields, the program aborts, otherwise it displays the number of items read.

MATREADCSV

The **MATREADCSV** statement reads a CSV format line of text from a directory file record previously opened for sequential access and parses it into the elements of a dimensioned matrix.

Format

MATREADCSV *matrix* **FROM** *file.var*
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

matrix	is the dimensioned matrix to receive the data read from the file.
file.var	is the file variable associated with the record by a previous **OPENSEQ** statement.
statement(s)	are statement(s) to be executed depending on the outcome of the **READSEQ**.

At least one of the **THEN** and **ELSE** clauses must be present.

A line of text is read from the file. It is then parsed according to the CSV format rules, placing the elements into successive elements of the matrix. If successful, the **THEN** clause is executed and the **STATUS()** function would return zero.

If there are fewer data items in the line of text than the number of variables supplied, the remaining elements of the matrix will be set to null strings. If the line of text has more data items than the number of elements in the matrix, the excess data is placed in the zero element as for **MATPARSE**.

If there are no further fields to be read, the **ELSE** clause is executed and the **STATUS()** function would return ER$RNF (record not found). The target matrix will be unchanged.

The CSV rules are described under the **WRITECSV** statement.

Example

```
DIM DETAILS(10)
LOOP
   MATREADCSV DETAILS FROM DELIVERY.F ELSE EXIT
   GOSUB PROCESS.DELIVERY.DETAILS
REPEAT
```

This program fragment reads CSV format lines of text from the record open for sequential access via the DELIVERY.F file variable into elements of the DETAILS matrix. It then calls the PROCESS.DELIVERY.DETAILS subroutine to process the new item. The loop terminates when the **ELSE** clause is executed when all fields have been processed.

See also:

CLOSESEQ, **NOBUF**, **OPENSEQ**, **READBLK**, **READSEQ**, **SEEK**, **WEOFSEQ**, **WRITEBLK**, **WRITECSV**, **WRITESEQ**, **WRITESEQF**

MATWRITE

The **MATWRITE** statement builds a record from successive elements of a matrix and writes this to a file.

The **MATWRITEU** statement is similar but preserves any lock on the record being written.

Format

MATWRITE *mat* **TO** *file.var*, *record.id* {**ON ERROR** *statement(s)*}

where

mat	is the matrix from which data is to be taken.
file.var	is the file variable associated with the file.
record.id	evaluates to the key of the record to be written.
statement(s)	are statements to be executed depending on the outcome of the operation.

The **MATWRITE** statement constructs a dynamic array by concatenating elements of *mat*, inserting a field mark between each element.

If the zero element of *mat* is a null string or unassigned, assembly of the dynamic array terminates after the last non-null element of *mat*. No trailing null fields will be written for later unassigned elements of *mat*.

If the zero element of *mat* contains data, all elements of *mat* are used and the zero element is concatenated as the final field of the record.

Pick style matrices do not have a zero element. See the **COMMON** and **DIMENSION** statements for more details.

If the **ON ERROR** clause is taken, the **STATUS()** function can be used to determine the cause of the error. Otherwise, for the **MATWRITE** statement, the **STATUS()** function returns 0 if the record was locked by this process prior to the **MATWRITE** or ER$NLK if it was not locked. The **STATUS()** function value is undefined after a successful **MATWRITEU** statement.

A **MATWRITE** statement is equivalent to a **MATBUILD** followed by a **WRITE**.

```
MATBUILD REC FROM mat
WRITE REC TO file.var, record.id ON ERROR statement(s)
```

Example

```
MATWRITE ITEMS TO ITEM.FILE, "ITEM.LIST" ON ERROR
   ABORT "Error " : STATUS() : " writing item list"
END
IF STATUS() = 0 THEN DISPLAY "Lock released"
```

This program fragment writes a record built from elements of matrix ITEMS. If it was locked prior to the **MATWRITE**, a message is displayed.

MAX()

The **MAX()** function returns the greater of two values.

Format

MAX(*a***,** *b***)**

where

a, *b* are the two values to be compared.

The **MAX()** function compares the values *a* and *b*, returning the greater value. If either value cannot be treated as a number, a character by character comparison from the left end is performed until a difference is found.

MAXIMUM()

The **MAXIMUM()** function returns the greatest value in a dynamic array.

Format

MAXIMUM(*dyn.array***)**

where

dyn.array is the dynamic array to be scanned.

The **MAXIMUM()** function returns the greatest numeric value in *dyn.array*. Non-numeric and null elements of *dyn,array* are ignored. If the entire dynamic array is null, a null string is returned.

Example

```
S = '61':@VM:'42':@FM:'71':@VM:'57'
CRT MAXIMUM(S)
```

This program fragment searches S for the largest numeric value and displays the result (71).

MIN()

The **MIN()** function returns the lesser of two values.

Format

MIN(*a***,** *b***)**

where

a, *b* are the two values to be compared.

The **MIN()** function compares the values *a* and *b*, returning the lesser value. If either value cannot be treated as a number, a character by character comparison from the left end is performed until a difference is found.

MINIMUM()

The **MINIMUM()** function returns the lowest value in a dynamic array.

Format

MINIMUM(*dyn.array***)**

where

dyn.array is the dynamic array to be scanned.

The **MINIMUM()** function returns the lowest numeric value in *dyn.array*. Non-numeric and null elements of *dyn,array* are ignored. If the entire dynamic array is null, a null string is returned.

Example

```
S = '61':@VM:'42':@FM:'71':@VM:'57'
CRT MINIMUM(S)
```

This program fragment searches S for the largest numeric value and displays the result (42).

MOD()

The **MOD()** function returns the modulus value of one value divided by another. The **MODS()** function is similar to **MOD()** but operates on successive elements of two dynamic arrays, returning a similarly structured dynamic array of results.

Format

MOD(*dividend***,** *divisor***)**

where

dividend evaluates to a number or a numeric array.

divisor evaluates to a number or a numeric array.

The **MOD()** function returns the modulus value of dividing *dividend* by *divisor*. This is defined as

```
MOD(x, y) = IF y = 0 THEN x ELSE x - (y * FLOOR(x / y))
```

where the FLOOR() function returns the highest integer with value not greater than its argument. For example, FLOOR(-3.7) is -4.

The **MOD()** function differs from the **REM()** function when one of its arguments is negative. The following table shows the result of the **MOD()** function.

Dividend	**Divisor**	**MOD()**
530	100	30
-530	100	70
530	-100	-70
-530	-100	-30
0	100	0
0	-100	0
100	0	100
-100	0	-100

The **MODS()** function operates on corresponding elements of two dynamic arrays, returning a similarly structured dynamic array of results. For arrays of differing structure, the structure of the result depends on whether the QMB.REUSE function is used.

Example

```
N = MOD(T, 30)
```

This statement finds the modulus of dividing T by 30 and assigns this to N.

See also:
[REM()]

NAP

The **NAP** statement causes the program in which it is executed to pause for a given number of milliseconds.

Format

NAP *time*

where

time is the number of milliseconds for which the program is to sleep.

If the value of *time* is less than 5000, the program pauses for the given number of milliseconds. This sleep cannot be interrupted by the quit key.

If the value of *time* is 5000 or greater, the value is truncated to whole seconds and the program enters an interruptable sleep for that period.

See also:
SLEEP

NEG()

The **NEG()** function returns the arithmetic inverse of a value. The **NEGS()** function is similar to **NEG()** but operates on successive elements of a dynamic array, returning a similarly structured dynamic array of results

Format

NEG(*expr***)**

where

expr evaluates to a number or a numeric array.

The **NEG()** function returns the negative of *expr*. It is equivalent to -*expr*.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **NEG()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

Example

```
N = NEG(A)
```

This statement finds the arithmetic inverse of A and assigns this to N.

NES()

The **NES()** function processes two dynamic arrays, returning a similarly structured result array indicating whether corresponding elements are not equal.

Format

NES(*expr1***,** *expr2***)**

where

expr1 and *expr2* are the dynamic arrays to be compared.

The **NES()** function compares corresponding elements of the dynamic arrays *expr1* and *expr2*, returning a similarly structured dynamic array of true / false values indicating the results of the comparison.

The **REUSE()** function can be applied to either or both expressions. Without this function, any absent trailing values are taken as zero.

Example

A contains 11FM0VM14VMABCFM2
B contains 12FM0VM14VMACBFM2

```
C = NES(A, B)
```

C now contains 1FM0VM0VM1FM0

See also:
ANDS(), **EQS()**, **GES()**, **GTS()**, **IFS()**, **LES()**, **LTS()**, **NOTS()**, **ORS()**, **REUSE()**

NOBUF

The **NOBUF** statement turns off buffering for a record opened using **OPENSEQ**.

Format

NOBUF *file.var*
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

file.var	is the file variable associated with the record by a previous **OPENSEQ** statement.
statement(s)	are statement(s) to be executed depending on the outcome of the **NOBUF** statement.

At least one of the **THEN** and **ELSE** clauses must be present.

Normally, QM buffers data for records opened using **OPENSEQ**. The **NOBUF** statement turns off this buffering such that **READBLK** will read the exact number of bytes specified and **WRITEBLK**, **WRITESEQ** and **WRITESEQF** write immediately without intermediate buffering. The **READSEQ** statement continues to use buffering as this is necessary for locating the end of a text line.

Using unbuffered processing will result in lower performance than normal operation but may be useful, for example, when the item opened using **OPENSEQ** is actually a device rather than a file system data record.

See also:
CLOSESEQ, **OPENSEQ**, **READBLK**, **READCSV**, **READSEQ**, **SEEK**, **WEOFSEQ**, **WRITEBLK**, **WRITECSV**, **WRITESEQ**, **WRITESEQF**

NOT()

The **NOT()** function returns the logical inverse of its argument. The **NOTS()** function is similar to **NOT()** but operates on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

NOT(*expr***)**

where

expr evaluates to a numeric value

The **NOT()** function returns the logical inverse of *expr*. If *expr* is zero (or a null string which equates to zero), the **NOT()** function returns true (1). If *expr* is non-zero, the **NOT()** function returns false (0).

Example

```
IF NOT(NUM(S)) THEN GOTO ERROR
```

This statement causes the program to jump to label ERROR if S is not numeric.

See also:
ANDS(), **EQS()**, **GES()**, **GTS()**, **IFS()**, **LES()**, **LTS()**, **NES()**, **ORS()**, **REUSE()**

NULL

The **NULL** statement performs no action.

Format

NULL

The **NULL** statement is useful to satisfy the requirements of QMBasic syntax where no specific action is required. No object code is generated by this statement.

Example

```
READ REC FROM CONTROL.FILE, "INVOICE.LIST" ELSE NULL
```

This statement reads the record "INVOICE.LIST" from the file open as file variable CONTROL.FILE. The **READ** statement must have either or both of the **THEN** and **ELSE** clauses. If the record is not found, REC will be set to a null string by the **READ** statement and the **ELSE** clause will be executed. As no further action is required, this clause is simply a **NULL** statement.

NUM()

The **NUM()** function tests whether a string can be converted to a number. The **NUMS()** function is similar to **NUM()** but operates on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

NUM(*string***)**

where

string evaluates to the string to be tested.

The **NUM()** function returns true (1) if the *string* can be converted to a number. The function returns false (0) for a string which cannot be converted to a number. A null string is a valid representation of zero and hence causes **NUM()** to return true.

Example

```
LOOP
   DISPLAY "Enter part number ":
   INPUT PART.NO
UNTIL LEN(PART.NO) AND NUM(PART.NO)
   PRINTERR "Part number is invalid"
REPEAT
```

This program fragment prompts for and inputs a part number. If the data entered is null or cannot be converted to a number, an error message is displayed and the prompt is repeated.

OBJECT()

The **OBJECT()** function instantiates an object for object oriented programming.

Format

OBJECT(*cat.name***,** {*args*...})

where

cat.name	is the name of the catalogued **CLASS** module defining the object.
args	are optional arguments that will be passed into the CREATE.OBJECT subroutine.

The **OBJECT()** function loads the catalogued class module defined by *cat.name* and creates an object that references it. The function returns and object reference that should be stored in a program variable.

```
OBJ = OBJECT("MYOBJECT")
```

If the class module includes a public subroutine named CREATE.OBJECT this is executed as part of object instantiation.

Copying an object reference variable creates a second reference to the same object, not a new instantiation of the same object.

The object remains in existence until the last variable referencing it is overwritten or discarded. At this point, if the class module includes a public subroutine named DESTROY.OBJECT, it will be executed.

See also:
Object oriented programming, **CLASS**, **DISINHERIT**, **INHERIT**, **PRIVATE**, **PUBLIC**.

OBJINFO()

The **OBJINFO()** function returns information about an object variable.

Format

OBJINFO(*var***,** *key***)**

where

var	is the name of the object variable.
key	identifies the information to be returned:

0	OI$ISOBJ	Returns true (1) if *var* is an object, false (0) if not.
1	OI$CLASS	Returns the class module catalogue name associated with the object.

The **OBJINFO()** function returns information about an object variable based on the *key* value supplied.

See also:
CLASS, **OBJECT**

OCONV()

The **OCONV()** function performs output conversion. Data is converted from its internal representation to the external form. This function is typically used to convert data for display or printing. The **OCONVS()** function is identical to **OCONV()** except that it works on each element of a dynamic array, returning the result in a similarly delimited dynamic array.

Format

OCONV(*expr***,** *conv.spec***)**

OCONVS(*expr***,** *conv.spec***)**

where

expr	evaluates to the data to be converted.
conv.spec	evaluates to the conversion specification. This may be a multi-valued string containing more than one conversion code separated by value marks. Each conversion will be carried out in turn on the result of the previous conversion.

The **OCONV()** function converts the value of *expr* to its external representation according to the conversion codes in *conv.spec*.

If *conv.spec* is a null string, **OCONV()** returns *expr* as its result.

The **OCONV()** function sets the **STATUS()** function value to indicate whether the conversion was successful. Possible values are

0	Successful conversion.
1	Data to convert was invalid for the conversion specification.
2	The conversion code was invalid.

Conversions that result in a non-zero **STATUS()** value return the string that failed to convert as the function result. For an **OCONV()** function where *conv.spec* is not multi-valued or where the first stage of a multiple conversion fails, the function would return *expr*. If one or more stages of a multi-valued *conv.spec* have been completed, the returned value is the result of the last successful stage.

See also:
Conversion codes, **ICONV()**

ON GOSUB

The **ON GOSUB** statement enters one of a list of internal subroutines depending on the value of an expression.

Format

ON *expr* **GOSUB** *label1*{**:**}, *label2*{**:**}, *label3*{**:**}

where

expr is an expression which can be resolved to a numeric value

label1... are statement labels. The trailing colons are optional and have no effect on the behaviour of the statement.

The **ON GOSUB** statement may be written over multiple lines by inserting a newline after the comma separating two labels.

Execution of the program continues at *label1* if the value of *expr* (converted to an integer) is 1, *label2* if it is 2 and so on. By default, a value less than one will use *label1* and a value greater than the number of labels in the list will use the last label. The PICK.JUMP.RANGE option of the **$MODE** directive can be used to invoke the Pick style behaviour where an out of range value continues execution at the statement following the **ON GOSUB**.

See the **GOSUB** statement for more details on internal subroutines.

Example

```
ON X GOSUB SUBR1,
           SUBR2,
           SUBR3
```

This program fragment enters one of three internal subroutines depending on the value of variable X. If X could not be guaranteed to hold a valid value (1 to 3), error checking statements should be included to ease debugging of program errors.

ON GOTO

The **ON GOTO** statement jumps to one of a list of labels depending on the value of an expression.

Format

ON *expr* **GOTO** *label1*{**:**}, *label2*{**:**}, *label3*{**:**}

ON *expr* **GO** {**TO**} *label1*{**:**}, *label2*{**:**}, *label3*{**:**}

where

expr	is an expression which can be resolved to a numeric value
label1...	are statement labels. The trailing colons are optional and have no effect on the behaviour of the statement.

The **ON GOTO** statement may be written over multiple lines by inserting a newline after the comma separating two labels.

Execution of the program continues at *label1* if the value of *expr* (converted to an integer) is 1, *label2* if it is 2 and so on. By default, a value less than one will use *label1* and a value greater than the number of labels in the list will use the last label. The PICK.JUMP.RANGE option of the **$MODE** directive can be used to invoke the Pick style behaviour where an out of range value continues execution at the statement following the **ON GOTO**.

Example

```
ON ACTION GOTO DISPLAY.REPORT,
               PRINT.REPORT,
               SAVE.REPORT
```

This program fragment jumps to one of three labels depending on the value of variable ACTION. If ACTION could not be guaranteed to hold a valid value (1 to 3), error checking statements should be included to ease debugging of program errors.

OPEN

The **OPEN** statement opens a directory file or dynamic file, associating it with a file variable.

Format

OPEN {*dict.expr*,} *filename.expr* {**READONLY**} **TO** *file.var* {**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

dict.expr	evaluates to DICT to open the dictionary portion of the file or to a null string to open the data portion. If omitted or any other value, the data portion is opened.
filename.expr	evaluates to the VOC name of the file to be opened.
file.var	is the name of the variable to hold the file reference for use in later operations on this file.
statement(s)	are statements to be executed depending on the outcome of the **OPEN** operation.

At least one of the **THEN** and **ELSE** clauses must be present.

A file opened by the **OPEN** statement may be referenced using the file variable in subsequent statements that operate on the file.

The optional **READONLY** clause opens the file for read only access. Any attempt to write will fail.

If the file is opened successfully, the **THEN** clause is executed. If the open fails the **ELSE** clause is executed and the **STATUS()** function may be used to determine the cause of the failure.

The **ON ERROR** clause is taken only in the case of serious errors such as damage to the file's internal control structures. The **STATUS()** function will contain an error number. If no **ON ERROR** clause is present, a fatal error results in an abort.

QM allows more files to be open than the underlying operating system limit. This is achieved by automatically closing files at the operating system level if the limit is reached, retaining information to reopen them automatically when the next access to the file occurs. This process allows greater freedom of application design but has a performance penalty if a large number of files are used frequently.

For dynamic files, the **INMAT()** function used immediately after the **OPEN** returns the modulus of the file.

Example

```
OPEN "STOCK.FILE" TO STOCK ELSE ABORT "Cannot open file"
```

This statement opens a file with VOC name STOCK.FILE. If the open fails, the program aborts with an error message.

See also:
OPENPATH, **OPENSEQ**

OPENPATH

The **OPENPATH** statement opens a directory file or dynamic file by pathname, associating it with a file variable.

Format

OPENPATH *pathname* {**READONLY**} **TO** *file.var* {**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

pathname	evaluates to the VOC name of the file to be opened.
file.var	is the name of the variable to hold the file reference for use in later operations on this file.
statement(s)	are statements to be executed depending on the outcome of the **OPENPATH** operation.

At least one of the **THEN** and **ELSE** clauses must be present.

A file opened by the **OPENPATH** statement may be referenced using the file variable in subsequent statements that operate on the file.

The optional **READONLY** clause opens the file for read only access. Any attempt to write to the file will fail.

If the file is opened successfully, the **THEN** clause is executed. If the open fails the **ELSE** clause is executed and the **STATUS()** function may be used to determine the cause of the failure.

The **ON ERROR** clause is taken only in the case of serious errors such as damage to the file's internal control structures. The **STATUS()** function will contain an error number. If no **ON ERROR** clause is present, a fatal error results in an abort.

QM allows more files to be open than the underlying operating system limit. This is achieved by automatically closing files at the operating system level if the limit is reached, retaining information to reopen them automatically when the next access to the file occurs. This process allows greater freedom of application design but has a performance penalty if a large number of files are used frequently.

For dynamic files, the **INMAT()** function used immediately after the **OPENPATH** returns the modulus of the file.

Example

```
OPEN "\QMSYS\NEWVOC" TO NEWVOC ELSE ABORT "Cannot open NEWVOC"
```

This statement opens the skeleton NEWVOC file in the QMSYS directory using Windows pathname syntax. If the open fails, the program aborts with an error message.

See also:
OPEN, OPENSEQ

OPENSEQ

The **OPENSEQ** statement opens a record of a directory file for sequential access.

Format

OPENSEQ *file.name*, *id* {**APPEND** | **OVERWRITE** | **READONLY**} **TO** *file.var*
{**ON ERROR** *statement(s)*}
{**LOCKED** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

or

OPENSEQ *pathname* {**APPEND** | **OVERWRITE** | **READONLY**} **TO** *file.var*
{**ON ERROR** *statement(s)*}
{**LOCKED** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

file.name	evaluates to the VOC name of the directory file holding the record to be opened.
id	evaluates to the name of the record to be opened.
pathname	evaluates to the operating system pathname of the record to be opened.
file.var	is the name of a variable to be used in later statements accessing this record.
statement(s)	are statement(s) to be executed depending on the outcome of the **OPENSEQ** statement.

At least one of the **THEN** and **ELSE** clauses must be present.

The named record is opened and associated with *file.var* for later operations.

The optional **READONLY** clause opens the item for read only access. Any attempt to write will fail.

Use of **APPEND** causes the **OPENSEQ** statement to position at the end of any existing data in the record such that subsequent write operations will append new data. Use of **OVERWRITE** truncates the record to remove any existing data.

If the record already exists, the **THEN** clause is executed. An update lock will be set on this record unless the record is read-only in which case a shared read lock is set.

If the record does not already exist, the **ELSE** clause is executed and the **STATUS()** function returns zero. The record will have been locked and use of **WRITESEQ**, **WRITESEQF**, **WRITEBLK**, **WEOFSEQ** or **CREATE** with the returned *file.var* will create the record. Alternatively, the lock can be released using **RELEASE** or closing the *file.var*

The **ELSE** clause is also executed if the specified item cannot be opened due to an error. The STATUS() function will contain the error code.

The **LOCKED** clause is executed if the record is already locked by another process.

The **ON ERROR** clause is executed if a fatal error occurs when opening the record. The STATUS() function will return an error code relating to the problem.

A record open for sequential access may be read and written using **READSEQ** and **WRITESEQ** respectively. The **WRITESEQF** statement provides a forced write and **WEOFSEQ** sets an end of file marker. The record should be closed using **CLOSESEQ** though it will be closed automatically when the program in which the file variable lies terminates.

The second form of **OPENSEQ** may be used to open a serial port by using the device name as *pathname*. On Windows, this name is COM1, COM2, etc. On other platforms, it is the device driver name.

Examples

```
OPENSEQ "STOCKS", "STOCK.LIST" TO STOCK.LIST ELSE
   IF STATUS() THEN ABORT "Cannot open stocks list"
END
```

This program fragment opens the record STOCK.LIST of directory file STOCKS. If it fails to either open an existing record or to create a new record, the program aborts.

```
OPENSEQ "C:\TEMP\IMPORT.DATA" TO DAT.F ELSE
   IF STATUS() THEN ABORT "Cannot open import data file"
END
```

This program fragment opens the operating system file in C:\TEMP\IMPORT.DATA for sequential processing.

See also:
CLOSESEQ, NOBUF, READBLK, READCSV, READSEQ, SEEK, WEOFSEQ, WRITEBLK, WRITECSV, WRITESEQ, WRITESEQF

OPEN.SOCKET()

The **OPEN.SOCKET**() function opens a data socket for an outgoing connection.

Format

OPEN.SOCKET(*addr***,** *port***,** *flags***)**

where

addr is the address of the system to which a connection is to be established. This may be an IP address or a host name.

port is the port number on which the connection is to be established.

flags is a value determining the mode of operation of the socket, formed by adding the values of tokens defined in the SYSCOM KEYS.H record. The flags available in this release are:

SKT$BLOCKING	Sets the default mode of data transfer as blocking.
SKT$NON.BLOCKING	Sets the default mode of data transfer as non-blocking.

The **OPEN.SOCKET()** function opens a connection to the server with the given address and port number.

If the action is successful, the function returns a socket variable that can be used to read and write data using the **READ.SOCKET()** and **WRITE.SOCKET()** functions. The **STATUS()**function will return zero.

If the socket cannot be opened, the **STATUS()** function will return an error code that can be used to determine the cause of the error.

Example

```
SKT = OPEN.SOCKET("193.118.13.14", 3000, SKT$BLOCKING)
IF STATUS() THEN STOP 'Cannot open socket'
N = WRITE.SOCKET(SKT, DATA, 0, 0)
CLOSE.SOCKET SKT
```

This program fragment opens a connection to port 3000 of IP address 193.118.13.14, sends the data in DATA and then closes the socket.

See also:
ACCEPT.SOCKET.CONNECTION, **CLOSE.SOCKET**, **CREATE.SERVER.SOCKET()**, **READ.SOCKET()**, **SERVER.ADDR()**, **SET.SOCKET.MODE()**, **SOCKET.INFO()**, **WRITE.SOCKET()**

ORS()

The **ORS**() function performs a logical OR operation on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

ORS(*expr1***,** *expr2***)**

where

expr1, *expr2* are the dynamic arrays to be processed.

The **ORS**() function performs the logical OR operation between corresponding elements of the two dynamic arrays and constructs a similarly structured dynamic array of results as its return value. An element of the returned dynamic array is 1 if either or both of the corresponding elements of *expr1* and *expr2* are true. Any value other than zero or a null string is treated as true.

The **REUSE()** function can be applied to either or both expressions. Without this function, any absent trailing values are taken as false.

Example

A contains 1VM1SM0VM0VM1FM0VM1
B contains 1VM0SM1VM0VM1FM1VM0

```
C = ORS(A, B)
```

C now contains 1VM1SM1VM0VM1FM1VM1

See also:
ANDS(), **EQS()**, **GES()**, **GTS()**, **IFS()**, **LES()**, **LTS()**, **NES()**, **NOTS()**, **REUSE()**

OS.ERROR()

The **OS.ERROR()** function returns the error number associated with the last recorded operating system level error.

Format

OS.ERROR()

Some actions that return errors via the **STATUS()** function are related to errors from operating system calls. The **OS.ERROR()** function returns the value of the most recent operating system error. The error codes for which this is valid are all marked in the SYSCOM ERR.H include record.

The **!ERRTEXT()** subroutine will automatically insert this value into relevant expanded error messages.

OS.EXECUTE

The **OS.EXECUTE** statement executes an operating system command. This function is not available on the PDA version of QM.

Format

OS.EXECUTE *expr* {**CAPTURING** *var*}

where

expr	evaluates to the command to be executed (maximum 4096 characters).
var	is a variable to receive captured output.

The **OS.EXECUTE** statement allows a QMBasic program to execute an operating system command. The program does not continue execution until the command terminates. QM attempts to redirect any output from the command back to the user's terminal but this is not always possible. Some commands may cause output to appear on the server system.

The **CAPTURING** clause captures output that would otherwise have gone to the terminal or phantom log file, saving it in the named variable with field marks in place of newlines.

The **OS.EXECUTE** statement returns two error codes. The **STATUS()** function returns a non-zero value if QM detected an error and was unable to execute the command. For a zero **STATUS()** value, the **OS.ERROR()** function returns the termination status of the executed command. The interpretation of this value will depend on the command being executed.

Example

```
OS.EXECUTE "MKDIR TEMPDIR"
```

This statement uses the operating system MKDIR command to create a directory named TEMPDIR.

OUTERJOIN()

The **OUTERJOIN()** function returns the record ids of records in a file where a field holds a specified value.

Format

OUTERJOIN({**DICT**} *file.name***,** *field.name***,** *value***)**

where

file.name	evaluates to the name of the file from which data is to be retrieved. The optional **DICT** prefix specifies that the dictionary portion of the file is to be used. Alternatively, the *file.name* expression may include the uppercase word DICT before the actual file name and separated from it by a single space.
field.name	is the name of the field in *file.name* that determines the record ids to be returned. There must be an alternate key index on this field.
value	is the value that must appear in the specified field.

The **OUTERJOIN()** function uses an alternate key index on *field.name* to return a value mark delimited list of record ids of records in the specified file that contain the given *value*.

This function is mainly intended for use in dictionary I-type expressions where the equivalent programming built around **SELECTINDEX** cannot be used.

Examples

```
OUTERJOIN('ORDERS', 'CUST.NO', CUST.NO)
```

The above expression used in a dictionary I-type item retrieves a list of orders record ids for a given customer.

```
OPEN 'CUSTOMERS' TO CUS.F ELSE STOP 'Cannot open file'
SELECT CUS.F
LOOP
   READNEXT ID ELSE EXIT
   DISPLAY ID:': ':CHANGE(OUTERJOIN('ORDERS', 'CUST.NO', ID),
@VM, ', ')
REPEAT
```

The above program displays a list of customer numbers in the CUSTOMERS file and a list of the orders placed by each customer.

PAGE

The **PAGE** statement advances a print unit to a new page.

Format

PAGE {**ON** *print.unit*} {*page.no*}

where

print.unit	evaluates to the print unit number on which the action is to occur. If omitted, print unit zero is used.
page.no	evaluates to the page number to be used for the new page. If omitted, the page number is incremented from its current value.

The **PAGE** statement causes the footing to be printed at the end of the current page and advances to the next page. The heading will be printed if further output is directed to the print unit. The **PAGE** statement can be used to complete printing of the final page of output from a program.

If a new page number is specified, this takes effect after print unit has been advanced to the new page. A *page.no* of less than one causes the page number to be set to one.

A **PAGE** statement directed to the display causes the pagination prompt to be displayed unless it has been suppressed. The screen will be cleared to advance to the new page.

Example

```
PAGE ON PRINT.UNIT
```

This statement causes the print unit identified by PRINT.UNIT to advance to the next page.

PAUSE

The **PAUSE** statement pauses execution until awoken by another process. This function is not available on the PDA version of QM.

Format

PAUSE {*timeout*}

where

timeout specifies the maximum time to wait in seconds. A value less than one indicates that an infinite timeout should be used.

The **PAUSE** statement suspends program execution until awoken by another process using the **WAKE** statement. The optional *timeout* specifies the maximum time in seconds for which the program can remain suspended.

If the **PAUSE** is terminated by detection of a **WAKE** event, the **STATUS()** function will return zero. If the PAUSE is terminated by a timeout, the **STATUS()** function will return ER$TIMEOUT.

A **WAKE** request occurring before the **PAUSE** is executed is remembered and the program is not suspended. Note that under rare conditions, precise timing of the **PAUSE**/**WAKE** pair can cause a program to appear to wake spuriously. Programs should be written to allow for this possibility.

PRECISION

The **PRECISION** statement sets the maximum number of decimal places to appear when converting numeric values to strings.

Format

PRECISION *expr*

where

expr is an expression specifying the number of decimal places. This value must be between zero and fourteen. Negative values are treated as zero; values greater than fourteen are treated as fourteen.

Arithmetic operations performed by QM always work to the maximum precision of the computer system. The precision value determines the number of decimal places when numeric values are converted to strings, for example, when printing.

Values are converted with rounding on the last digit. Trailing zero digits are removed from the decimal places and, if the resultant value is an integer, the decimal point is also removed.

The precision value is associated with each program and subroutine and is initially set to 4. A program which sets a precision of 6 and calls a subroutine will use precision 6 up to the call, the subroutine will use precision 4 and, on return to the calling program, the precision reverts to 6.

Example

```
X = 333.33333
Y = 666.66666
PRINT X, Y
PRECISON 4
PRINT X, Y
PRECISION 1
PRINT X, Y
PRECISION 0
PRINT X, Y
```

This program fragment would print

```
333.3333  666.6667
333.3     666.7
333       667
```

PRINT

The **PRINT** statement outputs data to a print unit.

Format

PRINT {**ON** *print.unit*} {*print.list*}

where

print.unit	identifies the print unit to which output is to be directed. If omitted, print unit zero is used.
print.list	is a list of items to print in the format described for the **DISPLAY** statement.

The data is output to the requested print unit. Print unit -1 is always associated with the display and cannot be changed. Print unit 0 can be switched between the display and the printer by use of the **PRINTER** statement. Print units 1 to 255 direct their output to the hold file by default but can be redirected using the **SETPTR** command.

By using **PRINT** statements instead of **DISPLAY** in programs it is possible to select whether the output is directed to the display or to a printer. The **LPTR** option to the **RUN** command is equivalent to a **PRINTER ON** at the start of the program.

Use of the **@(x,y)** cursor movement function in a **PRINT** statement that sends output to the display will disable pagination. See **DISPLAY** for more details.

Example

```
N = DCOUNT(LINE, @FM)
FOR I = 1 TO N
   PRINT ON PU LINE<I>
NEXT I
PAGE ON PU
```

This program fragment emits each field of LINE to the print unit identified by PU and then advances to a new page.

PRINTCSV

The **PRINTCSV** statement outputs CSV format data to a print unit.

Format

PRINTCSV {**ON** *print.unit*} *var1*, *var2*, ...

where

print.unit identifies the print unit to which output is to be directed. If omitted, print unit zero is used.

var1, *var2*, ... is a list of items to be assembled as a CSV format text string.

The assembled CSV format data is output to the requested print unit. Print unit -1 is always associated with the display and cannot be changed. Print unit 0 can be switched between the display and the printer by use of the **PRINTER** statement. Print units 1 to 255 direct their output to the hold file by default but can be redirected using the **SETPTR** command.

The optional trailing colon suppresses the normal linefeed after the data has been output.

Example

```
PRINTCSV PROD.NO, QTY
```

This statement prints the contents of the PROD.NO and QTY variables as a CSV format text string.

See also:
INPUTCSV, **READCSV**, **WRITECSV**

PRINTER CLOSE

The **PRINTER CLOSE** statement closes one or all print units.

Format

PRINTER CLOSE {**ON** *print.unit*}

where

print.unit identifies the print unit to be closed. If omitted, all print units are closed.

The **PRINTER CLOSE** statement terminates activity on a print unit. If this print unit was directed to a spool file, the data will be printed. Any heading and footing text is discarded. Subsequent data sent to the same print unit starts a new output stream. If this is for the default printer, it will be necessary to use **PRINTER ON** if the output is to be directed to a printer rather than the screen.

The implementation of **PRINTER CLOSE** with no *print.unit* specified differs on various multivalue database products. By default, in QM a **PRINTER CLOSE** with no *print.unit* causes all print units to be closed. The same effect can be achieved by using a *print.unit* value of -2 though this is not portable to other environments. The PRCLOSE.DEFAULT.0 option of the **$MODE** compiler directive can be used to modify this behaviour so that only printer zero is closed.

All print units are closed automatically on return to the command prompt.

The **PRINTER** command has a **KEEP.OPEN** option which, when used, causes requests from programs to close printers only to terminate the page and discard any heading and footing text. This printer remains open so that subsequent output to the same print unit will be merged to form a single print job.

PRINTER DISPLAY

The **PRINTER DISPLAY** statement directs output sent to a print unit to the display.

Format

PRINTER DISPLAY {**ON** *print.unit*}
{**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

print.unit	evaluates to the print unit on which the action is be to performed. If omitted, the default print unit (unit 0) is used.
statement(s)	are statements to be executed depending on the outcome of the operation.

The **ON ERROR**, **THEN** and **ELSE** clauses are all optional.

The **ON ERROR** clause is executed in the event of a fatal internal error. The error code returned by the **STATUS()** function will indicate the cause of the error. If this clause is omitted, the program will abort in the event of a fatal error.

The **THEN** clause is executed if the operation is successful. The **STATUS()** function will return zero.

The **ELSE** clause is executed in the event of a non-fatal error. If this clause is omitted, program execution continues after an error.

Example

```
PRINTER DISPLAY ON 1
```

This statement directs output from print unit 1 to the display.

PRINTER FILE

The **PRINTER FILE** statement associates a file with a print unit.

Format

PRINTER FILE {**ON** *print.unit*} *file.name*, *record.name*
{**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

print.unit	evaluates to the print unit on which the action is be to performed. If omitted, the default print unit (unit 0) is used.
file.name	evaluates to the VOC name of an existing directory file.
record.name	evaluates to the name of the record within *file.name* to which output to *print.unit* is to be directed. If the record already exists, it will be overwritten.
statement(s)	are statements to be executed depending on the outcome of the operation.

The **ON ERROR**, **THEN** and **ELSE** clauses are all optional.

Output to print units 1 to 255 is directed to a hold file by default but can be redirected. The **PRINTER FILE** statement causes the named record to be created and output will be directed to this file until the print unit is closed.

The **ON ERROR** clause is executed in the event of a fatal internal error while attempting to open the file. The error code returned by the **STATUS()** function will indicate the cause of the error. If this clause is omitted, the program will abort in the event of a fatal error.

The **THEN** clause is executed if the operation is successful. The **STATUS()** function will return zero.

The **ELSE** clause is executed if the file cannot be opened. The error code returned by the **STATUS()** function will indicate the cause of the error. If this clause is omitted, program execution continues after an error.

Example

```
PRINTER FILE ON 1 "MYFILE", "SAVED"
```

This statement directs output from print unit 1 to record SAVED in directory file MYFILE.

PRINTER NAME

The **PRINTER NAME** statement associates a named printer device with a print unit.

Format

PRINTER NAME {**ON** *print.unit*} *printer.name*
{**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

print.unit	evaluates to the print unit on which the action is be to performed. If omitted, the default print unit (unit 0) is used.
printer.name	evaluates to a printer name.
statement(s)	are statements to be executed depending on the outcome of the operation.

The **ON ERROR**, **THEN** and **ELSE** clauses are all optional.

The **ON ERROR** clause is executed in the event of a fatal internal error. The error code returned by the **STATUS()** function will indicate the cause of the error. If this clause is omitted, the program will abort in the event of a fatal error.

The **THEN** clause is executed if the operation is successful. The **STATUS()** function will return zero.

The **ELSE** clause is executed if the printer does not exist. If this clause is omitted, program execution continues after an error.

Example

```
PRINTER NAME ON 1 "LPT1"
```

This statement directs output from print unit 1 to a printer named LPT1.

PRINTER

The **PRINTER ON** and **OFF** statements determine whether output from **PRINT** statements to the default print unit (unit 0) is directed to the display or to the printer.

Format

PRINTER ON
PRINTER OFF

The **PRINTER ON** statement causes subsequent output to print unit zero to be directed to the printer. A later **PRINTER OFF** statement resumes output to the display.

The **STATUS()** function returns the previous state of the **PRINTER** setting. A value of zero indicates that the printer was on. A value of one indicates that it was off.

By using **PRINT** statements instead of **DISPLAY** in programs it is possible to select whether the output is directed to the display or to a printer. The **LPTR** option to the **RUN** command is equivalent to a **PRINTER ON** at the start of the program followed by a **PRINTER CLOSE** on return to the command prompt.

Example

```
PRINTER ON
PRINT "This is sent to the printer"
PRINTER OFF
PRINT "This is sent to the display"
```

PRINTER RESET

The **PRINTER RESET** statement resets the default print unit and display output.

Format

PRINTER RESET

The **PRINTER RESET** statement performs the following actions:

Output to the default print unit (unit 0) is directed to the display (similar to use of **PRINTER OFF**)

Pagination is restarted on the display if it was previously suppressed.

The page number is reset to 1.

Any heading and footing set up for the display device are cancelled.

The **PRINTER RESET** statement is particularly useful in programs which have disabled line counting through use of cursor movement **@()** functions and subsequently want to restart pagination of line by line output.

PRINTER SETTING

The **PRINTER SETTING** statement sets a control parameter for a print unit.

This statement is obsolete. The [SETPU] statement should be used in its place.

Format

PRINTER SETTING {**ON** *print.unit*} *param*, *new.value*

where

print.unit evaluates to the print unit on which the action is be to performed. If omitted, the default print unit (unit 0) is used.

param identifies the parameter to be changed.

new.value is the value to be set. A *new.value* of -1 sets the parameter to its default value.

The parameters which may be set by this statement are identified by *param* numbers. Tokens for these are defined in the KEYS.H include record in the SYSCOM file.

Key	Token	Default	Function
1	LPTR$WIDTH	80	Page width
2	LPTR$LINES	66	Lines per page for printer
		or 24	Lines per page for display
3	LPTR$TOP.MARGIN	0	Top margin size (lines)
4	LPTR$BOTTOM.MARGIN	0	Bottom margin size (lines)
5	LPTR$LEFT.MARGIN	0	Left margin size (characters)
11	LPTR$FLAGS	Printer mode flags	

The value of lines per page is best set to at least one less than the physical page size to prevent the automatic page throw of most printers after the final line of the page is printed.

Example

```
PRINTER SETTING ON 1 LPTR$LINES 60
```

This statement sets the number of lines per page on print unit 1 to 60.

PRINTER.SETTING()

The **PRINTER.SETTING()** function sets or retrieves a control parameter for a print unit.

*This function is obsolete. The **SETPU** statement or **GETPU()** function should be used in its place.*

Format

PRINTER.SETTING(*print.unit***,** *param***,** *new.value***)**

where

print.unit	evaluates to the print unit on which the action is be to performed.
param	identifies the parameter to be changed using the keys shown below.
new.value	is the value to be set. A *new.value* of -1 sets the parameter to its default value. A *new.value* of -2 returns the current value without changing it.

The **PRINTER.SETTING()** function returns the new (or unchanged) value of the parameter.

The parameters which may be set or retrieved by this statement are identified by *param* numbers. Tokens for these are defined in the KEYS.H include record in the SYSCOM file.

Key	Token	Default	Function
1	LPTR$WIDTH	80	Page width
2	LPTR$LINES	66	Lines per page for printer
		or 24	Lines per page for display
3	LPTR$TOP.MARGIN	0	Top margin size (lines)
4	LPTR$BOTTOM.MARGIN	0	Bottom margin size (lines)
5	LPTR$LEFT.MARGIN	0	Left margin size (characters)
6 *	LPTR$DATA.LINES		Lines excluding page heading and footing
7 *	LPTR$HEADING.LINES		Heading lines per page
8 *	LPTR$FOOTING.LINES		Footing lines per page
9 *	LPTR$MODE		Printer mode number
10 *	LPTR$NAME		Printer or file name
11	LPTR$FLAGS		Printer mode flags
12 *	LPTR$LINE.NO		Current position on page within data area
13 *	LPTR$PAGE.NO		Current page number
14 *	LPTR$LINES.LEFT		Lines remaining on current page
15	LPTR$COPIES	1	Number of copies to print

Modes marked with an asterisk are query only.

The value of lines per page is best set to at least one less than the physical page size to prevent the automatic page throw of most printers after the final line of the page is printed.

Example

```
WIDTH = PRINTER.SETTING(1, LPTR$WIDTH, -1)
```

This statement sets the page width on print unit 1 to the default value and stores this value in WIDTH.

PRINTERR

The **PRINTERR** statement displays an error message which is removed from the screen when the next input is entered.

The synonym **INPUTERR** can be used in place of **PRINTERR**.

Format

PRINTERR *expr*

where

expr evaluates to the text to be displayed.

The *expr* text is displayed on the bottom line of the screen using the current foreground and background colours. This message will be removed after the first keystroke of the next **INPUT @** statement. Input taken from the **DATA** queue will also clear the message.

Example

```
LOOP
   DISPLAY "Enter password " :
   ECHO OFF
   PROMPT ""
   INPUT @(5,10) PASSWORD :
   ECHO ON
WHILE PASSWORD # "SECRET"
   PRINTERR "Incorrect password"
REPEAT
```

This program fragment reads a password from the keyboard. If it is entered incorrectly, a message is displayed and the input is repeated.

PRIVATE

The **PRIVATE** statement defines private variables in a local subroutine or in a class module.

Format

PRIVATE *var*, *mat*(*rows*, *cols*)

where

var	is a simple scalar variable.
mat(*rows*, *cols*)	is a dimensioned matrix name. The *rows* and *cols* values must be numeric constants.

The **PRIVATE** statement has two uses:

Immediately after the **LOCAL** statement defining a local function or subroutine. It identifies variables that have scope only within the local routine and are discarded on exit. If the routine calls itself recursively, each invocation has its own private variables. See the **LOCAL** statement for more details.

Used in a **CLASS** module, it defines variables that are private to the object but persist between successive executions of components of the class module. See the **CLASS** statement and Object Oriented Programming for more details.

See also:
Object oriented programming, **CLASS**, **DISINHERIT**, **INHERIT**, **OBJECT()**, **PUBLIC**.

PROCREAD

The **PROCREAD** statement reads data from the PROC primary input buffer.

Format

PROCREAD *var* {**THEN** *statement(s)*} {**ELSE** *statement(s)*}

where

var	is the variable to receive the data.
statement(s)	are statements to be execute dependant on the outcome of the operation.

At least one of the **THEN** and **ELSE** clauses must be present.

If the current program was called directly or indirectly from a PROC, the **PROCREAD** statement copies the content of the PROC primary input buffer to the named variable and executes the **THEN** clause.

If the current program was not called from a PROC, the variable is set to a null string and the **ELSE** clause is executed.

See also:
VOC PQ-type records

PROCWRITE

The **PROCWRITE** statement writes data to the PROC primary input buffer.

Format

PROCWRITE *expr*

where

expr is the data to be written.

The data specified by *expr* is copied to the PROC primary input buffer.

See also:
VOC PQ-type records

PROGRAM

The **PROGRAM** statement introduces a program.

Format

PROGRAM *name*

where

name is the name of the program.

QMBasic programs should commence with a **PROGRAM**, **SUBROUTINE**, **FUNCTION** or **CLASS** statement. If none of these is present, the compiler behaves as though a **PROGRAM** statement had been used with *name* as the name of the source record.

The **PROGRAM** statement must appear before any executable statements.

The name need not be related to the name of the source record though this eases program maintenance. The name must comply with the QMBasic name format rules.

A program module may be entered by referencing it a **RUN** command, by executing a command name that corresponds to the name of the program in the system catalogue, or by use of the QMBasic **CALL** statement in another program.

Example

```
PROGRAM SUM
   TOTAL = 0
   LOOP
      DISPLAY TOTAL
      INPUT S
   WHILE LEN(S)
      IF NUM(S) THEN TOTAL += S
      ELSE DISPLAY @SYS.BELL :
   REPEAT
END
```

This program reads numbers from the keyboard and displays a running total until a blank line is entered.

PROMPT

The **PROMPT** statement sets the character to be used as the prompt in **INPUT** statements.

Format

PROMPT *expr*

where

expr evaluates to the character to be used.

The first character of *expr* is used as the prompt character. If *expr* is a null string, the prompt is suppressed.

The default input prompt is the question mark. Changes to the prompt character remain in effect until the program returns to the command prompt.

Use of **EXECUTE** to start a new command processing layer resets the prompt to a question mark but it will be restored to its previous value on return from the executed command.

Example

```
DISPLAY "Enter account number " :
PROMPT ""
INPUT ACCOUNT.NO
PROMPT "?"
```

This program fragment suppresses the prompt for the **INPUT** statement and then restores the default prompt character. In normal usage, a program would use the **PROMPT** statement once at the start of the program to set the prompt character to be used for the entire program.

PUBLIC

The **PUBLIC** statement defines public property variables, subroutines and functions in a class module.

Format

PUBLIC *var*, *mat*(*rows*, *cols*), ...

PUBLIC SUBROUTINE *name*{(*arg1*, *arg2*)} {**VAR.ARGS**}
...statements...
END

PUBLIC FUNCTION *name*{(*arg1*, *arg2*)} {**VAR.ARGS**}
...statements...
END

where

var	is a simple scalar variable. The variable name may be followed by **READONLY** to indicate that external references to the variable may not update it.
mat(*rows*, *cols*)	is a dimensioned matrix name. The *rows* and *cols* values must be numeric constants. The dimension values may be followed by **READONLY** to indicate that external references to the variable may not update it.
name(*arg1*, *arg2*)	is the subroutine or function name and an optional list of arguments. See the **CLASS** statement for the maximum number of arguments allowed in this list. Specifying the final argument name as three periods (...) effectively extends the argument list to the maximum permissible length with unnamed arguments that may be accessed using the **ARG()** function. Use of this syntax automatically implies the VAR.ARGS option which must not also be present.

Note that the equivalence of a function to a subroutine with a hidden first argument as found with the **SUBROUTINE** and **FUNCTION** statements does not apply to public subroutines and functions.

Examples

```
PUBLIC FUNCTION CONNECT(SERVER, PORT)
   SKT = OPEN.SOCKET(SERVER, PORT, SKT$BLOCKING)
   RETURN STATUS() = 0
END
```

The above function takes a fixed length list of two arguments and uses the supplied values to open a socket connection to a remote server. The SKT variable in this example would be a private variable within the class module.

```
PUBLIC FUNCTION CONNECT(SERVER, PORT) VAR.ARGS
   IF UNASSIGNED(PORT) THEN PORT = 4000
   SKT = OPEN.SOCKET(SERVER, PORT, SKT$BLOCKING)
   RETURN STATUS() = 0
END
```

This example extends the previous one by making the PORT argument optional and, if it is not supplied by the caller, defaulting it to 4000.

```
PUBLIC SUBROUTINE INSERT.ITEMS(ID, ...)
   READU REC FROM FVAR, ID ELSE NULL
   FOR I = 2 TO ARG.COUNT()
      VALUE = ARG(I)
      LOCATE VALUE IN REC<1> BY 'AL' SETTING POS ELSE
         INS VALUE BEFORE REC<POS>
      END
   NEXT I
   WRITE REC TO FVAR, ID
END
```

This example uses the ... syntax to specify a variable length argument list of the maximum permissible length. It reads a record identified by the ID argument and then inserts all items from the remaining arguments that are not already in the record.

See also:
Object oriented programming, **CLASS**, **DISINHERIT**, **INHERIT**, **OBJECT()**, **PRIVATE**

PWR()

The **PWR()** function returns the value of a number raised to a given power.

Format

PWR(*expr***,** *pwr.expr***)**

where

expr	evaluates to a number or a numeric array.
pwr.expr	evaluates to a number or a numeric array.

The **PWR()** function returns the value of *expr* raised to the power *pwr.expr*. It is equivalent to use of the ** operator.

If either *expr* or *pwr.expr* is a numeric array (a dynamic array where all elements are numeric), the **PWR()** function operates on each element in turn and returns another numeric array. The structure of this array will be the same as that of the *expr* and *pwr.expr* arrays if they are identical. For arrays of differing structure, the structure of the result depends on whether the **REUSE()** function is used.

Example

```
N = PWR(T, 3)
```

This statement finds the value of T cubed. For small integer values of *pwr.expr*, use of the multiply operator is faster.

QUOTE()

The **QUOTE()** function returns a copy of its argument string enclosed in double quotes. The **DQUOTE()** synonym is identical.

Format

QUOTE(*expr*)

where

expr evaluates to the source string.

The **QUOTE()** function returns *expr* enclosed in double quotation marks.

Example

```
A = QUOTE('ABC123')
```

This statement sets A to the eight character string `"ABC123"`.

See also:
SQUOTE()

RAISE()

The **RAISE()** function converts mark characters in a string to the next higher level mark.

Format

RAISE(*string***)**

where

string evaluates to the string in which mark characters are to be converted.

The **RAISE()** function replaces mark characters according to the following table:

Original	Replacement
Item mark	Item mark (unchanged)
Field mark	Item mark
Value mark	Field mark
Subvalue mark	Value mark
Text mark	Subvalue mark

Example

```
FORMLIST RAISE(LIST)
```

This statement takes a value mark delimited variable LIST, raises the marks and uses this to create a select list.

See also:
LOWER()

RANDOMIZE

The **RANDOMIZE** statement initialises the random number generator.

Format

RANDOMIZE *expr*

where

expr evaluates to a number. If omitted or a null string, the time of day is used.

The **RANDOMIZE** statement initialises the seed value of the random number generator function, **RND()**. Supplying the same seed value in successive uses of this statement guarantees that the same pseudo-random number sequence is generated. Note that the sequence returned may vary between QM releases even if the same seed value is set.

If the *expr* value is omitted or given as a null string, the time of day is used thus giving a reasonable chance of a different pseudo-random sequence on successive executions of the program.

See also:
RND()

RDIV()

The **RDIV**() function returns the rounded integer result of dividing two values

Format

RDIV(*dividend***,** *divisor***)**

where

dividend evaluates to the value to be divided.

divisor evaluates to the value by which *dividend* is to be divided.

The **RDIV**() function divides dividend by divisor and returns the result as an integer, rounded according to the rule that values with a fractional part of 0.5 or greater are rounded away from zero.

A zero value of *divisor* will cause a run time error.

Examples

Dividend	Divisor	Result
132	10	13
135	10	14
-135	10	-14

See also:
IDIV()

READ

The **READ** statement reads a record from a previously opened file.

Format

READ *var* **FROM** *file.var, record.id* {**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

var	is the name of a variable to receive the dynamic array read from the file.
file.var	is the file variable associated with the file.
record.id	evaluates to the id of the record to be read.
statement(s)	are statements to be executed depending on the outcome of the **READ** operation.

At least one of the **THEN** and **ELSE** clauses must be present.

The specified record is read into the named variable.

The **THEN** clause is executed if the **READ** is successful.

The **ELSE** clause is executed if the **READ** fails because no record with the given id is present on the file. If the PICK.READ mode of the **$MODE** directive is used *var* will be left unchanged, otherwise it will be set to a null string. The **STATUS()** function will indicate the cause of the error.

The **ON ERROR** clause is executed for serious fault conditions such as errors in a file's internal control structures. The **STATUS()** function will return an error number. If no **ON ERROR** clause is present, an abort would occur.

Example

```
READ ITEM FROM STOCK, ITEM.ID THEN
    ...processing statements...
END ELSE
   DISPLAY "Record " : ITEM.ID : " not found"
END
```

This program fragment reads a record from the a file previously opened to file variable STOCK into variable ITEM. If successful, the processing statements are executed. If the record is not found, a message is displayed.

READBLK

The **READBLK** statement reads a given number of bytes from the current file position in a record previously opened using **OPENSEQ**.

Format

READBLK *var* **FROM** *file.var, bytes*
{**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

var	is the name of a variable to receive the data read from the file.
file.var	is the file variable associated with the file.
bytes	evaluates to the number of bytes to be read.
statement(s)	are statements to be executed depending on the outcome of the **READBLK** operation.

At least one of the **THEN** and **ELSE** clauses must be present.

The **THEN** clause is executed if the **READBLK** is successful.

The **ELSE** clause is executed if the **READBLK** fails. The **STATUS()** function will indicate the cause of the error.

The **ON ERROR** clause is executed for serious fault conditions such as errors in a file's internal control structures. The **STATUS()** function will return an error number. If no **ON ERROR** clause is present, an abort would occur.

If *file.var* refers to a serial port opened using **OPENSEQ**, the **READBLK** statement reads up to *bytes* bytes of data from the port but does not wait if there is less than the requested number of bytes available.

Example

```
READBLK VAR FROM SEQ.F, 100 THEN
    ...processing statements...
END ELSE
   DISPLAY "Data block not read"
END
```

This program fragment reads 100 bytes from the a file previously opened to file variable SEQ.F into variable VAR.

See also:
CLOSESEQ, NOBUF, OPENSEQ, READCSV, READSEQ, SEEK, WEOFSEQ, WRITEBLK, WRITECSV, WRITESEQ, WRITESEQF

READCSV

The **READCSV** statement reads a CSV format line of text from a directory file record previously opened for sequential access and parses it into multiple variables.

Format

READCSV FROM *file.var* **TO** *var1***,** *var2***,**...
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

file.var	is the file variable associated with the record by a previous **OPENSEQ** statement.
*var1***,** *var2* ...	are the variables to receive the data read from the file.
statement(s)	are statement(s) to be executed depending on the outcome of the **READSEQ**.

At least one of the **THEN** and **ELSE** clauses must be present.

A line of text is read from the file. It is then parsed according to the CSV format rules, placing the elements into the data items identified by *var1*, *var2*, etc. If successful, the **THEN** clause is executed and the **STATUS()** function would return zero.

If there are fewer data items in the line of text than the number of variables supplied, the remaining variables will be set to null strings. If the line of text has more data items than the number of variables supplied, the excess data is ignored.

If there are no further fields to be read, the **ELSE** clause is executed and the **STATUS()** function would return ER$RNF (record not found). The target variables will be unchanged.

The CSV rules are described under the **WRITECSV** statement.

Example

```
LOOP
   READCSV FROM DELIVERY.F TO PROD.NO, QTY ELSE EXIT
   GOSUB PROCESS.DELIVERY.DETAILS
REPEAT
```

This program fragment reads CSV format lines of text from the record open for sequential access via the DELIVERY.F file variable, placing the elements of the line into PROD.NO and QTY. It then calls the PROCESS.DELIVERY.DETAILS subroutine to process the new item. The loop terminates when the **ELSE** clause is executed when all fields have been processed.

See also:
CLOSESEQ, **NOBUF**, **OPENSEQ**, **READBLK**, **READSEQ**, **SEEK**, **WEOFSEQ**,

WRITEBLK, WRITECSV, WRITESEQ, WRITESEQF

READL

The **READL** statement reads a record from a previously opened file, setting a read lock.

Format

READL *var* **FROM** *file.var, record.id* {**ON ERROR** *statement(s)*}
{**LOCKED** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

var	is the name of a variable to receive the dynamic array read from the file.
file.var	is the file variable associated with the file.
record.id	evaluates to the id of the record to be read.
statement(s)	are statements to be executed depending on the outcome of the **READL** operation.

At least one of the **THEN** and **ELSE** clauses must be present.

The specified record is read into the named variable and a read lock is set. See Locks for full details of QM's locking mechanism.

The **LOCKED** clause is executed if the file or record is exclusively locked by another process. The **STATUS()** function will return the user id of a process holding a lock on this file or record. If the **LOCKED** clause is omitted and the file or record is locked, the program will wait for the lock to be released.

The **THEN** clause is executed if the **READL** is successful.

The **ELSE** clause is executed if the **READL** fails because no record with the given id is present on the file. If the PICK.READ mode of the **$MODE** directive is used *var* will be left unchanged, otherwise it will be set to a null string. The **STATUS()** function will indicate the cause of the error.

The **ON ERROR** clause is executed for serious fault conditions such as errors in a file's internal control structures. The **STATUS()** function will return an error number. If no **ON ERROR** clause is present, an abort would occur.

Example

```
READL ITEM FROM STOCK, ITEM.ID THEN
   ...processing statements...
   WRITE ITEM TO STOCK, ITEM.ID
END ELSE
   DISPLAY "Record " : ITEM.ID : " not found"
   RELEASE STOCK, ITEM.ID
END
```

This program fragment reads a record from the a file previously opened to file variable. STOCK into variable ITEM, setting a read lock on the record. If successful, the processing statements are executed. If the record is not found, a message is displayed and the lock is released.

READLIST

The **READLIST** statement reads a select list into a dynamic array.

Format

READLIST *var* {**FROM** *list.no*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

var	is the variable to receive the select list.
list.no	is the select list number. If omitted, select list zero is used.
statement(s)	are statement(s) to be performed depending on the outcome of the **READLIST** operation.

At least one of the **THEN** and **ELSE** clauses must be present.

The specified select list is read into *var*. If the list had already been partially processed by **READNEXT** statements, only the remaining unprocessed items are stored in *var*.

The select list is empty after the **READLIST** statement is completed.

The **THEN** clause is executed if *var* contains one or more items. Items are separated by field marks. If compatibility with other software is required, it is suggested that programs should be written to accept either field marks or item marks (or a mix) as list separators.

The **ELSE** clause is executed if the select list was not active or if no items remained to be processed. In this case *var* will be set to a null string.

Example

```
READLIST S FROM 2 THEN
   WRITE S TO LISTS, "UNPROCESSED"
END
```

This program fragment retrieves the remaining items in select list 2 and, if there are any, writes them to a record UNPROCESSED in file LISTS.

READNEXT

The **READNEXT** statement returns the next item from an active select list.

Format

READNEXT *var* {**,** *val.pos* {**,** *subval.pos*}} {**FROM** *list.no*}
{**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

var	is the variable to receive the select list item.
val.pos	is the variable to receive the value position with an exploded select list.
subval.pos	is the variable to receive the subvalue position with an exploded select list.
list.no	is the select list number. If omitted, select list zero is used. The **READNEXT** statement can also use select list variables returned by the **SELECTV** statement or the RTNLIST option of the **EXECUTE** statement.
statement(s)	are statement(s) to be executed depending on the outcome of the **READNEXT** operation.

At least one of the **THEN** and **ELSE** clauses must be present.

The next item in the specified select list is removed from the list and stored in *var*. Although the list may be of any size, a single item extracted by **READNEXT** cannot exceed 32k bytes. Attempting to extract an item larger than this limit will be handled as a fatal error as described below.

The **ON ERROR** clause is executed if a fatal error occurs. The **STATUS()** function will return an value relating to the error. If no **ON ERROR** clause is present, fatal errors result in an abort.

The **THEN** clause is executed if the select list was active and not empty.

The **ELSE** clause is executed if the select list was not active or no items remained to be read. The *var* variable will be set to a null string.

The **STATUS()** function will return zero unless the **ON ERROR** clause is executed.

Exploded Select Lists

QM supports two styles of select list; a standard list and an exploded list.

A standard select list contains only simple data, usually record ids. The optional *val.pos* and *subval.pos* items are always returned as zero with this type of list.

An exploded select list is created using the BY.EXP or BY.EXP.DSND keywords of the query processor to break apart multi-values and subvalues in a field. Each entry contains the record id together with the value and subvalue position corresponding to the data element associated with the list entry

The optional val.pos and subval.pos components of the **READNEXT** statement can be used to retrieve this positional data. There are three possible formats:

If both are present, the value and subvalue positions are returned in these variables. Where the value was not subdivided into subvalues, the subvalue position is returned as zero.

If only val.pos is present, the value position is returned and any subvalue information is discarded.

If neither is present, normally only the record id is returned, however, if the program is compiled with the COMPOSITE.READNEXT option of the $MODE compiler directive in force, the data returned in *var* is made up from the record id, the value position and the subvalue position separated by value marks.

Example

```
SELECT STOCK.FILE
LOOP
   READNEXT ID
   PRINT ID
REPEAT
```

This program fragment produces a list of the record keys present in STOCK.FILE.

READSEQ

The **READSEQ** statement reads the next field from a directory file record previously opened for sequential access.

Format

READSEQ *var* **FROM** *file.var* {**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

var	is the variable to receive the data read from the file.
file.var	is the file variable associated with the record by a previous **OPENSEQ** statement.
statement(s)	are statement(s) to be executed depending on the outcome of the **READSEQ**.

At least one of the **THEN** and **ELSE** clauses must be present.

The next field is read into *var*. If successful, the **THEN** clause is executed and the **STATUS()** function would return zero.

If there are no further fields to be read, the **ELSE** clause is executed and the **STATUS()** function would return ER$RNF (record not found).

If a fatal error occurs, the **ON ERROR** clause is executed. The **STATUS()** function can be used to establish the cause of the error. If no **ON ERROR** clause is present, a fatal error causes an abort.

The **FILEINFO()** function can be used with key FL$LINE to determine the field number that will be read by the next **READSEQ**.

Example

```
LOOP
   READSEQ REC FROM STOCK.LIST ELSE EXIT
   GOSUB PROCESS.STOCK.ITEM
REPEAT
```

This program fragment reads fields from the record open for sequential access via the STOCK.LIST file variable and calls the PROCESS.STOCK.ITEM subroutine for each field. The loop terminates when the **ELSE** clause is executed when all fields have been processed.

See also:
CLOSESEQ, **NOBUF**, **OPENSEQ**, **READBLK**, **READCSV**, **SEEK**, **WEOFSEQ**, **WRITEBLK**, **WRITECSV**, **WRITESEQ**, **WRITESEQF**

READ.SOCKET()

The **READ.SOCKET()** function reads data from a socket opened with ACCEPT.SOCKET.CONNECTION() or OPEN.SOCKET().

Format

READ.SOCKET(*skt*, *max.len*, *flags*, *timeout***)**

where

skt is the socket variable returned by ACCEPT.SOCKET.CONNECTION() or OPEN.SOCKET().

max.len is the maximum number of bytes to read.

flags is a value determining the mode of operation of the socket for this read, formed by adding the values of tokens defined in the SYSCOM KEYS.H record. The flags available in this release are:

SKT$BLOCKING	Sets the default mode of data transfer as blocking.
SKT$NON.BLOCKING	Sets the default mode of data transfer as non-blocking.

If neither blocking flag is given, the blocking mode set when the socket was opened is used.

timeout is the timeout period in milliseconds. A value of zero implies no timeout.

The **READ.SOCKET()** function returns data read from the specified socket. The STATUS() function returns zero if the action is successful, or a non-zero error code if an error occurs. A timeout will return an error code of ER$TIMEOUT as defined in the SYSCOM ERR.H record.

Example

```
SRVR.SKT = CREATE.SERVER.SOCKET("", 0)
IF STATUS() THEN STOP 'Cannot initialise server socket'
SKT = ACCEPT.SOCKET.CONNECTION(SRVR.SKT, 0)
IF STATUS() THEN STOP 'Error accepting connection'
DATA = READ.SOCKET(SKT, 100, SKT$BLOCKING, 0)
CLOSE.SOCKET SKT
CLOSE.SOCKET SRVR.SKT
```

This program fragment creates a server socket, waits for an incoming connection, reads a single data packet of up to 100 bytes from this connection and then closes the sockets. The timeout value of 0 in the **READ.SOCKET()** call specifies that no timeout is to be used.

See also:
ACCEPT.SOCKET.CONNECTION, CLOSE.SOCKET, CREATE.SERVER.SOCKET(), OPEN.SOCKET(), SERVER.ADDR(), SET.SOCKET.MODE(), SOCKET.INFO(), WRITE.SOCKET()

READU

The **READU** statement reads a record from a previously opened file, setting an update lock.

Format

> **READU** *var* **FROM** *file.var, record.id* {**ON ERROR** *statement(s)*}
> {**LOCKED** *statement(s)*}
> {**THEN** *statement(s)*}
> {**ELSE** *statement(s)*}

where

var	is the name of a variable to receive the dynamic array read from the file.
file.var	is the file variable associated with the file.
record.id	evaluates to the id of the record to be read.
statement(s)	are statements to be executed depending on the outcome of the **READU** operation.

At least one of the **THEN** and **ELSE** clauses must be present.

The specified record is read into the named variable and an update lock is set. See Locks for full details of QM's locking mechanism.

The **LOCKED** clause is executed if the file or record is locked by another process. The **STATUS()** function will return the user id of a process holding a lock on this file or record. If the **LOCKED** clause is omitted and the file or record is locked, the program will wait for the lock to be released.

The **THEN** clause is executed if the **READU** is successful.

The **ELSE** clause is executed if the **READU** fails because no record with the given id is present on the file. If the PICK.READ mode of the **$MODE** directive is used *var* will be left unchanged, otherwise it will be set to a null string. The **STATUS()** function will indicate the cause of the error.

The **ON ERROR** clause is executed for serious fault conditions such as errors in a file's internal control structures. The **STATUS()** function will return an error number. If no **ON ERROR** clause is present, an abort would occur.

Example

```
READU ITEM FROM STOCK, ITEM.ID THEN
   ...processing statements...
   WRITE ITEM TO STOCK, ITEM.ID
END ELSE
   DISPLAY "Record " : ITEM.ID : " not found"
   RELEASE STOCK, ITEM.ID
END
```

This program fragment reads a record from the a file previously opened to file variable. STOCK into variable ITEM, setting an update lock on the record. If successful, the processing statements are executed. If the record is not found, a message is displayed and the record is unlocked.

READV

The **READV** statement reads a specific field from a record of a previously opened file.

Format

READV *var* **FROM** *file.var, record.id***,** *field.expr*
{**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

var	is the name of a variable to receive the dynamic array read from the file.
file.var	is the file variable associated with the file.
record.id	evaluates to the id of the record to be read.
field.expr	evaluates to the number of the field to be read.
statement(s)	are statements to be executed depending on the outcome of the **READV** operation.

At least one of the **THEN** and **ELSE** clauses must be present.

The specified record is read and the field identified by *field.expr* is extracted into the named variable. If the field does not exist, *var* is set to a null string.

A *field.expr* value of zero may be used to determine if the record exists. *var* will be set to a null string.

The **THEN** clause is executed if the record is read successfully regardless of whether the specified field is present.

The **ELSE** clause is executed if the **READV** fails because no record with the given id is present on the file. If the PICK.READ mode of the **$MODE** directive is used *var* will be left unchanged, otherwise it will be set to a null string. The **STATUS()** function will indicate the cause of the error.

The **ON ERROR** clause is executed for serious fault conditions such as errors in a file's internal control structures. The **STATUS()** function will return an error number. If no **ON ERROR** clause is present, an abort would occur.

Example

```
READV ITEM FROM STOCK, ITEM.ID, 3 THEN
...processing statements...
END ELSE
   DISPLAY "Record " : ITEM.ID : " not found"
END
```

This program fragment reads field 3 of a record from the file previously opened to file variable STOCK into variable ITEM. If successful, the processing statements are executed. If the record is not found, a message is displayed.

READVL

The **READVL** statement reads a specific field from a record of a previously opened file, setting a read lock. The **READVU** statement is similar but sets an update lock.

Format

READVL *var* **FROM** *file.var, record.id*, *field.expr*
{**ON ERROR** *statement(s)*}
{**LOCKED** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

var	is the name of a variable to receive the dynamic array read from the file.
file.var	is the file variable associated with the file.
record.id	evaluates to the id of the record to be read.
field.expr	evaluates to the number of the field to be read.
statement(s)	are statements to be executed depending on the outcome of the operation.

At least one of the **THEN** and **ELSE** clauses must be present.

The specified record is read and the field identified by *field.expr* is extracted into the named variable. If the field does not exist, *var* is set to a null string.

READVL sets a read lock is set on the record. **READVU** sets an update lock on the record. See Locks for full details of QM's locking mechanism.

A *field.expr* value of zero may be used to determine if the record exists. *var* will be set to a null string.

The **LOCKED** clause is executed if the file or record is locked by another process (exclusively in the case of **READVL**). The **STATUS()** function will return the user id of a process holding a lock on this file or record. If the **LOCKED** clause is omitted and the file or record is locked, the program will wait for the lock to be released.

The **THEN** clause is executed if the record is read successfully regardless of whether the specified field is present.

The **ELSE** clause is executed if the operation fails because no record with the given id is present on the file. If the PICK.READ mode of the **$MODE** directive is used *var* will be left unchanged, otherwise it will be set to a null string. The **STATUS()** function will indicate the cause of the error.

The **ON ERROR** clause is executed for serious fault conditions such as errors in a file's internal control structures. The **STATUS()** function will return an error number. If no **ON ERROR** clause is present, an abort would occur.

Example

```
READVU ITEM FROM STOCK, ITEM.ID, 3 THEN
   ...processing statements...
   WRITEV ITEM TO STOCK, ITEM.ID, 3
END ELSE
   DISPLAY "Record " : ITEM.ID : " not found"
   RELEASE STOCK, ITEM.ID
END
```

This program fragment reads field 3 of a record from the file previously opened to file variable STOCK into variable ITEM, setting an update lock. If successful, the processing statements are executed and the modified value is written back to the file. If the record is not found, a message is displayed and the record is unlocked.

RECORDLOCKED()

The **RECORDLOCKED()** function indicates whether a given record is locked.

Format

RECORDLOCKED(*file.var*, *record.id*)

where

file.var	is the file variable associated with the file.
record.id	evaluates to the key of the record to be tested.

The **RECORDLOCKED()** function returns a value indicating the state of any locks on record *record.id* of the file open as *file.var*. The tokens shown in the table below are defined in the KEYS.H record of the SYSCOM file.

Value	Token	Lock state
-3	LOCK$OTHER.FILELOCK	Another user holds a file lock
-2	LOCK$OTHER.READU	Another user holds an update lock
-1	LOCK$OTHER.READL	Another user holds a read lock
0	LOCK$NO.LOCK	The record is not locked
1	LOCK$MY.READL	This user holds a read lock
2	LOCK$MY.READU	This user holds an update lock
3	LOCK$MY.FILELOCK	This user holds a file lock

A record may be multiply locked in which case the **RECORDLOCKED()** function reports only one of the current locks. File locks take precedence over read or update locks. If no file lock is set, read or update locks held by the process in which the **RECORDLOCKED()** function is performed take precedence over locks held by other processes.

Executing the **STATUS()** function after a **RECORDLOCKED()** function indicates that a lock is active will return the user number of the user holding the lock.

Example

```
IF RECORDLOCKED(STOCK, "ORDER.LIST") THEN
   DISPLAY "Record is locked by user " : STATUS()
END
```

This program fragment checks if record ORDER.LIST is locked and, if so, reports the user number of the process that holds the lock.

RECORDLOCKL

The **RECORDLOCKL** statement sets a read lock on a record. The **RECORDLOCKU** statement is similar but sets an update lock.

Format

RECORDLOCKL *file.var*, *record.id* {**ON ERROR** *statement(s)*}
{**LOCKED** *statement(s)*}

where

file.var	is the file variable associated with the file.
record.id	valuates to the key of the record to be locked.
statement(s)	are statements to be executed depending on the outcome of the operation.

The **RECORDLOCKL** statement sets a read lock on record *record.id* of the file open as *file.var*. The **RECORDLOCKU** statement sets an update lock.

The **LOCKED** clause is executed if the file or record is locked by another process in a manner than prevents further locking. The **STATUS()** function will return the user id of a process holding a lock on this file or record. If the **LOCKED** clause is omitted and the file or record is locked, the program will wait for the lock to be released.

A process may lock records within files for which it also holds the file lock. These statements may also be used to convert an existing read lock to an update lock or vice versa.

Example

```
RECORDLOCKL STOCK, "ORDER.LIST" LOCKED
   DISPLAY "Waiting. Order list locked by user " : STATUS()
   RECORDLOCKL STOCK, "ORDER.LIST"
END
```

This program fragment attempts to lock record ORDER.LIST of the file open as STOCK. If it is locked, a message is displayed and a second **RECORDLOCKL** statement is executed without a **LOCKED** clause to wait for the lock.

RELEASE

The **RELEASE** statement releases read, update or file locks.

Format

RELEASE {*file.var*{, *record.id*}} {**ON ERROR** *statement(s)*}

where

file.var	is the file variable associated with the file.
record.id	evaluates to the key of the record to be unlocked.
statement(s)	are statements to be executed depending on the outcome of the operation.

The **RELEASE** statement operates in three ways according to whether *file.var* and *record.id* are specified.

With no *file.var* or *record.id*, all file, read and update locks owned by the process on all files are released.

With *file.var* but no *record.id*, all locks associated with *file.var* are released.

With both *record.id* and *file.var*, a specific lock is released.

The **ON ERROR** clause is executed if a fatal error occurs. The **STATUS()** function can be used to obtain an error code to determine the cause.

The **RELEASE** statement has no effect inside a transaction.

Examples

```
RELEASE STOCK, "ORDER.LIST"
```

This statement releases any locks on record ORDER.LIST of the file open as STOCK.

```
RELEASE
```

This statement releases all file, read and update locks held by the user.

REM()

The **REM()** function returns the remainder when one value is divided by another.

Format

REM(*dividend***,** *divisor***)**

where

dividend	evaluates to a number or a numeric array.
divisor	evaluates to a number or a numeric array.

The **REM()** function returns the remainder of dividing *dividend* by *divisor*. This is defined as

```
REM(x, y) = SIGN(x) * MOD(ABS(X), ABS(Y))
```

where the SIGN() function returns 1 for x > 0, -1 for x < 0 and 0 for x = 0.

The **REM()** function differs from the **MOD()** function when one of its arguments is negative. The following table shows the result of the **REM()** function.

Dividend	Divisor	REM()
530	100	30
-530	100	-30
530	-100	30
-530	-100	-30
0	100	0
0	-100	0
100	0	100
-100	0	-100

If either *dividend* or *divisor* is a numeric array (a dynamic array where all elements are numeric), the **REM()** function operates on each element in turn and returns another numeric array. The structure of this array will be the same as that of the *dividend* and *divisor* arrays if they are identical. For arrays of differing structure, the structure of the result depends on whether the **REUSE()** function is used.

Example

```
N = REM(T, 30)
```

This statement finds the remainder of dividing T by 30 and assigns this to N.

See also:

MOD()

REMARK

The **REMARK** statement, which may be abbreviated to **REM**, enters comment text into a program.

Format

REMARK *text*

where

text is arbitrary comment text.

The **REMARK** statement inserts *text* as a comment in the program which is totally ignored by the compiler. The semicolon delimiter cannot be used to include an executable statement on the same line as a **REMARK** as the entire line after the **REMARK** keyword is ignored.

Comments are more usually inserted using the an asterisk or exclamation mark prefix.

Examples

```
REMARK This text is totally ignored
* This text is totally ignored
! This text is totally ignored
A = B + C   ;* This is a trailing comment
```

REMOVE

The **REMOVE** statement and **REMOVE()** function extract characters from a dynamic array up to the next mark character.

Format

REMOVE *string* **FROM** *dyn.array* **SETTING** *var*

REMOVE(*dyn.array***,** *var***)**

where

string	is the variable to receive the extracted substring.
dyn.array	is the dynamic array from which *string* is to be extracted.
var	is the variable to be set according to the delimiter that terminates the extracted substring.

The statement

```
S = REMOVE(X, Y)
```

is equivalent to

```
REMOVE S FROM X SETTING Y
```

The **REMOVE** operation associates a **remove pointer** with the *dyn.array* from which data is extracted. Whenever a string is assigned to a variable the remove pointer is set to the start of the string. Subsequent **REMOVE** operations extract characters from the position of the remove pointer up to the next mark character or the end of the string. Because the remove pointer gives immediate access to the position at which the **REMOVE** should commence, this operation can be much faster than field, value or subvalue extraction.

The value returned in *var* indicates the delimiter that terminated the **REMOVE**. The delimiter character is not stored as part of the extracted substring. Values of *var* are

0	End of string
1	Item mark
2	Field mark
3	Value mark
4	Subvalue mark
5	Text mark

The mark character itself can be reconstructed as CHAR(256 - *var*) for a non-zero value of *var*.

Once the end of the *dyn.array* has been reached, the remove pointer remains positioned at the end of the string and further **REMOVE** operations would return a null string.

The remove pointer may be reset to the start of the string by assigning a new value to *dyn.array*. Where it is required to reset the remove pointer without changing the string, a statement such as

```
S = S
```

will assign S to itself thus resetting the remove pointer.

There is a limit to the number of remove pointers that can be active at one time. A remove pointer that is set to the start of the string is not considered to be active. It is useful to reset remove pointers when they are no longer required if the variable will not be reassigned. Remove pointers associated with a program or subroutine are reset automatically when the program terminates and its variables are released.

Note that the **REMOVE** operation performs a type conversion on *dyn.arrray* if it is not already a string. Thus the program

```
S = 99
REMOVE X FROM S SETTING DELIM
```

would convert S to be a string "99". Although this is unlikely to have any undesirable effects, it is a side effect to be aware of.

Examples

```
LOOP
   REMOVE BOOK.NO FROM BOOK.LIST SETTING DELIM
   PRINT "Book number is " : BOOK.NO
WHILE DELIM
REPEAT
```

This program fragment extracts entries from the BOOK.LIST dynamic array and prints then. There is an assumption that BOOK.LIST is not a null string (in which case a single null BOOK.NO would be printed).

```
S = ""
LOOP
   REMOVE FLD FROM REC SETTING DELIM
   S := FLD
   IF DELIM = 2 OR DELIM = 0 THEN
      PRINT S
      S = ""
   END ELSE
      S := CHAR(256 - DELIM)
   END
WHILE DELIM
REPEAT
```

This program prints fields from REC. Note the use of the **ELSE** clause to append the delimiter that terminated the substring if it was not a field mark or the end of the string.

This is equivalent to

```
N = DCOUNT(REC, @FM)
FOR I = 1 TO N
   PRINT REC<I>
NEXT I
```

but may be much faster where REC is large and has a very large number of fields.

See also:
GETREM(), SETREM

REPLACE()

The **REPLACE()** function replaces a field, value or subvalue of a dynamic array, returning the result.

Format

REPLACE(*dyn.array***,** *field* {**,** *value* {**,** *subvalue*}} **,** *string***)**

where

dyn.array	evaluates to a string in which the replacement is to occur.
field	evaluates to the field position number. If zero, this argument defaults to one.
value	evaluates to the value position number. If omitted or zero, the entire field is replaced.
subvalue	evaluates to the subvalue position number. If omitted or zero, the entire value is replaced.
string	evaluates to the replacement data.

If *field*, *value* and *subvalue* are not all present, the comma before the *string* argument must be replaced by a semicolon.

The statement

```
S = REPLACE(S, F, V, SV, NEW)
```

is equivalent to

```
S<F, V, SV> = NEW
```

If the specified *field*, *value* or *subvalue* is not present in the *dyn.array*, mark characters are added and the new item is inserted.

A negative value of *field*, *value* or *subvalue* causes a new field, value or subvalue to be appended. The lower ranking items are taken as being one. For example,

```
S = REPLACE(X, -1, 2, 3, Z)
```

appends a new field. The *value* and *subvalue* arguments are treated as though the statement were

```
S = REPLACE(X, -1, 1, 1, Z)
```

See the description of the S<*f*,*v*,*sv*> assignment operator for a discussion of how QM appends items.

Example

```
S = REPLACE(REC, 3, 1; ITEM)
```

This statement assigns S with the result of replacing field 3, value 1 of REC by the contents of ITEM. The value of REC is not changed.

See also:
DEL, **DELETE()**, **EXTRACT()**, **FIND**, **FINDSTR**, **INS**, **INSERT()**, **LISTINDEX()**, **LOCATE**, **LOCATE()**

RESTORE.SCREEN

The **RESTORE.SCREEN** statement restores a rectangular portion of the display screen image previously saved using **SAVE.SCREEN()**.

This statement can only be used with QMConsole and QMTerm sessions and with terminals that support the save and restore screen region functions (e.g. AccuTerm 5.2b upwards).

Format

RESTORE.SCREEN *image*, *restore.state*

where

image	is the screen image data to be restored.
restore.state	is a boolean value indicating whether the cursor position, pagination mode and current display attributes are to be restored from the saved data.

The **RESTORE.SCREEN** statement restores the data previously saved in *image* using **SAVE.SCREEN()**. The data cannot be restored to a different screen position from which it was saved. If the *restore.state* expression evaluates to a non-zero value, the pagination mode will also be restored.

Example

```
IMAGE = SAVE.SCREEN(0, 0, 80, 25)
EXECUTE COMMAND.STRING
RESTORE.SCREEN IMAGE, @TRUE
```

The above code fragment saves the screen image, executes the command in variable COMMAND.STRING and then restores the screen image.

See also:
SAVE.SCREEN

RETURN

The **RETURN** statement returns from an internal subroutine entered by **GOSUB** or an external subroutine entered by **CALL**.

Format

RETURN {**TO** *label*{**:**}}

RETURN *expr*

where

label	is a label in the same program or subroutine as the **RETURN** statement.
expr	is the value to be returned from a user written function.

The **RETURN** statement returns from the most recent **GOSUB** or **CALL** statement. Thus the same **RETURN** statement could leave either an internal or catalogued subroutine.

The optional **TO** *label* clause causes return from a **GOSUB** to continue execution at the given label rather than at the statement following the **GOSUB**. This clause is ignored when returning from a **CALL**. Excessive use of **RETURN TO** can lead to programs that are extremely difficult to maintain.

Where a subroutine needs to return to the calling routine but it is not known how many internal subroutines may be active (e.g. in error paths), it is useful to write a statement of the form

```
ERROR.LABEL:  RETURN TO ERROR.LABEL
```

This will cause all internal subroutines to return to the **RETURN** statement and then return to the calling program. This is different from **STOP** which would also terminate the current sentence.

The **RETURN** *expr* form of the **RETURN** statement is only valid in a **FUNCTION** and returns *expr* as the result of the function. If no **RETURN** statement of this form is executed by the function, a null string is returned.

Examples

```
SUBROUTINE  PRINT.REPORT(ID)
...statements...
RETURN
END
```

This skeleton subroutine performs its task and then returns to its caller.

```
FUNCTION MATMAX(MAT A)
   MAX = A(1)
   N = INMAT(A)
   FOR I = 1 TO N
```

```
      IF A(I) > MAX THEN MAX = A(I)
   NEXT I

   RETURN MAX
END
```

This function scans a one dimensional matrix and passes back the value of the largest element.

See also:
CALL, GOSUB

REUSE()

The **REUSE()** function determines how arithmetic operators applied to numeric arrays handle unequal numbers of fields, values or subvalues.

Format

REUSE(*num.array***)**

where

num.array is a numeric array.

Arithmetic operators such as addition applied to numeric arrays (dynamic arrays where each element is numeric) operate on each field, value or subvalue in turn. Where the layout of fields, values and subvalues in the two numeric arrays is identical there is no difficulty, each element of one array being added (etc) to its corresponding element from the second array.

If the arrays are of different structure, such as one having more fields than the other or more values in one field than the corresponding field of the other array, the arithmetic operators normally use a default value for the missing item. This value is zero except for the divisor of a division operation which defaults to one.

The **REUSE()** function causes the previous field, value or subvalue to be reused in place of this default value where array structures do not match. The **REUSE()** function applies only to values in expressions; its effect cannot be assigned to a variable but it can be used to qualify an argument in a subroutine or function call.

Examples

```
A = "1" : @FM : "2" : @FM : "3"
B = "10" : @FM : "20"
C = A + B
D = A + REUSE(B)
```

In this example, C is set to "11FM22FM3" and D to "11FM22FM23". The **REUSE()** function causes the final field of B to be reused in the addition with field 3 of A.

```
A = "1" : @FM : "2" : @FM : "3"
C = A + 10
D = A + REUSE(10)
```

This example is similar except that numeric array B has been replaced by a simple numeric constant which can be considered to be a single element numeric array.
In this case, C is set to "11FM2FM3" and D to "11FM12FM13".

```
A =
"1":@FM:"2":@VM:"3":@VM:"4":@FM:"5":@VM:"6":@VM:"7":@FM:"8"
B = "10":@FM:"20":@FM:"30":@VM:"40"
```

```
C = A + B
D = A + REUSE(B)
```

In this example individual fields and values of A and B are matched into pairs for the addition operations.
C is set to "11FM22VM3VM4FM35VM36VM7FM8".
D is set to "11FM22VM23VM24FM35VM36VM37FM48".

See also:
ANDS(), EQS(), GES(), GTS(), IFS(), LES(), LTS(), NES(), NOTS(), ORS()

RND()

The **RND()** function returns a random number.

Format

RND(*expr***)**

where

expr evaluates to an integer or a numeric array.

The **RND()** function returns a random number. The range of values is determined by the value of *expr* rounded towards zero as an integer. If *expr* is positive, the number is in the range zero to *expr* minus one. If *expr* is negative, the number is in the range *expr* plus one to zero. If *expr* is zero, **RND()** returns zero.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **RND()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

The seed value of the random number generator may be set using **RANDOMIZE**. Note that the sequence returned may vary between QM releases even if the same seed value is set.

Example

```
TWO.DICE = RND(6) + RND(6) + 2
```

This statement produces a value in TWO.DICE equivalent to throwing a pair of dice. The two calls to the **RND()** function will each return a value in the range 0 to 5. The values are then brought into the appropriate range by adding two.

See also:
RANDOMIZE

SAVE.SCREEN()

The **SAVE.SCREEN()** function saves a rectangular portion of the display screen image.

This statement can only be used with QMConsole and QMTerm sessions and with terminals that support the save and restore screen region functions (e.g. AccuTerm 5.2b upwards).

Format

SAVE.SCREEN(*col*, *line*, *width*, *height***)**

where

col	is the screen column (from zero) of the leftmost column to be saved.
line	is the screen line (from zero) of the top line to be saved.
width	is the width of the screen region to be saved.
height	is the height of the screen region to be saved.

The **SAVE.SCREEN()** function saves the data and display attributes of the screen image within the specified screen area. The value assigned to the variable set by this function can only be used by the **RESTORE.SCREEN** statement.

Example

```
IMAGE = SAVE.SCREEN(0, 0, 80, 25)
EXECUTE COMMAND.STRING
RESTORE.SCREEN IMAGE, @TRUE
```

The above code fragment saves the screen image, executes the command in variable COMMAND.STRING and then restores the screen image.

See also:
RESTORE.SCREEN

SAVELIST

The **SAVELIST** statement saves an active select list to the $SAVEDLISTS file.

Format

SAVELIST *name* {**FROM** *list.no*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

name	is the name of the $SAVEDLISTS entry to be written.
list.no	is the select list number to be saved. If omitted, this defaults to zero.
statement(s)	are statements to be executed depending on the outcome of the operation.

The **SAVELIST** statement saves an active select in the $SAVEDLISTS file. The numbered list is destroyed by this operation.

If the list had been partially processed before the **SAVELIST** statement is performed, only the unprocessed portion of the list is saved.

At least one of the **THEN** and **ELSE** clauses must be present. If the list is successfully saved, the **THEN** clause is executed. If the list cannot be saved for any reason, the **ELSE** clause is executed.

SEEK

The **SEEK** statement sets the current read / write position in a directory file record previously opened for sequential access.

Format

SEEK *file.var* {**,** *offset*{**,** *relto* }}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

file.var	is the file variable associated with the record by a previous **OPENSEQ** statement.
offset	is the byte position relative to the point given by *relto*. If *offset* and *relto* are both omitted, the file position is set to the start of the file.
relto	indicates the point from which *offset* is calculated. Defaults to 0 if omitted. 0 Start of file (*offset* must be positive). 1 Current position (*offset* may be positive or negative) 2 End of file (*offset* must be negative)
statement(s)	are statement(s) to be executed depending on the outcome of the **SEEK**.

At least one of the **THEN** and **ELSE** clauses must be present. The **THEN** clause is executed if the operation is successful. The **ELSE** clause is executed if the **SEEK** operation fails.

Example

```
SEEK SEQ.F 0, 2 ELSE ABORT "Seek error"
```

This statement positions to the end of the record ready to append new data.

See also:
CLOSESEQ, **NOBUF**, **OPENSEQ**, **READBLK**, **READCSV**, **READSEQ**, **WEOFSEQ**, **WRITEBLK**, **WRITECSV**, **WRITESEQ**, **WRITESEQF**

SELECT

The **SELECT** statement creates a select list containing all record keys from a file.

Format

SELECT *var* {**TO** *list.no*} {**ON ERROR** *statement(s)*}

SELECTN *var* {**TO** *list.no*} {**ON ERROR** *statement(s)*}

SELECTV *var* **TO** *list.var* {**ON ERROR** *statement(s)*}

where

var	is the file variable associated with an open file or a field mark delimited dynamic array of items to form the list.
list.no	is the select list number of the list to be created. If omitted, select list zero is used.
list.var	is the select list variable to receive the list. Select list variables can be processed by the **READNEXT** statement as an alternative to using numbered select lists.
statement(s)	are statement(s) to be executed if a fatal error occurs.

The **SELECT** and **SELECTN** statements construct a list of record keys in the file open as *var* and store this as an active select list *list.no* replacing any previously active list. If there are no records in the file, an empty list is created.

|The **SELECTV** statement constructs the list in the same way but stores it in a select list variable which can be processed by a subsequent use of **READNEXT**.

For compatibility with other database products, the action of the **SELECT** statement can be changed to produce a select list variable in the same was as **SELECTV**. This is achieved by setting the **SELECTV** option of the **$MODE** compiler directive.

The QMBasic **SELECT** statement uses an optimised method for processing hashed files such that each group is examined only when the record keys are extracted from the select list. This reduces disk transfers and gives better application performance than constructing the entire list in one operation. This benefit does not apply to **SELECTV**. This overlapping of processing with record selection means that, if the application writes new records while the select list is being processed, these new records may be seen later in the operation.

It is important that a program that does not completely process a select list should use **CLEARSELECT** to clear the remainder of the list. While the list is active, split and merge operations are suspended on the data file. Thus, leaving a list active may cause the file performance to degrade if updates are made. Note that the file will automatically reconfigure for optimum performance once the select operation has terminated.

The **@SELECTED** variable is set to the number of records selected for a directory file or the number of records in the first non-empty group for a dynamic file.

The optional **ON ERROR** clause is executed in the event of a fatal error. This covers such situations as disk hardware errors and faults in the internal structure of the file. The **STATUS()** function will return a value relating to the cause of the error. If no **ON ERROR** clause is present, a fatal error will result in an abort.

Except where the **ON ERROR** clause is taken, the **STATUS()** function will return zero.

Use of a Dynamic Array instead of a File Variable

For compatibility with Pick style environments, QM also supports a variation on these statements where the *var* is a dynamic array in which each field becomes an entry in the target select list.

Example

```
SELECT STAFF TO 7
```

This statement creates a list of the records on the file with file variable STAFF and saves it as active select list 7.

SELECTE

The **SELECTE** statement transfers select list 0 to a select list variable.

Format

SELECTE TO *list.var*

where

list.var is the select list variable to receive the list. Select list variables can be processed by the **READNEXT** statement as an alternative to using numbered select lists.

The **SELECTE** statement transfers the unprocessed portion of the default select list (list 0) to the named variable.

SELECTINDEX

The **SELECTINDEX** statement creates a select list from an alternate key index entry.

Format

SELECTINDEX *index.name* {**,** *value*} **FROM** *file.var* {**TO** *list.no*}

where

index.name	is the name of the alternate key index to be processed.
value	is the value to be located in the index.
file.var	is the file variable associated with an open file.
list.no	is the select list number of the list to be created. If omitted, select list zero is used.

If the *value* is omitted, the **SELECTINDEX** statement constructs a select list containing all the values of the index identified by *index.name*. If the *value* is included, the **SELECTINDEX** statement constructs a select list containing keys of records for which the index indentifed by *index.name* has the given *value*.

Thus, in a file of orders with an index on the customer number field, the first form would return a list of customers referenced by the orders file and the second form would return a list of orders for a specific customer.

The **STATUS()** function returns zero if the **SELECTINDEX** is successful, non-zero if it fails because the index does not exist. Selecting records for a *value* that is not present in the index will return an empty list.

The **@SELECTED** variable is set to the number of entries in the returned list.

The **SELECTINDEX** operation leaves the internal index pointer used by the **SELECTLEFT** and **SELECTRIGHT** statements positioned at the item that has been located or, if not found, at the position where such an item would go.

Use of this statement inside a transaction will not reflect any uncommitted updates to the file.

Examples

```
SELECTINDEX 'CUST.NO' FROM ORDERS.FILE TO 7
LOOP
   READNEXT CUST.NO FROM 7 ELSE EXIT
   CRT CUST.NO
   SELECTINDEX 'CUST.NO', CUST.NO FROM ORDERS.FILE
   LOOP
      READNEXT ORDER.NO ELSE EXIT
      CRT ORDER.NO
   REPEAT
```

```
REPEAT
```

This program builds a select list of all the customers referenced by the orders file as list 7. The inner loop then constructs a list of the order numbers for each customer in turn.

See also:
SETLEFT, **SETRIGHT**, **SELECTLEFT**, **SELECTRIGHT**

SELECTINFO()

The **SELECTINFO()** function returns information about a select list.

Format

SELECTINFO(*list.no***,** *key***)**

where

list.no	evaluates to the number of the select list to be examined. If omitted, select list zero is used.
key	identifies the action to be performed.

Values for the *key* to the **SELECTINFO()** function are defined in the KEYS.H record in the SYSCOM file. These are

1	SL$ACTIVE	Returns true (1) if the select list is active, false (0) if it is not active.
3	SL$COUNT	Returns the number of items remaining to be processed in the select list. If the list is not active, the **SELECTINFO()** function will return zero.

Use of mode 3 with a list constructed using the QMBasic **SELECT** statement on a dynamic file requires completion of the selection process and thus may reduce application performance.

Example

```
SELECT STOCK.FILE
PRINT "Stock file has " : SELECTINFO(0, SL$COUNT) : " records"
CLEARSELECT
```

This program fragment counts and reports the number of records in the file open with file variable STOCK.FILE..

SELECTLEFT and SELECTRIGHT

The **SELECTLEFT** and **SELECTRIGHT** statements create a select list from the entry in an alternate key index to the left or right of the last entry processed.

Format

SELECTLEFT *index.name* **FROM** *file.var* {**SETTING** *key*} {**TO** *list.no*}
SELECTRIGHT *index.name* **FROM** *file.var* {**SETTING** *key*} {**TO** *list.no*}

where

index.name	is the name of the alternate key index to be processed.
file.var	is the file variable associated with an open file.
key	is the variable to be set to the key value associated with the returned list.
list.no	is the select list number of the list to be created. If omitted, select list zero is used.

The **SELECTLEFT** and **SELECTRIGHT** statements construct a select list from the alternate key index entry to the left or right of the one most recently returned using **SELECTINDEX**, **SELECTLEFT** or **SELECTRIGHT**. The position of the scan can be set to the extreme left using **SETLEFT** or the extreme right using **SETRIGHT**.

These operations allow a program to find a specific value and then walk through successive values in the sorted data structure that makes up an alternate key index.

If **SELECTINDEX** is used to locate a value that does not exist in the index, **SELECTLEFT** will return a list of records for the value immediately before the non-existent one and **SELECTRIGHT** will return a list of records for the value immediately after the non-existent one.

The **STATUS()** function returns zero if the operation is successful, non-zero if it fails because the index does not exist. The **@SELECTED** variable is set to the number of entries in the returned list, or zero if there are no further index entries to be returned.

Use of these statements inside a transaction will not reflect any uncommitted updates to the file.

Examples

```
KEY = 'M'
SELECTINDEX 'POSTCODE', KEY FROM CLIENTS.FILE
LOOP
   LOOP
      READNEXT CLIENT.NO ELSE EXIT
      CRT CLIENT.NO
   REPEAT
   SELECTRIGHT 'POSTCODE' FROM CLIENTS.FILE SETTING POSTCODE
UNTIL STATUS()
WHILE POSTCODE[1,LEN(KEY)] = KEY
```

```
REPEAT
```

This program displays a list of all clients with postcodes beginning with M.

The **SELECTINDEX** looks for an index entry for a postcode of "M". This is unlikely to exist and hence the select list will probably be empty. If it did find any records, the inner loop would display these. Having processed this initial list, the **SELECTRIGHT** moves one step right (i.e. in ascending order) through the index tree and builds a list of these records. The POSTCODE variable is returned as the value of the indexed item located. Processing continues until the **SELECTRIGHT** finds an item that does not begin with the characters in KEY.

```
SELECTINDEX 'TIME', TIMESTAMP FROM LOG.F TO 1
IF @SELECTED = 0 THEN
   SELECTLEFT 'TIME' FROM LOG.F TO 1
END IF
```

The above program fragment finds the record in the file open as LOG.F with the TIME field equal to TIMESTAMP. If there is no such record it finds the record with the nearest time before the requested timestamp. If multiple records have the same timestamp value, select list 1 will contain all of their ids. If TIME was the id of records in the log file, the select list could never contain multiple values.

See also:
SELECTINDEX, **SETLEFT**, **SETRIGHT**

SENTENCE()

The **SENTENCE()** function returns command line that started the current program.

Format

SENTENCE()

The **SENTENCE()** function is an alternative to use of the **@SENTENCE** variable.

SEQ()

The **SEQ()** function returns the ASCII character set position value of a character.

Format

SEQ(*char***)**

where

char evaluates to the character to be processed.

The **SEQ()** function returns the character value of *char*. It is the inverse of the **CHAR()** function.

If *char* is a null string, **SEQ()** returns zero. If *char* is more than one character in length, **SEQ()** returns the value of the first character.

Example

```
N = SEQ(KEYIN())
```

This statement reads a single character from the keyboard and then uses **SEQ()** to find its ASCII character set value.

See also:
CHAR()

SERVER.ADDR()

The **SERVER.ADDR()** function returns the IP address for a given server name.

Format

SERVER.ADDR(*server.name***)**

where

server.name is the name of the server for which the IP address is required.

The **SERVER.ADDR()** function can be used to find the IP address of a network server from its name. This function is not usually needed as the QMBasic socket functions work with either IP addresses or server names.

If successful, the **STATUS()** function will return zero. All error conditions return a null string as the IP address and subsequent use of the **STATUS()** function will return the error code.

Example

```
DISPLAY SERVER.ADDR("openqm.com")
```

This statement displays the IP address of the openqm.com server.

See also:
ACCEPT.SOCKET.CONNECTION, **CLOSE.SOCKET**, **CREATE.SERVER.SOCKET()**, **OPEN.SOCKET()**, **READ.SOCKET()**, **SET.SOCKET.MODE()**, **SOCKET.INFO()**, **WRITE.SOCKET()**

SET.ARG

The **SET.ARG** statement updates a subroutine argument value based on its position in the argument list. It is intended for use with subroutines declared with the VAR.ARGS option.

Format

SET.ARG *n*, *value*

where

n	is the argument list position, numbered from one.
value	is the value to be set.

Subroutines declared with the VAR.ARGS option may have a variable number of arguments. Although each argument must have a name assigned to it in the **SUBROUTINE** statement, it is often useful to be able to process a series of arguments by indexing this list.

The **SET.ARG** statement sets the value of argument n. The actual number of arguments passed may be determined using the **ARG.COUNT()** function. Use of an argument position value less than one or greater than the number of arguments causes the program to abort.

See also:
ARG(), **ARG.COUNT**

SET.EXIT.STATUS

The **SET.EXIT.STATUS** statement sets the final exit status returned by QM to the operating system. This operation has no effect on the PDA version of QM.

Format

SET.EXIT.STATUS *value*

where

value is the exit status value to be set.

By default, QM returns an exit status of zero to the operating system on termination. The **SET.EXIT.STATUS** statement allows an application to return an alternative exit status value to indicate, for example, success or failure. Note that error conditions detected during startup of a QM session return an exit status of 1.

See also the **SET.EXIT.STATUS** command.

SET.PORT.PARAMS()

The **SET.PORT.PARAMS()** function sets the communications parameters for a serial port. This function is not available on the PDA version of QM.

Format

SET.PORT.PARAMS(*fvar***,** *params***)**

where

fvar	is the file variable from the **OPENSEQ** statement that was used to open the port.
params	is a dynamic array holding the new parameters to be set.

The **SET.PORT.PARAMS()** function returns true (1) if successful, false (0) if an error occurs.

The *params* dynamic array contains the following data:

Field 1	Port name (ignored)
Field 2	Baud rate
Field 3	Parity mode (0 = off, 1 = odd, 2 = even)
Field 4	Bits per byte (5 to 8)
Field 5	Stop bits (1 or 2)

To allow for the possibility of additional fields being added in future releases, programs should use the **GET.PORT.PARAMS()** function to retrieve the current settings, modify this as required and then use **SET.PORT.PARAMS()** to set the new parameters.

Example

```
PARAMS = GET.PORT.PARAMS(PORT)
PARAMS<2> = 9600
IF NOT(SET.PORT.PARAMS(PORT, PARAMS) THEN STOP 'Error setting
parameters'
```

SET.SOCKET.MODE()

The **SET.SOCKET.MODE()** function sets parameters for an open socket.

Format

SET.SOCKET.MODE(*skt***,** *key***,** *value***)**

where

skt	is the socket variable for an open socket.
key	identifies the mode to be set: SKT$INFO.BLOCKING — Default blocking mode. SKT$INFO.NO.DELAY — Nagle algorithm disabled? SKT$INFO.KEEP.ALIVE — Send keep alives?
value	is the required value of the parameter.

The **SET.SOCKET.MODE()** function returns TRUE (1) if the action is successful, FALSE (0) if it fails. The **STATUS()** function can be used to determine the cause of failure.

See also:
ACCEPT.SOCKET.CONNECTION, **CLOSE.SOCKET**, **CREATE.SERVER.SOCKET()**, **OPEN.SOCKET()**, **READ.SOCKET()**, **SERVER.ADDR()**, **SOCKET.INFO()**, **WRITE.SOCKET()**

SETLEFT and SETRIGHT

The **SETLEFT** and **SETRIGHT** statements set the scanning position of an alternate key index at the extreme left or right of the data.

Format

SETLEFT *index.name* **FROM** *file.var*
SETRIGHT *index.name* **FROM** *file.var*

where

index.name	is the name of the alternate key index to be processed.
file.var	is the file variable associated with an open file.

The **SETLEFT** and **SETRIGHT** statements are used with **SELECTLEFT** and **SELECTRIGHT** to set the scan position to the first or last entry in an alternate key index.

The **STATUS()** function returns zero if the operation is successful, non-zero if it fails because the index does not exist.

Example

```
SETLEFT 'POSTCODE' FROM CLIENTS.FILE
LOOP
   SELECTRIGHT 'POSTCODE' FROM CLIENT.FILE SETTING POSTCODE
UNTIL POSTCODE[1,1] >= 'N'
   CRT POSTCODE
REPEAT
```

This program displays a list of all postcodes commencing with a letter in the first half of the alphabet.

See also:
SELECTINDEX, **SELECTLEFT**, **SELECTRIGHT**

SETNLS

The **SETNLS** statement sets the value of a national language support parameter.

Format

SETNLS *key***,** *value*

where

key	identifies the parameter to be set.
value	is the new value for the parameter.

The **SETNLS** statement sets the value of the named national language support parameter. NLS parameter name tokens are defined in the KEYS.H include record.

Available parameters are:

Parameter	Key	Meaning
1	NLS$CURRENCY	Default currency symbol. Maximum 8 characters.
2	NLS$THOUSANDS	Default thousands separator character.
3	NLS$DECIMAL	Default decimal separator character.

Example

```
SETNLS NLS$CURRENCY, 'Eur'
```

SETPU

The **SETPU** statement sets the characteristics of a print unit.

Format

SETPU *key*, *unit*, *value*

where

key identifies the parameter to retrieved. This may be:

1	PU$MODE	Print unit mode
2	PU$WIDTH	Characters per line
3	PU$LENGTH	Lines per page
4	PU$TOPMARGIN	Top margin size
5	PU$BOTMARGIN	Bottom margin size
6	PU$LEFTMARGIN	Left margin size
7	PU$SPOOLFLAGS	Various print unit flags
9	PU$FORM	Form name (not used by all spoolers)
10	PU$BANNER	Banner page text
11	PU$LOCATION	Printer / file name
12	PU$COPIES	Number of copies to print
15	PU$PAGENUMBER	Current page number (see below)
1002	PU$LINESLEFT	Lines left on page
1003	PU$HEADERLINES	Lines occupied by header
1004	PU$FOOTERLINES	Lines occupied by footer
1005	PU$DATALINES	Lines between header and footer
1006	PU$OPTIONS	Options to be passed to the spooler
1007	PU$PREFIX	Pathname of file holding prefix data to be added to the start of the output
1008	PU$SPOOLER	Spooler to be used (ignored on Windows)
1009	PU$OVERLAY	Catalogued overlay subroutine name (see **SETPTR**)
1010	PU$CPI	Characters per inch (may be non-integer value)
1011	PU$PAPER.SIZE	Paper size. See SYSCOM PCL.H
1012	PU$LPI	Lines per inch. Must be 1, 2, 3, 4, 6, 8, 12, 16, 24, 48
1013	PU$WEIGHT	Font stroke weight. See SYSCOM PCL.H
1014	PU$SYMBOL.SET	Symbol set. See SYSCOM PCL.H
1015	PU$STYLE	Query processor style. See the Query processor **STYLE** option for details.

2000	PU$LINENO	Current line number

unit evaluates to the print unit number.

value is the value to set for the given parameter.

The **SETPU** statement sets the print unit characteristic specified by *key* to the given *value*. It is closely related to the **SETPU()** subroutine.

If successful, **STATUS()** is set to zero. Otherwise, **STATUS()** returns an error code.

Mode 15 (PU$PAGENUMBER) can be used to set the current page number before any output to the print unit if a report is to start at a page number other than one. Using this mode after output has commenced may have indeterminate effects.

Example

```
SETPU PU$LOCATION, 3, "LASER"
```

The above statement sets the destination for print unit 3 to be the LASER printer.

SETREM

The **SETREM** statement sets the remove pointer of a string.

Format

SETREM *offset* **ON** *string*

where

offset	is the character offset of the remove pointer to be set.
string	is the string on which the remove pointer position is to be set.

Assigning a character string variable automatically sets the remove pointer to zero, effectively pointing one character before the start of the string. The **SETREM** statement allows an application to set the remove pointer to an arbitrary offset into string. The **STATUS()** function will return zero if the action is successful.

If the offset is negative or greater than the length of *string*, any existing remove pointer is not altered and the **STATUS()** function will return error code ER$LENGTH.

SETREM is typically used with **GETREM()** to save and restore the remove pointer position.

Example

```
RMV.PTR = GETREM(S)
GOSUB PROCESS.DATA
SETREM RMV.PTR ON S
```

The above code fragment saves the remove pointer associated with string S and restores it after execution of subroutine PROCESS.DATA which might change this remove pointer.

See also:
GETREM, **REMOVE**

SHIFT()

The **SHIFT()** function performs a logical bit-shift operation on an integer value.

Format

SHIFT(*value***,** *shift.len***)**

where

value	evaluates to the integer to be shifted.
shift.len	indicates the number of bit positions by which *value* is to be shifted.

The **SHIFT()** function converts *value* to a thirty two bit integer, truncating any fractional part of a non-integer value, and shifts the bit pattern of this value by *shift.len* positions.

A positive value of *shift.len* shifts right (towards the low order end). A negative value of *shift.len* shifts left (towards the high order end).

Values of *shift.len* that are outside the range -32 to +32 have undefined results.

Example

```
FOR I = 30 TO 0 STEP - 3
   DISPLAY BITAND(SHIFT(N, I), 7) :
NEXT I
```

This program fragment displays the value of N in octal. The MO conversion mode of the **OCONV()** function would be more appropriate.

See also:
BITAND(), **BITNOT()**, **BITOR()**, **BITRESET()**, **BITSET()**, **BITTEST()**, **BITXOR()**

SIN()

The **SIN()** function returns the sine of a value.

Format

SIN(*expr***)**

where

expr evaluates to a number or a numeric array.

The **SIN()** function returns the cosine of *expr*. Angles are measured in degrees.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **SIN()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

Example

```
OPP = HYP * SIN(ANGLE)
```

This statement finds the length of the opposite side of a right angled triangle from the length of the hypotenuse and the adjacent angle.

See also:
ACOS(), **ASIN()**, **ATAN()**, **COS()**, **TAN()**

SLEEP

The **SLEEP** statement causes the program in which it is executed to pause for a given number of seconds or until a specific time. The synonym **RQM** may be used in place of **SLEEP**.

Format

SLEEP {*time*}

where

time determines the time for which the program is to sleep. If omitted, *time* defaults to one.

The **SLEEP** statement operates in one of two ways depending on the format of *time*.

If *time* is a number, it is rounded to an integer value and the program sleeps for that number of seconds. If *time* is negative or zero, the program continues without sleeping.

If *time* is not a number, an attempt is made to convert it to a time of day using any of the formats accepted by the **ICONV()** function **MT** conversion. If successful, the program sleeps until this time. The **SLEEP** statement used in this way cannot sleep across midnight. If the time of day specified by *time* has already passed or if *time* cannot be converted to a time of day, the program continues without sleeping.

In all cases, if there is more than one process running, the **SLEEP** statement causes a process switch to occur. It can therefore be used to relinquish the remainder of the timeslice of the current process if waiting for some event to occur in another process, such as release of a lock.

If the break key is used to interrupt a program which is sleeping, selection of the G option will continue to sleep to the specified time. The Q option will abort the program immediately.

Examples

```
SLEEP "10:30PM"
```

This statement causes the program to sleep until half past ten at night unless it is already later than that time.

```
SLEEP 10
```

This statement causes the program to pause for 10 seconds

```
DISPLAY "Time to continue"
INPUT T
DELAY = ICONV(T, "MT") - TIME()
IF DELAY < 0 THEN DELAY += 86400
SLEEP DELAY
```

This program fragment prompts for and reads a time of day from the keyboard. It then converts this to a number of seconds from the current time and sleeps until this time. This technique, with the conditional statement handling times earlier than the current time allows the program to sleep across midnight.

See also:
NAP

SOCKET.INFO()

The **SOCKET.INFO()** function returns information about an open socket.

Format

SOCKET.INFO(*skt***,** *key***)**

where

skt	is the socket variable for an open socket.
key	identifies the information to be returned:

SKT$INFO.OPEN	Is *skt* a socket variable? Returns true (1) or false (0).
SKT$INFO.TYPE	Type or socket. Returns one of the following values according to which socket function was used to open the socket:

SKT$INFO.TYPE.SERVER	CREATE.SERVER.SOCKET()
SKT$INFO.TYPE.INCOMING	ACCEPT.SOCKET.CONNECTION()
SKT$INFO.TYPE.OUTGOING	OPEN.SOCKET()

SKT$INFO.PORT	Port number.
SKT$INFO.IP.ADDR	IP address.
SKT$INFO.BLOCKING	Default blocking mode.
SKT$INFO.NO.DELAY	Nagle algorithm disabled?
SKT$INFO.KEEP.ALIVE	Send keep alives?

The **SOCKET.INFO()** function returns information about an open socket as shown in the parameter descriptions above.

See also:
ACCEPT.SOCKET.CONNECTION, CLOSE.SOCKET, CREATE.SERVER.SOCKET(), OPEN.SOCKET(), READ.SOCKET(), SERVER.ADDR(), SET.SOCKET.MODE(), WRITE.SOCKET()

SOUNDEX()

The **SOUNDEX()** function returns a four character string determined by the phonetic content of a string. The **SOUNDEXS()** function is similar to **SOUNDEX()** but operates on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

SOUNDEX(*string***)**

where

string is the string for which the sound code is to be returned.

The **SOUNDEX()** function is useful for situations where it is desired to compare or locate items by their spoken sound. For example, names in a telephone directory could be indexed by their **SOUNDEX()** value to aid location of similar sounding names.

The value returned by **SOUNDEX()** is made up from the first letter of *string* in upper case followed by three digits which are found by examination of further characters of *string* according to the following table.

0	A E H I O U W Y
1	B F P V
2	C G J K Q S X Z
3	D T
4	L
5	M N
6	R

Letters in group 0 are ignored. Consecutive letters that result in the same value result in only a single character. If the result is less than four characters long, zeros are added to fill the remaining positions. Thus the word SOUNDEX encodes to S532.

Example

```
DISPLAY "Enter name "
INPUT NAME
KEY = SOUNDEX(NAME)
READ OTHER.NAMES FROM PHONONYMS, KEY THEN
   NAME = OTHER.NAMES
END
```

This program fragment prompts for and reads a name. It then establishes the soundex key for this name and attempts to read a list of similar sounding names from the PHONONYMS file. If found, this list replaces the NAME value.

SPACE()

The **SPACE()** function returns a string consisting of a given number of spaces. The **SPACES()** function is similar to **SPACE()** but operates on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

SPACE(*count***)**

where

count evaluates to the desired number of spaces.

The **SPACE()** function is a useful way to generate multiple spaces. It can aid readability of programs by removing the need for space filled strings and it can be used to provide variable numbers of spaces where required.

Example

```
PRINT SPACE(INDENT) : TEXT
```

This statement prints the contents of TEXT indented by the number of spaces specified by INDENT.

See also:
STR()

SPLICE()

The **SPLICE()** function concatenates corresponding elements of a dynamic array, inserting a string between each pair of items.

Format

SPLICE(*array1***,** *string***,** *array2***)**

where

array1	is the first dynamic array.
string	is the string to be inserted between each pair of items.
array2	is the second dynamic array.

The **SPLICE()** function returns the result of concatenating corresponding dynamic array components (fields, values and subvalues) from the supplied arrays, inserting string between each pair.

The **REUSE()** function can be applied to either or both dynamic arrays. Without this function, any absent trailing values are taken as null strings.

Example

```
S1 = "ABC":@fm@"DEF"
S2 = "123":@vm:"456":@fm:"789"
X = SPLICE(S1,'-', S2)
```

The above code fragment concatenates elements of the two strings yielding a result in X of "ABC123VM456FMDEF789"

SQRT()

The **SQRT()** function returns the square root of a value.

Format

SQRT(*expr***)**

where

expr	evaluates to a number or a numeric array.

The **SQRT()** function returns the square root of *expr*.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **SQRT()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

A negative value of *expr* will cause a run time error.

Example

```
N = SQRT(A)
```

This statement finds the square root of A and assigns this to N.

SQUOTE()

The **SQUOTE()** function returns a copy of its argument string enclosed in single quotes.

Format

SQUOTE(*expr***)**

where

expr evaluates to the source string.

The **SQUOTE()** function returns *expr* enclosed in single quotation marks.

Example

```
A = SQUOTE('ABC123')
```

This statement sets A to the eight character string `'ABC123'`.

See also:
QUOTE()

SSELECT

The **SSELECT** statement creates a select list containing all record keys from a file sorted into left justified ascending order.

Format

SSELECT *file.var* {**TO** *list.no*} {**ON ERROR** *statement(s)*}

where

file.var	is the file variable associated with an open file.
list.no	is the select list number of the list to be created. If omitted, select list zero is used.
statement(s)	are statement(s) to be executed if a fatal error occurs.

A list of record keys in the file open as *file.var* is created and stored as an active select list *list.no* replacing any previously active list. If there are no records in the file, an empty list is created. Keys will be stored in left justified ascending order. The @SELECTED variable is set to the number of records selected.

The optional **ON ERROR** clause is executed in the event of a fatal error. This covers such situations as disk hardware errors and faults in the internal structure of the file. The **STATUS()** function will return a value relating to the cause of the error. If no **ON ERROR** clause is present, a fatal error will result in an abort.

Except where the **ON ERROR** clause is taken, the **STATUS()** function will return zero.

Use of a Dynamic Array instead of a File Variable

For compatibility with Pick style environments, QM also supports a variation on **SSELECT** where the *file.var* is replaced by a dynamic array in which each field becomes an entry in the target select list.

Example

```
SSELECT STAFF TO 7
```

This statement creates a sorted list of the records on the file with file variable STAFF and saves it as active select list 7.

STATUS()

The **STATUS()** function returns information following execution of certain other statements. In many cases, this information gives details of an error condition.

Format

STATUS()

The **STATUS()** function is used to fetch status information set by other statements as documented in their descriptions. Where the value relates to an error condition, the tokens in the ERR.H record of the SYSCOM file can be used. Use of the actual values of error status codes is discouraged.

The **STATUS()** function can be used any number of times to retrieve the current status value but this value may be changed by other statements. In general, the **STATUS()** function should be used as close a possible to the statement that set the value to be retrieved. In particular, use of **CALL** and **EXECUTE** are very likely to result in execution of statements that destroy the previous value of the **STATUS()** function.

There is a standard subroutine, **!ERRTEXT()**, that can be used to translate an error number to an equivalent text message.

See the **OS.ERROR()** function for a way to access operating system level error numbers.

Example

```
OPEN "STOCK.FILE" TO FVAR ELSE
   ABORT "Open failed : Error code " : STATUS()
END
```

This program fragment attempts to open a file and, if the **OPEN** fails, reports the error code.

STATUS

The **STATUS** statement returns a dynamic array containing a variety of information about an open file. Not all fields are returned on the PDA version of QM.

Format

STATUS *var* **FROM** *file.var* **THEN** *statement(s)* **ELSE** *statement(s)*

where

var	is the variable to receive the dynamic array.
file.var	is the file variable associated with an open file.

At least one of the **THEN** and **ELSE** clauses must be present for compatibility with other multivalue products. The implementation of **STATUS** in QM never executes the **ELSE** clause.

The **STATUS** statement returns a dynamic array where the fields contain the following information:

1	File position for a sequential file.
2	1 if at end of file, else 0 (sequential files)
3	Unused on QM
4	Bytes available to read (sequential files)
5	File permission flags in the form used by Linux, etc to define access rights
6	File size
7	Number of hard links (not Windows)
8	User id of owner (not Windows)
9	Group id of owner (not Windows)
10	Inode number (not Windows)
11	Device number
12	Unused on QM
13	Time of last access
14	Date of last access
15	Time of last modification
16	Date of last modification
17-19	Unused on QM
20	Operating system file pathname
21	File type (see FILEINFO() for a list of values)

See also:
FILEINFO()

STOP

The **STOP** statement terminates the current program. **STOPE** and **STOPM** provide compatibility with other multivalue database products.

Format

STOP {*print.list*}

where

print.list evaluates to the message to be displayed. This is of the form described under the **DISPLAY** statement.

Control is passed to the calling program, menu or paragraph.

The Pick syntax of **STOP** can be enabled by including a line

```
$MODE PICK.ERRMSG
```

in the program before the first **STOP** statement. In this syntax, the **STOP** statement becomes

STOP {*msg.id* {**,** *arg...*}}

where

msg.id evaluates to the id of a record in the ERRMSG file which holds the message to be displayed. If this id is numeric, it will be copied to @SYSTEM.RETURN.CODE.

arg... is an optional comma separated list of arguments to be substituted into the message.

See the **ERRMSG** statement for a description of the ERRMSG file message format.

The **STOPE** statement always uses Pick style message handling and the **STOPM** statement always uses Information style message handling, regardless of the setting of the PICK.ERRMSG option.

Examples

```
IF NO.OF.ENTRIES = 0 THEN STOP
```

This statement terminates the program if the value of the variable NO.OF.ENTRIES is zero. No error message is printed. **STOP** statements without error text messages can result in difficult diagnostic work to locate faults.

```
OPEN "STOCK.FILE" TO STOCK ELSE
   STOP "Cannot open STOCK.FILE - Error " : STATUS()
END
```

This program fragment attempts to open a file named STOCK.FILE. If the open fails, the program

displays an error message and terminates the program.

See also:
ABORT

STR()

The **STR()** function returns a string made up of a given number of repeated occurrences of another string. The **STRS()** function is similar to **STR()** but operates on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

STR(*string***,** *count***)**

where

string	evaluates to the string to be repeated.
count	evaluates to the number of repeats of *string* that are required.

The **STR()** function returns *count* occurrences of *string*. If *count* is less than one, a null string is returned.

Example

```
PRINT STR("*", 79)
```

This statement prints a line of 79 asterisks.

See also:
SPACE()

SUBR()

The **SUBR()** function calls a subroutine as a function in an expression. It is normally only used in dictionary I-type items.

Format

SUBR(*name* {,*arg1* {, *arg2*...}})

where

name	evaluates to the name of the subroutine to be called.
arg1, etc	are the arguments to the subroutine.

The **SUBR()** function calls catalogued subroutine *name*, passing *arg1*, *arg2*, etc to it as its arguments. The subroutine must be written to have an additional first argument through which it returns its result which is used as the value of the **SUBR()** function.

A statement such as

```
A = B + SUBR("EVALUATE", C, D)
```

is equivalent to

```
CALL EVALUATE(X, C, D)
A = B + X
```

The *name* argument may be any expression that evaluates to the name of the subroutine. The catalogue look-up process is performed for each execution of the **SUBR()** function unlike a CALL statement where the look-up is performed just once for each invocation of the calling program.

When used in a QMBasic program, the **SUBR()** function does not support the **MAT** keyword to pass a whole matrix as an argument. The CALL statement must be used to achieve this.

Example

```
SUBROUTINE CUST.ORD(RESULT, CUST.NO)
$INCLUDE FILES.H
   SELECTINDEX 'CUST', CUST.NO FROM ORDERS.F TO 1
   READLIST RESULT FROM 1 ELSE NULL
   RETURN
END
```

The above subroutine takes a customer number as its second argument and uses this to access an alternate key index, returning a list of all orders that were placed by the given customer. This example assumes that the ORDERS.F file variable is in a common block defined in the FILES.H include record and that the file is already open.

The subroutine could alternatively be written as a function:

```
FUNCTION CUST.ORD(CUST.NO)
```

```
$INCLUDE FILES.H
   SELECTINDEX 'CUST', CUST.NO FROM ORDERS.F TO 1
   READLIST RESULT FROM 1 ELSE NULL
   RETURN RESULT
END
```

In either case, assuming that the subroutine or function is catalogued as CUST.ORD, it could be used from within a dictionary I-type item by use of a **SUBR()** function such as:

```
SUBR('CUST.ORD', CUST.NO)
```

where CUST.NO is the name of a field within the data records being processed.

SUBROUTINE

The **SUBROUTINE** statement introduces a subroutine. The abbreviation **SUB** may be used.

Format

SUBROUTINE *name*{(*arg1* {, *arg2*...}) {**VAR.ARGS**}}

where

name	is the name of the subroutine.
arg1, etc	are the names of the arguments to the subroutine.

QMBasic programs should commence with a **PROGRAM**, **SUBROUTINE**, **FUNCTION** or **CLASS** statement. If none of these is present**,** the compiler behaves as though a **PROGRAM** statement had been used with *name* as the name of the source record.

The **SUBROUTINE** statement must appear before any executable statements. A **SUBROUTINE** with no arguments is equivalent to a **PROGRAM**. The brackets are optional if there are no arguments. The **SUBROUTINE** statement may be split over multiple lines by breaking after a comma.

The name used in a **SUBROUTINE** statement need not be related to the name of the source record though this eases program maintenance. The name must comply with the QMBasic name format rules

A subroutine module is entered by referencing it a **CALL** statement. A subroutine that has no arguments can also be entered by use of the **RUN** command or by executing a command name that corresponds to the name of the program in the system catalogue.

The number of arguments in calls to the subroutine must be the same as in the **SUBROUTINE** statement unless the subroutine is declared with the **VAR.ARGS** option. When **VAR.ARGS** is used, any arguments not passed by the caller will be unassigned. The **ARG.COUNT()** function can be used to determine the actual number of arguments passed. If the values of argument variables are changed by the subroutine, these changes are reflected in the variables used in the **CALL** statement that entered the subroutine.

Subroutine arguments are normally passed by reference such that changes made to the argument variable inside a subroutine will be visible in the caller's variable referenced by that argument. The **CALL** statement allows arguments to be passed by value by enclosing them in brackets. The **SUBROUTINE** statement also supports this dereferencing syntax. For example

```
SUBROUTINE INVOICE(P, (Q))
```

An argument may refer to a whole matrix. In this case the argument variable name must be preceded by the keyword **MAT** and there must be a **DIM** statement following the subroutine declaration to indicate whether this is a one or two dimensional matrix. Alternatively, the dimensions may be given after the variable name in the **SUBROUTINE** statement. In either case, the actual dimension values are counted by the compiler but otherwise ignored. Use of a dimension

value of one emphasises to readers of the program that the value is meaningless. A matrix passed as an argument cannot be redimensioned in the subroutine.

For example

```
SUBROUTINE MATMAX(MAX, MAT A)
   DIM A(1)
   MAX = A(1)
   N = INMAT(A)
   FOR I = 2 TO N
      IF A(I) > MAX THEN MAX = A(I)
   NEXT I
END
```

This subroutine scans a one dimensional matrix and passes back the value of the largest element via the MAX argument. The first two lines could alternatively be written as

```
SUBROUTINE MATMAX(MAX, A(1))
```

SUBSTITUTE()

The **SUBSTITUTE()** function performs substring replacement on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

SUBSTITUTE(*dyn.array***,** *old.list***,** *new.list* {**,** *delimiter*}**)**

where

dyn.array	is the dynamic array to be processed.
old.list	is list of items to replace.
new.list	is list of replacement items.
delimiter	is the single character delimiter separating items in *old.list* and *new.list*. If omitted, this defaults to a value mark.

The **SUBSTITUTE()** function processes each element of dynamic array *dyn.array* constructing an equivalently structured new dynamic array result. Where an element of *dyn.array* contains a value in the *old.list*, the result contains the corresponding item from *new.list*. Where there is no match with an item in *old.list*, the source data is copied to the result dynamic array.

Although this function is defined to operate on dynamic array, it may be equally useful when *dyn.array* is a simple single valued string.

Example

A contains DFMDVMFVMP

```
B = SUBSTITUTE(A, 'D|P', 'Done|Pending', '|')
```

B will contain DoneFMDoneVMFVMPending

SUBSTRINGS()

The **SUBSTRINGS()** function performs substring extraction on successive elements of a dynamic array, returning a similarly structured dynamic array of results.

Format

SUBSTRINGS(*dyn.array***,** *start***,** *length***)**

where

dyn.array	is the dynamic array to be processed.
start	is the start position for extraction of each substring.
length	is the length of each extracted substring.

The **SUBSTRINGS()** function is the multi-valued equivalent of the substring extraction operator **[** *start***,** *length***]** and processes each element of *dyn.array* in turn to produce a result dynamic array.

Example

A contains ABCDE FM FGHIJ VM KLMNO VM PQRST

```
B = SUBSTRINGS(A, 2, 3)
```

B will contain BCD FM GHI VM LMN VM QRS

SUM()

The **SUM()** function eliminates the lowest level of a dynamic array by adding the elements to form an item of the next highest level.

Format

SUM(*expr***)**

where

expr evaluates to a numeric array.

The **SUM()** function identifies the lowest level elements present in *expr* and forms the sum of each group of elements at this level, replacing the group with an item of the next highest level.

In a numeric array containing subvalues, the subvalues are summed to form values.

If there are no subvalues and the numeric array contains values, the values are summed to form fields.

If there are no subvalues or values, the fields are summed to form a single field.

If only one item remains, the **SUM()** function returns *expr*.

Example

```
TOTAL.PAID = SUM(PAYMENTS)
```

This statement sums a multi-valued list of payments to form the total amount paid.

See also:
SUMMATION()

SUMMATION()

The **SUMMATION()** function returns the total value of all elements of a numeric array.

Format

SUMMATION(*expr***)**

where

expr evaluates to a numeric array.

The **SUMMATION()** function adds together all elements of *expr*, returning the total value. It is equivalent to repeated use of the SUM() function until just one value remains.

Example

```
TOTAL.PAID = SUMMATION(PAYMENTS)
```

This statement sums a multi-valued list of payments to form the total amount paid.

See also:

SUM()

SWAPCASE(0

The **SWAPCASE()** function inverts the case of all alphabetic characters in a string.

Format

SWAPCASE(*string***)**

where

string evaluates to the string in which substitution is to occur.

The **SWAPCASE()** function returns the value of *string* with all uppercase letters converted to lower case and all lowercase letters converted to uppercase. If *string* is a variable rather than an expression, the value of the variable is not affected.

Example

```
S = "ABCdef"
PRINT SWAPCASE(S)
```

This program fragment prints the string "abcDEF".

See also:
DOWNCASE(), **UPCASE()**

SYSTEM()

The **SYSTEM()** function returns information regarding the status of various aspects of the system. On the PDA version of QM, key values that are inappropriate return a zero value.

Format

SYSTEM(*key*)

where

key identifies the information to be returned.

The **SYSTEM()** function is provided for compatibility with other data management products. Many of the *key* values correspond to those found in other multivalue database products though some values are implemented inconsistently across products. Values 1000 and above are usually specific to QM.

The following *key* values are implemented. All other *key* values return a zero value.

Key	Function
1	Returns 1 if a PRINTER ON statement is in effect
2	Current page width of the default print unit
3	Current page length of the default print unit
4	Lines remaining on current page of the default print unit
5	Current page number of the default print unit
6	Current line number of the default print unit
7	Terminal type (same as @TERM.TYPE)
9	Cumulative processor time used (mS) by this QM session
10	Input waiting in the DATA queue? (1 if so, 0 if not)
11	Select list 0 active? (1 if so, 0 if not)
12	Time in seconds since midnight (same as **TIME()**)
18	User number (same as @USERNO)
23	Break key enabled? (1 if so, 0 if not)
24	Input echo enabled? (1 if so, 0 if not)
25	Is this a phantom process?
26	Returns the current input prompt character
27	Returns the operating system uid for the user's process. (Not Windows or PDA)
28	Returns the operating system effective uid for the user's process. (Not Windows or PDA)
29	Returns the operating system gid for the user's process. (Not Windows or PDA)
30	Returns the operating system effective gid for the user's process. (Not Windows or

	PDA)
31	Licence number
32	Returns the system directory pathname
38	Returns temporary directory pathname
42	Returns telnet connection IP address, null for a console user
91	Returns 1 on Windows, 0 on other platforms
1000	Returns 1 if EXECUTE CAPTURING is in effect, 0 otherwise
1001	Returns 1 if case inversion is enabled, 0 otherwise
1002	Returns the program call history. This is a dynamic array in which each program is represented by a field, the current program being in field 1. The first value in each field contains the program name. Subsequent values are divided into two subvalues containing the program address and line number (where available) for each internal subroutine call (**GOSUB**) in the program.
1003	Returns a dynamic array containing a list of open files. Each field has two values; the first holds the internal file number, the second holds the file's pathname.
1004	Returns the peak number of files that have been open at one time since QM was started.
1005	Returns the combined date and time value as DATE() * 86400 + TIME().
1006	Returns 1 if running on a Windows NT style system (NT and later).
1007	Returns the current transaction number, zero if not in a transaction.
1008	Returns the current transaction level, zero if not in a transaction.
1009	Returns the system byte ordering, 1 for high byte first, 0 for low byte first.
1010	Returns the platform name; Windows, Linux or FreeBSD.
1011	Returns the pathname of the QM configuration file (qm.ini on Windows, qmconfig on other platforms)
1012	Returns the QM version number.
1013	Returns user limit, excluding users reserved for phantom processes.
1014	Returns user limit, including users reserved for phantom processes.
1015	Returns the name of the host computer system.
1016	Returns the remaining number of licensed non-phantom users.
1017	Returns the tcp/ip port number for a socket connection.
1018	Returns the device licensing ip address limit.
1019	Returns the device licensing current ip address count.
1020	Returns the time of day in milliseconds since midnight.
1024	Returns the current working directory pathname when QM was entered.
1025	Returns a dynamic array where field 1 is a multivalued list of environment variable names and field 2 is a corresponding list of their values.
1026	Returns *xxx* when QM is entered using "qm *xxx*".
1027	Returns the name of the serial port when logged in on a serial connection.

1028	Returns the system id of the active QM licence, zero if the licence is not system specific.
1029	Returns the current internal subroutine depth.
1030	Returns login time as date * 86400 + time.
1031	Returns operating system process id.
1032	Returns and clears the break pending flag, set if the break key is pressed with breaks disabled.

QM allows users to add definitions for their own **SYSTEM()** function *key* values by writing a QMBasic subroutine that performs whatever processing is required. This subroutine takes two arguments. The first is used to return the result and the second is the *key* value passed in. This subroutine must be catalogued as $SYSTEM.

TAN()

The **TAN()** function returns the tangent of a value.

Format

TAN(*expr***)**

where

expr evaluates to a number or a numeric array.

The **TAN()** function returns the tangent of *expr*. Angles are measured in degrees.

If *expr* is a numeric array (a dynamic array where all elements are numeric), the **TAN()** function operates on each element in turn and returns a numeric array with the same structure as *expr*.

Example

```
OPP = ADJ * TAN(ANGLE)
```

This statement finds the length of the opposite side of a right angled triangle from the length of the adjacent side and the angle between it and the hypotenuse.

See also:
ACOS(), **ASIN()**, **ATAN()**, **COS()**, **SIN()**

TCLREAD

The **TCLREAD** statement retrieves the sentence that started the current program.

Format

TCLREAD *var*

where

var is the variable to receive the sentence.

The **TCLREAD** statement is an alternative to use of the **@SENTENCE** variable.

TERMINFO()

The **TERMINFO()** function returns information from the terminfo database.

Format

TERMINFO()
TERMINFO(*cap.name***)**

where

cap.name evaluates to the name of a terminfo capability.

The **TERMINFO()** function enables programs to examine the terminfo database to establish capabilities of the currently selected terminal type.

In the first form, **TERMINFO()** returns a dynamic array containing a wide range of capability information about the terminal. The structure of this dynamic array is defined in the TERMINFO.H include record in the SYSCOM file. Additional entries may be added in future releases but existing entries will not be moved.

The second form of the **TERMINFO()** function returns the value of the named capability. The *cap.name* argument should evaluate to a capability name as used in terminfo source files. This name is case sensitive. Unrecognised capabilities and those for which the terminfo database has no entry will be returned as null strings.

Both modes of this function return a null string on the PDA version of QM.

TIME()

The **TIME()** function returns the current time as the number of seconds since midnight.

Format

TIME()

The **TIME()** function returns the number of seconds since midnight. The **OCONV()** function can be used to format this in a number of ways for display.

Example

```
DISPLAY OCONV(TIME(), "MTS")
```

This statement displays the time in the form *hh*:*mm*:*ss* using the 24 hour clock.

TIMEDATE()

The **TIMEDATE()** function returns the current time and date as a string.

Format

TIMEDATE()

The **TIMEDATE()** function returns the current time and date as a 20 character string in the form

*hh***:***mm***:***ss dd mmm yyyy*

where

hh	hours in 24 hour format, zero filled
mm	minutes, zero filled
ss	seconds, zero filled
dd	day of month, zero filled
mmm	first three letters of the month name, first letter uppercase
yyyy	year

Example

```
DISPLAY @(60, 0) : TIMEDATE()
```

This statement displays the time and date at the top right of the display.

TIMEOUT

The **TIMEOUT** statement sets a timeout for **READBLK** and **READSEQ**.

Format

TIMEOUT *file.var*, *interval*

where

file.var	is the file variable associated with a file opened using **OPENSEQ**.
interval	is the timeout period in seconds. A negative value disables the timeout.

The **TIMEOUT** statement can be used when **OPENSEQ** is used to open a FIFO (named pipe). If no input is received by **READBLK** or **READSEQ** in the given *interval*, the read terminates.

The **TIMEOUT** statement is ignored on Windows systems and for files that are not FIFOs.

TOTAL()

The **TOTAL()** function accumulates totals for use with the **CALC** query processor keyword. It is only available in dictionary I-type items.

Format

TOTAL(*expr***)**

where

expr is an expression.

The **TOTAL()** function can be used in dictionary I-type expressions. While processing the detail lines of a report, the **TOTAL()** function returns the value of the expression but also accumulates a running total internally. When the query includes fields prefixed by the **CALC** keyword, the expression is re-evaluated on the total lines of the report using the accumulated total in place of the **TOTAL()** function.

TRANS(), RTRANS(), XLATE()

The **TRANS()** function returns a field or the entire record from a named data file. It is normally only used in dictionary I-type items. The synonym **XLATE()** may be used.

The **RTRANS()** function is similar but has a slight difference described below for closer compatibility with some other environments.

Format

TRANS({DICT} *file.name*, *record.id*, *field*, *action***)**

RTRANS({DICT} *file.name*, *record.id*, *field*, *action***)**

where

file.name evaluates to the name of the file from which data is to be retrieved. The optional **DICT** prefix specifies that the dictionary portion of the file is to be used. Alternatively, the *file.name* expression may include the uppercase word DICT before the actual file name and separated from it by a single space.

In a QMBasic program, *file.name* is evaluated in the same way as any other expression. In a dictionary I-type record, *file.name* may be specified as a quoted string or as the actual name of the file, optionally preceded by the DICT qualifier.

record.id evaluates to the id of the record to be retrieved. When used in a QMBasic program, this must be the actual record id. When used in an I-type dictionary expression, this may be

the name of a D or I-type item defined in the same dictionary which contains the id of the record to be retrieved.

a literal record id enclosed in quotes.

field identifies the field to be returned. A *field* value of zero returns the record id and can be used to check the existence of a record. A *field* value of -1 indicates that the entire record is to be returned. When used in a dictionary I-type expression this can also be

A D or I-type field name as defined in the target file's dictionary.

A field number

@RECORD or -1 to return the entire record.

An expression that evaluates to the field position. This must be enclosed in brackets to avoid potential syntactic ambiguity.

action determines the action taken if the record does not exist or the required field is null. This may evaluate to:

C Return the record id.
V Print a warning message and return a null value.
X Return a null value (default).

The **TRANS()** function returns the specified data with any mark characters lowered by one level (e.g. value marks become subvalue marks).

If *record.id* is multi-valued, the **TRANS()** function extracts each requested record and returns a multi-valued result with the data from each record separated by a value mark.

The **RTRANS()** function is identical to **TRANS()** except that it does not lower the mark characters. This makes it impossible to distinguish between the results of retrieving a multivalued field from a single record and retrieving a single valued field from multiple records.

Examples

```
TOTAL.VALUE = QTY * TRANS('STOCK', PART.NO, 'PRICE', 'X')
```

The above statement reads from the STOCK file a record (or list of records) whose id(s) can be found in the PART.NO variable. The X error code causes the **TRANS()** function to return a null value for any record that cannot be found.

```
X = TRANS(DICT 'ORDERS', 'DISCOUNT', 'X')
X = TRANS('DICT ORDERS', 'DISCOUNT', 'X')
```

Both of the above statements perform the same action. Either might be used, for example, to retrieve an I-type item named DISCOUNT from the dictionary of the ORDERS file.

TRANSACTION ABORT, TRANSACTION COMMIT, TRANSACTION START

The **TRANSACTION START/COMMIT/ABORT** statements provide an alternative to use of the **BEGIN TRANSACTION**, **COMMIT**, **ROLLBACK** and **END TRANSACTION** statements.

Format

TRANSACTION START
THEN {*statements*}
ELSE {*statements*}

TRANSACTION COMMIT
THEN {*statements*}
ELSE {*statements*}

TRANSACTION ABORT

A transaction is a group of updates that must either be performed in their entirety or not at all. The **TRANSACTION START** statement starts a new transaction. All updates within the transaction are cached and only applied to the database when the **TRANSACTION COMMIT** statement is executed. Execution of the program then continues at the statement following the **TRANSACTION COMMIT**.

The **TRANSACTION ABORT** statement terminates the transaction, discarding any cached updates. Execution continues at the statement following the **TRANSACTION ABORT**.

The **THEN** and **ELSE** clauses are optional and are provided for compatibility with other products. Within QM any errors occurring in a **TRANSACTION START** or **TRANSACTION COMMIT** will result in run time errors.

Deletes and writes inside a transaction will fail unless the program holds an update lock on the record or the file. All locks obtained inside the transaction are retained until the transaction terminates and are then released. Locks already owned when the transaction begins will still be present after the transaction terminates, even if the record is updated or deleted within the transaction.

Closing a file inside a transaction appears to work in that the file variable is destroyed though the actual close is deferred until the transaction terminates and any updates have been applied to the file. Rolling back the transaction will not reinstate the file variable.

Access to indices using **SELECTINDEX**, **SELECTLEFT** or **SELECTRIGHT**inside a transaction will not reflect any updates within the transaction as these have not been committed.

Updates to sequential records opened using **OPENSEQ** are not affected by transactions.

Transactions may be nested. If the **TRANSACTION START** statement is executed inside an active transaction, the active transaction is stacked and a new transaction commences. Termination of the new transaction reverts to the stacked transaction.

The following operations are banned inside transactions:
CLEARFILE

PHANTOM

Example

```
TRANSACTION START
READU CUST1.REC FROM CUST.F, CUST1.ID ELSE
   TRANSACTION ABORT
   RETURN
END
CUST1.REC<C.BALANCE> -= TRANSFER.VALUE
WRITE CUST1.REC TO CUST.F, CUST1.ID

READU CUST2.REC FROM CUST.F, CUST2.ID ELSE
   TRANSACTION ABORT
   RETURN
END
CUST2.REC<C.BALANCE> += TRANSFER.VALUE
WRITE CUST2.REC TO CUST.F, CUST2.ID
TRANSACTION COMMIT
```

The above program fragment transfers money between two customer accounts. The updates are only committed if the entire transaction is successful.

TRIM()

The **TRIM()** function removes excess characters from a string.

Format

TRIM(*string***)**

TRIM(*string***,** *character*{**,** *mode*}**)**

where

string	evaluates to the string to be trimmed.
character	is the character to be removed
mode	evaluates to a single character which determines the mode of trimming:

A	Remove all occurrences of *character*.
B	Remove all leading and trailing occurrences of *character*.
C	Replace multiple instances of *character* with a single character.
D	Remove all leading and trailing spaces, replacing multiple embedded spaces with a single space. The value of *character* is ignored.
E	Remove all trailing spaces. The value of *character* is ignored.
F	Remove all leading spaces. The value of *character* is ignored.
L	Remove all leading occurrences of *character*.
R	Remove all leading and trailing occurrences of *character*, replacing multiple embedded instances of *character* with a single character.
T	Remove all trailing occurrences of *character*.

The first format of the **TRIM()** function removes all leading and trailing spaces from *string* and replaces multiple embedded spaces by a single space.

The second form is more generalised and allows other characters to be removed.

Examples

```
X = "   1   2   3   "
Y = TRIM(X)
```

This program fragment removes excess spaces from string X setting Y to "1 2 3"

```
X = "ABRACADABRA"
Y = TRIM(X, 'A', 'A')
```

This program fragment removes all occurrence of the letter A from string X setting Y to "BRCDBR"

```
X = "ABRACADABRA"
Y = TRIM(X, 'A', 'B')
```

This program fragment removes leading and trailing occurrences of the letter A from string X setting Y to "BARCADABR"

See also:
TRIMB(), TRIMF(), TRIMS()

TRIMB()

The **TRIMB()** function removes excess spaces from the back of a string. The **TRIMBS()** function is similar to **TRIMB()** but operates on each element of a dynamic array and returns an equivalently structured dynamic array of trimmed strings.

Format

TRIMB(*string***)**

where

string evaluates to the string to be trimmed.

The **TRIMB()** function removes all trailing spaces from *string*.

Examples

```
A = "  1  2  3  "
B = TRIMB(A)
```

This program fragment removes excess spaces from string A setting B to " 1 2 3"

```
A = "  1  2  3  " : @FM : "  4  5  6"
B = TRIMBS(A)
```

This program fragment is similar to the previous example but it shows the way in which **TRIMBS()** operates on the two fields separately.
B becomes " 1 2 3FM 4 5 6"

See also:
TRIM(), **TRIMF()**, **TRIMS()**

TRIMF()

The **TRIMF()** function removes excess spaces from the front of a string. The **TRIMFS()** function is similar to **TRIMF()** but operates on each element of a dynamic array and returns an equivalently structured dynamic array of trimmed strings.

Format

TRIMF(*string***)**

where

string evaluates to the string to be trimmed.

The **TRIMF()** function removes all leading spaces from *string*.

Where *string* is delimited by mark characters, the **TRIMF()** function works on each delimited substring as a separate item.

Examples

```
A = "   1   2   3   "
B = TRIMF(A)
```

This program fragment removes excess spaces from string A setting B to "1   2   3   "

```
A = "   1   2   3   " : @FM : "   4   5   6"
B = TRIMFS(A)
```

This program fragment is similar to the previous example but it shows the way in which **TRIMFS()** operates on the two fields separately.
B becomes "1   2   3   FM4   5   6   "

See also:
TRIM(), TRIMB(), TRIMS()

TRIMS()

The **TRIMS()** function removes excess spaces from strings in a dynamic array, operating on each element in turn and and returning an equivalently structured dynamic array of trimmed strings.

Format

TRIMS(*string***)**

where

string evaluates to the string to be trimmed.

Example

```
A = "  1   2   3   " : @FM : "   4   5   6"
B = TRIMS(A)
```

B becomes "1 2 3FM4 5 6"

See also:
TRIM(), TRIMB(), TRIMF()

TTYGET()

The **TTYGET()** function returns a dynamic array containing the current terminal settings.

Format

TTYGET()

The **TTYGET()** function allows an application that alters terminal settings to read and save the original terminal settings for restore on exit.

The dynamic array currently contains the fields listed below. Further fields may be added in future.

Field	**Content**
1	Ctrl-C treated as the break key? (PTERM BREAK *mode*)
2	Case inversion on? (PTERM CASE *mode*)
3	Break character value (PTERM BREAK *n*)
4	Output newline sequence (PTERM NEWLINE)
5	Input return key code (PTERM RETURN)

See also:
PTERM, **TTYSET**

TTYSET

The **TTYSET** statement sets the terminal modes.

Format

TTYSET *var*

where

var is a dynamic array of terminal mode settings.

The **TTYSET** statement allows an application that alters terminal settings to restore previously saved settings on exit.

The format of the dynamic array *var* is described under the **TTYGET()** function. Because this dynamic array may be extended in future releases, programs must ensure that any additional fields returned by **TTYGET()** are restored on use of **TTYSET()**.

See also:
PTERM, **TTYGET()**

UNASSIGNED()

The **UNASSIGNED()** function tests whether a variable is unassigned.

Format

UNASSIGNED(*var***)**

where

var is the variable to be tested.

All QMBasic variables except those in common blocks are initially unassigned. Any attempt to use the contents of the variable in an expression would cause a run time error until such time as a value has been stored in it. The **UNASSIGNED()** function allows a program to test whether a variable is unassigned, returning true (1) if it is unassigned or (0) if it is assigned.

Example

```
SUBROUTINE VALIDATE(ACCOUNT.CODE, ERROR)
BEGIN CASE
   CASE UNASSIGNED(ACCOUNT.CODE)
      ERROR = 1
   CASE ACCOUNT.CODE MATCHES '3N-5N'
      ERROR = 2
   ...etc...
   CASE 1
      ERROR = 0
END CASE
RETURN
END
```

This program fragment validates an account code. The use of the **UNASSIGNED()** function prevents an abort if the variable has not been assigned.

See also:
ASSIGNED()

UNLOCK

The **UNLOCK** statement releases one of 64 system wide task locks.

Format

UNLOCK *lock.num* {**THEN** *statement(s)*} {**ELSE** *statement(s)*}

where

lock.num	evaluates to the lock number in the range 0 to 63.
statement(s)	are statements to be executed depending on the outcome of the **UNLOCK** operation.

The **THEN** and **ELSE** clauses are both optional.

The **UNLOCK** statement releases the specified task lock if it has previously been acquired using the **LOCK** statement. There is no means for a program to determine which task locks are held by the user except by attempting to lock each in turn and checking the **STATUS()** value. Beware that unlike read, update and file locks, task locks are only automatically released on leaving QM, not on return to the command prompt.

The **THEN** clause is executed if the lock is held by this process. The value of the **STATUS()** function will be zero.

The **ELSE** clause is executed if the lock is not owned by this process. The value of the **STATUS()** function will be ER$LCK if the lock is owned by another process or ER$NLK if it is not owned by any process.

Example

```
LOCK 7 THEN
    ...processing statements...
    UNLOCK 7
END
ELSE ABORT "Cannot obtain task lock"
```

This program fragment obtains task lock 7, performs some critical processing and then releases the lock.

UNTIL

The **UNTIL** statement is used in conjunction with the **FOR** / **NEXT** or **LOOP** / **REPEAT** constructs to determine whether execution of the loop should continue.

Format

UNTIL *expr*

where

expr evaluates to a numeric value

The **UNTIL** statement causes execution of the innermost **FOR/NEXT** or **LOOP/REPEAT** construct to terminate if the value of *expr* is non-zero. It is equivalent to a statement such as

```
IF expr # 0 THEN EXIT
```

Example

```
FOR I = 1 TO 20
UNTIL A(I) < 0
   DISPLAY A(I)
NEXT I
```

This program fragment displays elements of matrix A. The loop terminates if an element is found with a negative value.

See also:
EXIT, **WHILE**

UPCASE()

The **UPCASE()** function returns a string with all letters converted to upper case.

Format

UPCASE(*string***)**

where

string evaluates to the string in which substitution is to occur.

The **UPCASE()** function returns the value of *string* with all letters converted to upper case. If *string* is a variable rather than an expression, the value of the variable is not affected.

Example

```
NAME = "Thomas Smith"
PRINT UPCASE(NAME)
```

This program fragment prints the string "THOMAS SMITH".

See also:
[DOWNCASE()]

VSLICE()

The **VSLICE()** function returns a string formed by extracting a given value position from a dynamic array.

Format

VSLICE(*string***,** *value***)**

where

string is the string from which the value is to be extracted.

value evaluates to the value position to be extracted.

The **VSLICE()** function processes *string* to build a new dynamic array containing only the specified *value* position from each field. Subvalues are returned as part of each value in the result string.

If *value* is less than one, the **VSLICE()** function returns the source *string*. If *value* is greater than the number of values in all fields of *string*, a null string is returned.

Example

If S holds the string "AAVMBBVMCCFMDDVMEEVMFF"

```
X = VSLICE(S, 2)
```

would set X to "BBFMEE"

VOID

The **VOID** statement discards the result of an associated expression.

Format

VOID *expr*

where

expr is an expression.

The **VOID** statement evaluates the supplied expression and discards the result. It is intended for use when calling functions for which the returned value is not used by the program. Us of **VOID** removes the need for a dummy variable and possible compiler warning messages regarding a variable that is set but never used.

Example

```
VOID KEYIN()
```

The above statement waits for the user to press a key but discards the input data.

WAKE

The **WAKE** statement awakens another process that has executed a **PAUSE**. This function is not available on the PDA version of QM.

Format

WAKE *user.no*

where

user.no is the QM user number of the process to be awoken.

The **WAKE** statement resumes execution of another process that has executed a **PAUSE** statement.

If the **WAKE** is executed before the other process attempts to pause, the program is not suspended. Multiple wake events occurring in this way will only awaken the target process once.

The **WAKE** statement attempts to use an inter-process signalling mechanism to resume execution of the other process. Due to operating system limitations, this is usually only possible if both processes are running with the same user id. If this is not the case, the target process may take up to about a second to restart.

WEOFSEQ

The **WEOFSEQ** statement truncates a record open for sequential access at the current position.

Format

WEOFSEQ *file.var* {**ON ERROR** *statement(s)*}

where

file.var	is the file variable associated with the record by a previous **OPENSEQ** statement.
statement(s)	are statement(s) to be executed if the action fails.

The **WEOFSEQ** statement truncates the record at the current position. Performed immediately after the **OPENSEQ**, this will remove all data from the record. Performed after one or more **READSEQ** operations have been performed, all subsequent data is cleared from the record.

The **ON ERROR** clause is executed if a fatal error occurs. The **STATUS()** function can be used to determine the cause of the error. If no **ON ERROR** clause is present, a fatal error causes an abort.

Example

```
OPENSEQ "STOCKS", "STOCK.LIST" TO STOCK.LIST THEN
   WEOFSEQ STOCK.LIST
ELSE
   IF STATUS() THEN ABORT "Cannot open stocks list"
END
```

This program fragment opens the record STOCKS for sequential access. If it already exists, the **THEN** clause of the **OPENSEQ** is taken and the existing data is removed using **WEOFSEQ**.

See also:
CLOSESEQ, **NOBUF**, **OPENSEQ**, **READBLK**, **READCSV**, **READSEQ**, **WRITEBLK**, **WRITECSV**, **WRITESEQ**, **WRITESEQF**

WHILE

The **WHILE** statement is used in conjunction with the **FOR** / **NEXT** or **LOOP** / **REPEAT** constructs to determine whether execution of the loop should continue.

Format

WHILE *expr*

where

expr evaluates to a numeric value

The **WHILE** statement causes execution of the innermost **FOR/NEXT** or **LOOP/REPEAT** construct to terminate if the value of *expr* is zero. It is equivalent to a statement such as

```
IF expr = 0 THEN EXIT
```

Example

```
LOOP
   REMOVE ITEM FROM LIST SETTING DELIMITER
   DISPLAY ITEM
WHILE DELIMITER
REPEAT
```

This program fragment displays items removed from dynamic array LIST. The loop is terminated when the value of DELIMITER becomes zero.

See also:
EXIT, **UNTIL**

WRITE

The **WRITE** statement writes a record to a previously opened file. The **WRITEU** statement is identical but preserves any lock on the record.

Format

WRITE *var* **TO** *file.var, record.id* {**ON ERROR** *statement(s)*}

where

var	is the name of a variable containing the data to be written.
file.var	is the file variable associated with the file.
record.id	evaluates to the id of the record to be written.
statement(s)	are statements to be executed if the write fails.

The keyword **ON** may be used in place of **TO**.

The contents of *var* are written to the file. Any existing record of the same id is replaced by this action. The **WRITE** statement releases any read or update lock on this record. The **WRITEU** statement preserves the lock. Within a transaction, the lock is retained until the transaction terminates and then released regardless of which statement is used. Attempting to write a record in a transaction will fail if the process does not hold an update lock on the record or the file.

The **ON ERROR** clause is executed for serious fault conditions such as errors in a file's internal control structures. The **STATUS()** function will return an error number. If no **ON ERROR** clause is present, an abort would occur.

Example

```
WRITE ITEM TO STOCK, ITEM.ID
```

This statement writes the content of ITEM to a record with the id in ITEM.ID on the file previously opened to file variable STOCK.

WRITEBLK

The **WRITEBLK** statement writes data at the current file position in a record previously opened using **OPENSEQ**.

Format

WRITEBLK *var* **TO** *file.var*
{**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

var	is the name of a variable holding the data to be written.
file.var	is the file variable associated with the file.
statement(s)	are statements to be executed depending on the outcome of the **WRITEBLK** operation.

At least one of the **THEN** and **ELSE** clauses must be present.

The **THEN** clause is executed if the **WRITEBLK** is successful.

The **ELSE** clause is executed if the **WRITBLK** fails. The STATUS() function will indicate the cause of the error.

The **ON ERROR** clause is executed for serious fault conditions such as errors in a file's internal control structures. The STATUS() function will return an error number. If no **ON ERROR** clause is present, an abort would occur.

Example

```
WRITEBLK VAR TO SEQ.F ELSE STOP 'Write error'
```

This program fragment writes data to a file previously opened to file variable SEQ.F.

See also:
CLOSESEQ, NOBUF, OPENSEQ, READBLK, READCSV, READSEQ, WRITECSV, WEOFSEQ, WRITESEQ, WRITESEQF

WRITECSV

The **WRITECSV** statement writes data at the current file position in a record previously opened using **OPENSEQ**. The data to be written is assembled from one or more variables and written in CSV format.

Format

WRITECSV *var1***,** *var2***,** ... **TO** *file.var*
{**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

*var1***,** *var2***,** ...	are the items to be written to the file. If any of the variables contains field marks, each field is treated as a separate item in the resultant CSV data.
file.var	is the file variable associated with the file.
statement(s)	are statements to be executed depending on the outcome of the **WRITECSV** operation.

At least one of the **THEN** and **ELSE** clauses must be present.

The data in the named variables is assembled as a CSV format text string which is then written to the file with a newline appended. The **THEN** clause is executed if the **WRITECSV** is successful.

The **ELSE** clause is executed if the **WRITCSV** fails. The **STATUS()** function will indicate the cause of the error.

The **ON ERROR** clause is executed for serious fault conditions such as errors in a file's internal control structures. The **STATUS()** function will return an error number. If no **ON ERROR** clause is present, an abort would occur.

CSV Format

CSV format is used by many applications. QM adheres to the CSV standard (RFC 4180).

Items are enclosed in double quotes if they contain commas or double quotes. Embedded double quotes are replaced by a pair of double quotes.

Examples

```
WRITECSV PROD.NO, QTY TO SEQ.F ELSE STOP 'Write error'
```

This program fragment writes the contents of the PROD.NO and QTY variables as a CSV item to a file previously opened to file variable SEQ.F.

```
WRITECSV S<1>, S<2>, S<3> TO SEQ.F ELSE STOP 'Write error'
```

This program fragment writes the contents of fields 1 to 3 of S as CSV data to a file previously opened to file variable SEQ.F.

```
WRITECSV S TO SEQ.F ELSE STOP 'Write error'
```

If dynamic array S in the previous example had only three fields, this program fragment writes exactly the same data, treating each field as a separate CSV item.

See also:
CLOSESEQ, **NOBUF**, **OPENSEQ**, **READBLK**, **READCSV**, **READSEQ**, **WEOFSEQ**, **WRITESEQ**, **WRITEBLK**, **WRITESEQF**

WRITESEQ

The **WRITESEQ** statement writes a string array to a directory file record previously opened for sequential access. **WRITESEQF** is identical except that it force writes the data to disk.

Format

WRITESEQ *var* **TO** *file.var* {**ON ERROR** *statement(s)*}
{**THEN** *statement(s)*}
{**ELSE** *statement(s)*}

where

var	is the variable containing the data to be written.
file.var	is the file variable associated with the record by a previous **OPENSEQ** statement.
statement(s)	are statement(s) to be executed depending on the outcome of the **WRITESEQ**.

The keyword **TO** may be replaced by **ON**. At least one of the **THEN** and **ELSE** clauses must be present.

The data in *var* is written to the record at the current file position, overwriting any data already present. The **THEN** clause is executed if the write is successful.

The **ELSE** clause is executed if the **WRITESEQ** operation fails.

If a fatal error occurs, the **ON ERROR** clause is executed. The **STATUS()** function can be used to establish the cause of the error. If no **ON ERROR** clause is present, a fatal error causes an abort.

The **FILEINFO()** function can be used with key FL$LINE to determine the field number that will be written by the next **WRITESEQ**. This information is not valid if the **SEEK**, **READBLK** or **WRITEBLK** statements have been used.

The **WRITESEQF** statement is identical to **WRITESEQ** except that execution of the next QMBasic statement does not occur until the data has been written to disk. With **WRITESEQ**, the data may still be in internal buffers.

Example

```
WRITESEQ REC TO STOCK.LIST ELSE ABORT "Write error"
```

This statement writes the data in REC to the record open for sequential access via the STOCK.LIST file variable.

See also:
CLOSESEQ, **NOBUF**, **OPENSEQ**, **READBLK**, **READCSV**, **READSEQ**, **WEOFSEQ**,

WRITEBLK, WRITECSV

WRITE.SOCKET()

The **WRITE.SOCKET()** function writes data to a socket opened with **ACCEPT.SOCKET.CONNECTION()** or **OPEN.SOCKET()**.

Format

WRITE.SOCKET(*skt***,** *data***,** *flags***,** *timeout***)**

where

skt is the socket variable returned by **ACCEPT.SOCKET.CONNECTION()** or **OPEN.SOCKET()**.

data is the data to be written.

flags is a value determining the mode of operation of the socket for this write, formed by adding the values of tokens defined in the SYSCOM KEYS.H record. The flags available in this release are:

SKT$BLOCKING	Sets the default mode of data transfer as blocking.
SKT$NON.BLOCKING	Sets the default mode of data transfer as non-blocking.

If neither blocking flag is given, the blocking mode set when the socket was opened is used.

timeout is the timeout period in milliseconds. A value of zero implies no timeout.

The **WRITE.SOCKET()** function writes the given data and returns the number of bytes written. If non-blocking mode is used or a timeout occurs, this byte count may be less than the length of the data. The remaining data can be written with a subsequent call to **WRITE.SOCKET()** when buffer space becomes available.

The **STATUS()** function returns zero if the action is successful, or a non-zero error code if an error occurs. A timeout will return an error code of ER$TIMEOUT as defined in the SYSCOM ERR.H record.

Example

```
SKT = OPEN.SOCKET("193.118.13.14", 3000, SKT$BLOCKING)
IF STATUS() THEN STOP 'Cannot open socket'
N = WRITE.SOCKET(SKT, DATA, 0, 0)
CLOSE.SOCKET SKT
```

This program fragment opens a connection to port 3000 of IP address 193.118.13.14, sends the data in DATA and then closes the socket.

See also:
ACCEPT.SOCKET.CONNECTION, **CLOSE.SOCKET**, **CREATE.SERVER.SOCKET()**, **OPEN.SOCKET()**, **READ.SOCKET()**, **SERVER.ADDR()**, **SET.SOCKET.MODE()**,

SOCKET.INFO()

WRITEV

The **WRITEV** statement writes a specific field to a record of a previously opened file. The **WRITEVU** statement is identical but preserves any lock on the record.

Format

WRITEV *var* **TO** *file.var, record.id***,** *field.expr*
{**ON ERROR** *statement(s)*}

where

var	is the name of a variable containing the data to be written.
file.var	is the file variable associated with the file.
record.id	evaluates to the id of the record to be written.
field.expr	evaluates to the number of the field to be written.
statement(s)	are statements to be executed if the write fails.

The keyword **ON** may be used in place of **TO**.

The contents of *var* are written to field *field.expr* of record *record.id* of the file. If the record does not already exist, it will be created by this operation.. The **WRITEV** statement releases any read or update lock on this record. The **WRITEVU** statement preserves the lock. Within a transaction, the lock is retained until the transaction terminates and then released regardless of which statement is used. Attempting to write a record in a transaction will fail if the process does not hold an update lock on the record or the file.

A *field.expr* value of zero is treated as a reference to field one. A negative field number causes the *var* string to be appended as a new field at the end of the record.

The **ON ERROR** clause is executed for serious fault conditions such as errors in a file's internal control structures. The **STATUS()** function will return an error number. If no **ON ERROR** clause is present, an abort would occur.

Example

```
WRITEV ITEM TO STOCK, ITEM.ID, 3
```

This program fragment writes the value of ITEM to field 3 of record ITEM.ID in a file previously opened to file variable STOCK.

XTD()

The **XTD()** function converts a string of hexadecimal characters to a number.

Format

XTD(*expr***)**

where

expr evaluates to the hexadecimal string to be converted.

The **XTD()** function converts the supplied *expr* hexadecimal string to a number. If *expr* contains any characters other than 0-9 or A-F (upper or lower case) or is a null string, the function returns the original value of *expr*.

See also:
DTX()

6.5 Character Values for Terminal Input

The table below shows the keys that produce each character value on Windows systems using QMConsole, on all systems using QMTerm, or when using **KEYCODE()** to decode key sequences.

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
00x		Ctrl-A	Ctrl-B	Ctrl-C	Ctrl-D	Ctrl-E	Ctrl-F	Ctrl-G	Ctrl-H	Ctrl-I	
									Bsp	Tab	
01x	Ctrl-J	Ctrl-K	Ctrl-L	Ctrl-M	Ctrl-N	Ctrl-O	Ctrl-P	Ctrl-Q	Ctrl-R	Ctrl-S	
	Ctrl-rtn			Return							
02x	Ctrl-T	Ctrl-U	Ctrl-V	Ctrl-W	Ctrl-X	Ctrl-Y	Ctrl-Z	Esc		Ctrl-}	
03x	Ctrl-^	Ctrl-_	Space	!	"	#	$	%	&	'	
04x	(	)	*	+	,	-	.	/	0	1	
05x	2	3	4	5	6	7	8	9	:	;	
06x	<	=	>	?	@	A	B	C	D	E	
07x	F	G	H	I	J	K	L	M	N	O	
08x	P	Q	R	S	T	U	V	W	X	Y	
09x	Z	[	\	]	^	_	`	a	b	c	
10x	d	e	f	g	h	i	j	k	l	m	
11x	n	o	p	q	r	s	t	u	v	w	
12x	x	y	z		|	}	~	Ctrl-Bsp	F1	F2	
13x	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	
14x	Ctrl-F1	Ctrl-F2	Ctrl-F3	Ctrl-F4	Ctrl-F5	Ctrl-F6	Ctrl-F7	Ctrl-F8	Ctrl-F9	Ctrl-F10	
15x	Ctrl-F11	Ctrl-F12	Alt-F1	Alt-F2	Alt-F3	Alt-F4	Alt-F5	Alt-F6	Alt-F7	Alt-F8	
16x	Alt-F9	Alt-F10	Alt-F11	Alt-F12	Sh-F1	Sh-F2	Sh-F3	Sh-F4	Sh-F5	Sh-F6	
17x	Sh-F7	Sh-F8	Sh-F9	Sh-F10	Sh-F11	Sh-F12	CSA-F1	CSA-F2	CSA-F3	CSA-F4	
18x											
19x											
20x	Mouse			CsrLeft	CsrRgt	CsrUp	CsrDn	Pg Up	Pg Dn	Home	

21x	End	Insert	Delete	Ctrl-Tab	C-PgUp	C-PgDn	C-Home	C-End	User0	User1	
22x	User2	User3	User4	User5	User6	User7	User8	User9			
23x											
24x											
25x											

Character value tokens are defined in the KEYIN.H record of the SYSCOM file. Codes User0 to User9 are only returned by the **KEYCODE()** function.

6.6 @-Variables

QMBasic provides a number of special variables and constants with names prefixed by the @ character. Some @-variables can be updated by QMBasic programs though most are read-only.

Many of the @-variables are also available for use in I-type definitions or within paragraphs. A complete list of @-variables appears below.

Compile-time Constants

These constants are available in **QMBasic** programs and I-type definitions to improve readability.

@AM	Attribute mark (synonym for @FM)
@FM	Field mark
@IM	Item mark
@SM	Subvalue mark
@SVM	Subvalue mark (synonym for @SM)
@TM	Text mark
@VM	Value mark

@FALSE	0
@TRUE	1

Variables

Except where indicated in the descriptions, these items are read-only

@ABORT.CODE	A value indicating the cause of execution of the last abort. This variable is particularly useful within ON.ABORT paragraphs or programs invoked from them. Values are: 0 No abort has occurred 1 A QMBasic ABORT statement or the ABORT command has been used 2 The Quit option has been selected after the break key was pressed The value of @ABORT.CODE is initially zero and is reset to zero only by the EXECUTE statement
@ABORT.MESSAGE	Contains the text of any message associated with the most recent abort event.
@ANS	Contains the result of the last virtual attribute expression evaluated. This variable can be updated, usually only in C-type dictionary items.
@COMMAND	The last command entered at the command prompt or initiated using the QMBasic EXECUTE statement.

@COMMAND.STACK	This variable holds the last 99 commands executed at the command prompt as a field mark delimited dynamic array. The most recent command is field 1.
@CRTHIGH	Contains the number of lines per page of the display.
@CRTWIDE	Contains the width of the display.
@DATA.PENDING	Contains the data on the DATA queue, if any. Each item, including the last, is followed by an item mark character.
@DATE	The internal format date value (days since 31 December 1967) at which the last command started execution. Any changes made to this variable will also be reflected in the values of the @DAY, @MONTH, @YEAR and @YEAR4 variables described below.
@DAY	The day of the month at which the last command started execution as a two digit value. Changing @DATE will also change this value.
@DS	Contains the operating system specific directory delimiter character, \ on Windows, / on other platforms.
@FILE.NAME	The name of the file referenced in the most recent query processor command. This variable may be updated by a QMBasic program.
@HOSTNAME	The name of the server computer system. Same as SYSTEM(1015).
@ID	The record id of the record being processed by a query processor command or an I-type function. This variable may be updated by a QMBasic program.
@IP.ADDR	The IP address associated with a network user. Same as SYSTEM(42).
@ITYPE.MODE	This variable can be used to determine the mode of execution of an I-type. It has three possible values: 0 Normal 1 Evaluation of the old index value when updating or deleting a record from a file with an alternate key index. 2 Evaluation of the new index value when updating or adding a record to a file with an alternate key index.
@LEVEL	The current command processor depth (EXECUTE level). The initial command processor is level one, each **EXECUTE** level increments this by one, decrementing on return from that level.
@LOGNAME	User's login name. On Windows, this is converted to uppercase.
@LPTRHIGH	Contains the number of lines per page of print unit zero. Depending on the current setting of the PRINTER flag, this may refer to the display or to the printer.
@LPTRWIDE	Contains the width of print unit zero. Depending on the current setting of the PRINTER flag, this may refer to the display or to the printer.
@MONTH	The month in which the last command started execution as a two digit value. Changing @DATE will also change this value.
@NB	Break number level. Set to zero on detail lines and one upwards on break lines. A value of 255 represents the grand total line.
@NI	Item counter. Used in I-types, this holds the number of records

	retrieved by the query processor command.
@OPTION	Contains a copy of field 4 of the V-type VOC entry when a verb starts execution. Use of this variable enables related commands to be handled by a single program.
@PARASENTENCE	The sentence that invoked the most recent paragraph or sentence. On entering a command at the keyboard, this variable will be set to the same value as @COMMAND. If the command is a paragraph or sentence which invokes a further paragraph or sentence, the value will be updated to be the command which started this new paragraph or sentence.
@PATH	The pathname of the current account.
@PIB	The PROC primary input buffer.
@POB	The PROC primary output buffer.
@QMSYS	The pathname of the system account.
@RECORD	The data of the record being processed by an I-type function. This variable may be updated by a QMBasic program.
@SELECTED	Contains the total record count for the most recent SELECT or SSELECT operation. Note that a QMBasic SELECT operation against a dynamic file processes the file one group at a time and this variable will show the record count for the group being processed.
@SENTENCE	The currently active sentence. This is different from @COMMAND if the command runs a paragraph, sentence or menu.
@SIB	The PROC secondary input buffer.
@SOB	The PROC secondary output buffer.
@SYSTEM.RETURN.CODE	A status value returned from most commands.
@SYS.BELL	This variable is available to QMBasic programs and initially contains the ASCII BEL character (character 7) which, when sent to the display, causes the audible warning to sound. The BELL OFF command changes @SYS.BELL to a null string and BELL ON reverts to the default character. Thus use of @SYS.BELL in QMBasic programs results in an audible alarm which can be disabled by the user.
@TERM.TYPE	Terminal type.
@TIME	The internal format time value (seconds since midnight) at which the last command started execution. This value may be updated by a QMBasic program.
@TRANSACTION.ID	The unique id number for the currently active transaction. Zero if no transaction is active. Same as SYSTEM(1007).
@TRANSACTION.LEVEL	The transaction depth. Zero when no transaction is active, incremented for each active transaction, decremented when a transaction terminates. Same as SYSTEM(1008).
@TRIGGER.RETURN.C	A status value returned set by trigger functions that return a STATUS() value of ER$TRIGGER.

ODE

@TTY	Terminal device name. This variable is provided for compatibility with other systems. It contains one of the following values: console QMConsole interactive session on Windows /dev/... QMConsole interactive session on other platforms telnet Telnet session phantom Phantom process port Serial port connection vbsrvr QMClient process Other process types may be added in future.
@USER	Synonym for @LOGNAME
@USER0 to @USER4	These variables are initially set to zero and may be updated by QMBasic programs to provide status information, etc. QM places no rules on the use of these variables and does not update them at any time.
@USERNO	User number.
@USER.NO	Synonym for @USERNO.
@USER.RETURN.CODE	This variable is initially set to zero and may be updated by QMBasic programs to provide status information, etc. QM places no rules on the use of this variable and does not update it at any time.
@VOC	This @VOC variable can be used as the file variable for the VOC in place of opening it explicitly within user written application code.
@WHO	User's account name.
@YEAR	The last two digits of the year in which the last command started execution. Changing @DATE will also change this value.
@YEAR4	The four digit year number in which the last command started execution. Changing @DATE will also change this value.

6.7 Standard Subroutines

QMBasic includes a set of standard subroutines that may be called from user programs. These all have an exclamation mark prefix to the subroutine name.

!ABSPATH()	Form an absolute pathname from a directory and file path
!ATVAR()	Return value of an @-variable
!ERRTEXT()	Return text description of an error number
!GETPU()	Get print unit characteristics
!PATHTKN()	Process special tokens in a VOC or ACCOUNTS file pathname
!PARSER()	Command line parser
!PCL()	PCL control code functions
!PICK()	Display a pick list of options
!PICKLIST()	Display a pick list of options
!QMCLIENT	QMClient interface from QMBasic
!SCREEN()	Screen driver
!SETPU()	Set print unit characteristics
!SETVAR()	Set the value of an @-variable
!SORT()	Sort a delimited list
!USERNAME()	Return user name for a given user number
!USERNO()	Return a list of user numbers for a given user name
!VOCREC()	Read a VOC record, following remote pointers

!ABSPATH()

The **!ABSPATH()** subroutine forms an absolute pathname from a directory and file path.

Format

CALL !ABSPATH(*path***,** *dir***,** *file***)**

where

path is the returned absolute pathname.

dir is the directory path to be used when prefixing the pathname.

file is the file path to be processed.

The **!ABSPATH()** subroutine uses the supplied directory and file path to construct an absolute pathname.

If *file* commences with @QMSYS, *path* is returned as the *file* value with the @QMSYS token replaced by the QMSYS account pathname.

If *file* commences with a directory separator character, *path* is returned as *file*.

If *file* commences with a Windows drive specification, *path* is returned as *file*.

Otherwise, *path* is formed by concatenating *dir* and *file*, inserting a directory separator character if required.

Examples

Dir	File	Path
Any	@QMSYS\ACCOUNTS	C:\QMSYS\ACCOUNTS
Any	\SALES\CUSTOMERS	\SALES\CUSTOMERS
Any	C:\SALES\CUSTOMERS	C:\SALES\CUSTOMERS
C:\SALES	CUSTOMERS	C:\SALES\CUSTOMERS
C:\	CUSTOMERS	C:\CUSTOMERS

!ATVAR()

The **!ATVAR()** subroutine retrieves the value of an @-variable.

Format

CALL !ATVAR(*value***,** *name***)**

where

value is the returned value.

name is the name of the @-variable to be retrieved. The leading @ character may optionally be omitted. Variable names are case insensitive.

The **!ATVAR()** subroutine returns the value of the named @-variable. Although intended for accessing user defined variables, it can also return the standard variables.

The **!ATVAR()** function sets the value returned by the **STATUS()** function. This will be zero if the specified variable is found, non-zero if it is not recognised.

Example

```
CALL !ATVAR(VALUE, "@USER1")
```

or

```
DEFFUN ATVAR(NAME) CALLING "!ATVAR"
VALUE = ATVAR("@USER1")
```

Both of these examples retrieve the value of the @USER1 variable.

See the **!SETVAR()** subroutine for a way to set the value of an updateable @-variable.

!ERRTEXT()

The **!ERRTEXT()** subroutine returns a text description of an error number.

Format

CALL !ERRTEXT(*text***,** *errno***)**

where

text	is the returned descriptive text.
errno	is the error number.

The **!ERRTEXT()** subroutine can be used to retrieve a text description of a QM error number for display to a user or entry into a log file.

Where relevant, the associated operating system error number will be inserted into the text. For this to be correct, the **!ERRTEXT()** subroutine must be called before any actions are performed that might lose this value (e.g. file operations).

If *errno* is not recognised, the subroutine returns *errno* as the *text* description.

Examples

```
CALL !ERRTEXT(TEXT, STATUS())
DISPLAY 'Error ' : STATUS() : ' ' : TEXT
```

or

```
DEFFUN ERRTEXT(ERRNO) CALLING "!ERRTEXT"
DISPLAY 'Error ' : STATUS() : ' ' : ERRTEXT(STATUS())
```

!GETPU()

The **!GETPU()** subroutine gets the characteristics of a print unit.

Format

CALL !GETPU(*key***,** *unit***,** *value***,** *status***)**

where

key	identifies the parameter to retrieved. This is as for the **GETPU()** function.
unit	evaluates to the print unit number.
value	is the variable to receive the given parameter.
status	is the return status value. Zero if the action is successful, a non-zero error code if the action fails.

The **!GETPU()** subroutine retrieves the print unit characteristic specified by *key*, storing it in *value*. It is closely related to the **GETPU()** function.

Example

```
CALL !GETPU(PU$MODE, 3, MODE, STATUS)
```

The above statement gets the mode of print unit 3, storing it in MODE.

!PARSER()

The **!PARSER()** subroutine parses a command line.

Format

CALL !PARSER(*key***,** *type***,** *string***,** *keyword* {**,** *voc.rec*}**)**

where

key identifies the operation to be performed:

0	PARSER$RESET	Prepares to parse the data in *string*.
1	PARSER$GET.TOKEN	Returns the next token from the data.
2	PARSER$GET.REST	Returns all remaining tokens as a single string.
3	PARSER$EXPAND	Inserts *string* before the remaining tokens.
4	PARSER$LOOK.AHEAD	Previews the next token.
5	PARSER$MFILE	Like PARSER$GET.TOKEN but allows multifile syntax.

type is the returned token type:

0	PARSER$END	End of data reached.
1	PARSER$TOKEN	A token has been returned in *string*.
2	PARSER$STRING	A quoted string. The quotes are removed in *string*.
3	PARSER$COMMA	A comma has been found.
4	PARSER$LBR	A left bracket has been found.
5	PARSER$RBR	A right bracket has been found.

string is the returned token string. For *key* values 1 and 3, this is the string passed into the parser.

keyword is the returned token keyword number as defined in the VOC and in the SYSCOM PARSER.H record. This is negative if the token is not a VOC keyword. This argument is ignored for *key* values 1 and 3.

voc.rec is an optional argument, returned as the VOC record when *string* corresponds to a VOC key.

The **!PARSER()** subroutine can be used to parse the elements of a command line.

Example

```
CALL !PARSER(PARSER$RESET, 0, @SENTENCE, 0)
CALL !PARSER(PARSER$GET.TOKEN, TOKEN.TYPE, STRING, KEYWORD) ;*
Verb
LOOP
```

```
   CALL !PARSER(PARSER$GET.TOKEN, TOKEN.TYPE, STRING, KEYWORD)
UNTIL TOKEN.TYPE = PARSER$END
   …process token…
REPEAT
```

!PATHTKN()

The **!PATHTKN()** subroutine processes special tokens in a VOC or ACCOUNTS file pathname.

Format

CALL !PATHTKN(*inpath***,** *outpath***)**

where

inpath	is the pathname to be processed.
outpath	is the returned processed pathname. This may be the same variable as *inpath*.

Pathnames recorded in the VOC or the QMSYS ACCOUNTS file may include special tokens that represent variable components. The **!PATHTKN()** subroutine processes a pathname, substituting the expansions for these tokens.

The special tokens are:

@DRIVE	The drive letter for the QMSYS directory (Windows only).
@HOME	The user's home directory as defined by the operating system HOME environment variable.
@QMSYS	The full pathname of the QMSYS directory.
@TMP	The pathname of the system temporary directory as defined by the TEMPDIR configuration parameter.

The token must be the leading part of the pathname.

The **!PATHTKN()** subroutine is also defined as a function in the SYSCOM KEYS.H include record:

outpath = **PARSE.PATHNAME.TOKENS(***inpath***)**

Examples

The entry for the QMSYS account in the ACCOUNTS register is simply

@QMSYS

This ensures that the entire system can be moved without needing to update the QMSYS account location.

When using QM installed on a USB flash drive on Windows, creating an account on the USB device sets the ACCOUNTS register entry as

@DRIVE:pathname

The account is therefore accessible even if the flash drive takes on a different drive letter in later use.

!PCL()

The **!PCL** () subroutine constructs PCL control strings for various useful operations. It is intended for use as a series of functions defined in the SYSCOM PCL.H include record.

Format

CALL !PCL(*string*, *key*, *arg1*,...)

where

string	is the returned control string.
key	identifies the operation to be performed. See the PCL.H include record for the relationship between the *key* values and the functions described below.
arg1,...	are arguments defining the exact action. The !PCL() subroutine takes a variable length argument list.

The **!PCL()** subroutine should be called using the function interfaces defined below. The returned string can be sent to a PCL compatible printer to perform the requested action.

All page positioning values are measured using the PCL coordinate grid where (0,0) is at the top left of the page and the grid scale is 300 per inch. There is a useful grid template printing program, PCL.GRID, in the BP file of the QMSYS account.

Note: The quality of PCL implementations varies widely and these functions may not give the expected results on some printers. In particular, setting some font metrics may cause inconsistent character placement. It is the application developer's responsibility to ensure that the printed results are acceptable.

The following functions are defined in the SYSCOM PCL.H include record. Each returns the relevant control string to perform its action.

PCL.BOX(*left*, *top*, *width*, *height*, *pen.width*, *radius*)
Draws a rectangular box using the given position (*left*, *top*) and size (*width*, *height*) values. The *pen.width* determines the width of the lines used to draw the box. The *radius* value determines the radius of rounded corners. A value of zero results in square corners .

PCL.COPIES(*copies*)
Sets the number of copies to be printed.

PCL.CURSOR(*x*, *y*)
Sets the current cursor position to the given coordinates. Subsequent text output will occur at this point.

PCL.DUPLEX(*mode*)
Sets duplex mode. 0 = off, 1 = long edge binding, 2 = short edge binding.

PCL.FONT(*font*)
Sets the font details for text output. The *font* argument consists of comma separated list of case insensitive items chosen from the following list. Features that are not specified retain their

previous values. Not all printers support all options.

Font names:	ARIAL, COURIER, CG-TIMES, LETTER-GOTH, LINEPRINTER, UNIVERS
Character sets:	ASCII, LATIN-1, PC-8, ROMAN-8
Type style:	UPRIGHT, COMPRESSED, CONDENSED, CONDENSEDITALIC, EXPANDED, INLINE, ITALIC, OUTLINE, OUTLINESHADOW, SHADOW
Weight:	ULTRA-THIN, EXTRA-THIN, THIN, EXTRA-LIGHT, LIGHT, DEMI-LIGHT, SEMI-LIGHT, MEDIUM, SEMI-BOLD, DEMI-BOLD, BOLD, EXTRA-BOLD, BLACK, EXTRA-BLACK, ULTRA-BLACK
Spacing:	FIXED, PROPORTIONAL
Size:	*n*PT (point size), PITCH *n* (characters per inch)
Composite:	REGULAR (equivalent to UPRIGHT, MEDIUM)

PCL.HLINE(*x*, *y*, *length*, *pen.width*)
Draws a horizontal line starting at the given position and extending to the right, using the specified *length* and *pen.width* values.

PCL.LEFT.MARGIN(*col*)
Sets the left margin at column *col*.

PCL.ORIENTATION(*layout*)
Specifies the page format. The *layout* argument is a string and may be PORTRAIT or LANDSCAPE.

PCL.PAPER.SIZE(*size*)
Specifies the page size. The *size* argument is a string chosen from A3, A4, B5, C5, COM10, DL, EXECUTIVE, LEDGER, LEGAL, LETTER and MONARCH.

PCL.RESET()
Resets the printer.

PCL.RESTORE.CURSOR()
Restores a previously saved cursor position.

PCL.SAVE.CURSOR()
Saves the current cursor position. Note that there is a limit to the number of nested cursor save operations.

PCL.VLINE(*x*, *y*, *length*, *pen.width*)
Draws a vertical line starting at the given position and extending downwards, using the specified *length* and *pen.width* values.

The source version of the **!PCL()** subroutine is in the BP file of the QMSYS account so that users can add further options. A copy of any changes should be retained as this item will be replaced when an upgrade is installed.

Example

```
PRINTER ON
PRINT PCL.RESET() :
PRINT PCL.FONT('Courier, Pitch 10, Regular') :
PRINT PCL.BOX(300,300,300,100,2,15) :
```

```
PRINT PCL.CURSOR(350, 380) : 'Hello' :
```

The above program prints the word Hello in a box with rounded corners.

!PICK()

The **!PICK()** subroutine displays a list of entries from which a user may select one.

Format

CALL !PICK(*item***,** *top.line***,** *item.list***,** *title***,** *pos***)**

where

item	is the returned item. This will be returned as a null string if no item is selected
top.line	is the line number of the topmost display line to be used. The pick list display uses from this line to the bottom of the screen.
item.list	is a field mark delimited list of items to display. Long items will be truncated to fit a single line.
title	is a short text description of the items being processed. This is displayed alongside the item count at the bottom of the screen. This may be a null string to omit the title.
pos	enables programs to return to a pick list at the position of a previously displayed item. On initial entry, this should be zero or a null string. If a variable name is used for *pos*, this variable will be updated to contain position information related to the list. A subsequent call to **!PICK()** using this updated value will display the screen as it was when the previous item was selected. Programs should not make any assumption about the format of this variable as it may change between QM releases.

The **!PICK()** subroutine displays a list of items as specified in *list*. The user can move through this list using the following keys:

Down one line:	Cursor down	D	Ctrl-N	
Up one line:	Cursor up	U	Ctrl-P	Ctrl-Z
Down page:	Page down	N	Ctrl-V	
Up page	Page up	P	Esc-V	
Top:	Home	T	Esc-<	
Bottom:	End	B	Esc->	

Example

```
OPEN "ACCOUNTS" TO ACC.F ELSE STOP "Cannot open ACCOUNTS file"
SSELECT ACC.F
READLIST LIST ELSE NULL
CALL !PICK(ITEM, 0, LIST, "Accounts", POS)
IF ITEM # "" THE
   READ ACC.REC FROM ACC.F, ITEM THEN
              ...processing...
```

```
    END
END
```

The above example shows a list of records in the ACCOUNTS file and processes the selected record.

See also:
!PICKLIST()

!PICKLIST()

The **!PICKLIST()** subroutine displays a list of entries from which a user may select one.

Format

CALL !PICKLIST(*value***,** *list***,** *return.col***,** *index.col***)**

where

value	is the returned item. This will be returned as a null string if no option is selected.
list	is a field mark delimited list of items to process. The display can show multiple items for each entry (e.g. a code and an expanded text) in which case each field is divided into values corresponding to the columns to be shown. The number of displayed columns is determined by the number of values in the first field.
return.col	identifies which column (from 1) of the selected item is to be returned as *value*.
index.col	is the column number (from 1) for shortcut entry. The list must be sorted into ascending order of this column. A value of zero implies that no shortcut is to be allowed.

The **!PICKLIST()** subroutine displays a box containing the items to from *list*. The user can use the up and down cursor keys to move through this list. If the list is longer than can be displayed, the subroutine will scroll the displayed items. The page up and down key can be used to move rapidly through the entries. The return key selects the current item, returning it in the *value* argument.

If *index.col* is non-zero, the user may enter the initial characters of an entry in the chosen column to position directly to the first entry starting with the entered prefix. The characters entered are displayed in the lower border of the box.

When used on a QMTerm or Windows QMConsole session or on a terminal that supports screen region save and restore, the area of the screen overwritten by the pick list box is automatically saved and restored. Programs using other terminal systems will need to arrange their own system to recover the screen.

Example

```
LIST = 'Blue':@FM:'Green':@FM:'Red'
CALL !PICKLIST(ITEM, LIST, 1, 1)
DISPLAY 'Selected item was ' : ITEM
```

See also:
[!PICK()]

!QMCLIENT

The **!QMCLIENT** class module provides an object oriented interface to the QMClient API for use within QMBasic programs.

An QMClient object is instantiated using a QMBasic statement of the form

```
session = object('!qmclient')
```

The table below lists the QMClient API calls and their actions available with this object.

QMConnect	bool = session->Connect(host, port, username, password, account)
QMCall	session->Call(subr{, args})
QMClearSelect	session->ClearSelect(listno)
QMClose	session->Close(fno)
QMConnected	bool = session->Connected
QMDelete	session->Delete(fno, id)
QMDeleteu	session->Deleteu(fno, id)
QMDisconnect	session->Disconnect
QMEndCommand	session->EndCommand
QMExecute	str = session->Execute(cmd)
QMLogto	bool = session->Logto(acc)
QMMarkMapping	session->MarkMapping(fno, state)
QMOpen	fno = session->Open(name)
QMRead	str = session->Read(fno, id, err)
QMReadl	str = session->Readl(fnom id, wait, err)
QMReadList	str = session->ReadList(listno, err)
QMReadNext	str = session->ReadNext(listno, err)
QMReadu	str = session->Readu(fno, id, wait, err)
QMRecordLock	session->RecordLock(fno, id, update, wait)
QMRelease	session->Release(fno, id)
QMRespond	str = session->Respond(response, err)
QMSelect	session->Select(fno, listno)
QMSelectIndex	session->SelectIndex(fno, indexname, indexvalue, listno)
QMSelectLeft	str = session->SelectLeft(fno, indexname, listno)
QMSelectRight	str = session->SelectRight(fno, indexname, listno)
QMSetLeft	session->Setleft(fno, indexname)
QMSetRight	session->SetRight(fno, indexname)
QMWrite	session->Write(fno, id, data)
QMWriteu	session->Writeu(fno, id, data)
QMStatus	session->ServerStatus
QMError	session->Error

For a more detailed description, see QMClient.

!SCREEN()

The **!SCREEN()** subroutine performs screen based input using a screen definition created using the SCRB command.

Format

CALL !SCREEN(*scrn*, *data*, *step*, *status***)**

where

scrn	is a dynamic array holding the screen definition.
data	is the data record to be processed.
step	holds the step number at which screen execution is to commence. If this is a variable, it will be updated on exit to contain the step at which execution ended.
status	identifies the termination cause on returning to the calling program.

The **!SCREEN()** subroutine executes the screen starting at *step* except for the special *step* values described below.

step	**Action**
0	Clear the screen and paint text and data from all steps except those items with X in their mode value.
-1	Paint text and data from all steps except those items with X in their mode value without clearing the screen.
-2	Clear the screen without painting any data.
-3	Return a single keystroke value.

On returning to the calling program, *status* contains

-3	Illegal exit key code found in screen definition.
-2	Illegal validation code found in screen definition.
-1	Step number error.
0	Normal exit (X action code)
1	Exit key (escape) used with action code X
2	Backstep key used with no step history.
n	Function key used. *n* is the key value as in KEYIN.H.

Example

```
READ SCRN FROM SCR.F, 'MY.SCREEN' ELSE ABORT 'Cannot read
screen'
DATA = ''
CALL !SCREEN(SCRN, DATA, STEP, SCR.STATUS)
```

The above code fragment reads a screen definition and executes the screen driver to process the data record using this definition.

!SETPU()

The **!SETPU()** subroutine sets the characteristics of a print unit.

Format

CALL !SETPU(*key***,** *unit***,** *value***,** *status***)**

where

key	identifies the parameter to set. This is as for the **SETPU** statement.
unit	evaluates to the print unit number.
value	is the value to set for the given parameter.
status	is the return status value. Zero if the action is successful, a non-zero error code if the action fails.

The **!SETPU()** subroutine sets the print unit characteristic specified by *key* to the given *value*. It is closely related to the **SETPU** statement.

Example

```
CALL !SETPU(PU$LOCATION, 3, "LASER", STATUS)
```

The above statement sets the destination for print unit 3 to be the LASER printer.

!SETVAR()

The **!SETVAR()** subroutine sets the value of a user defined @-variable. It can also update some standard @variables.

Format

CALL !SETVAR(*name***,** *value***)**

where

name is the name of the @-variable to be set. The leading @ character may optionally be omitted. The name may be up to 32 characters and is case insensitive.

value is the value to be set. This may not include the mark characters.

The **!SETVAR()** subroutine sets the value of the named user defined @-variable. It can also set other standard @variables that are not read-only (e.g. @USER0) though these can be set using simple assignment statements.

The **!SETVAR()** function sets a status value that can be retrieved using the **STATUS()** function. This will be zero if the action is successful, or a non-zero error code if the *name* is invalid.

Example

```
CALL !SETVAR("@MYVAR", 71)
```

This example sets the user defined @MYVAR to 71.

See the **!ATVAR()** subroutine for a way to retrieve the value of a user defined @-variable.

!SORT()

The **!SORT()** subroutine sorts the elements of a dynamic array according to a specified sorting rule.

Format

CALL !SORT(*in.list***,** *out.list***,** *sort.rule***)**

where

in.list is the dynamic array containing the items to be sorted. Any mark character (or a mix of different mark characters) may be used to separate the items.

out.list is the variable to receive the sorted dynamic array. The items will be separated by field marks.

sort.rule defines the manner of sorting. This is a string containing characters from the following:
- **A** Sort in ascending order (default)
- **D** Sort in descending order
- **L** Sort as left aligned values (default)
- **R** Sort as right aligned values
- **N** Ignore null elements
- **U** Return unique items. Multiple occurrences of an item are replaced by just one item.

Invalid or conflicting *sort.rule* elements are ignored.

The **!SORT()** subroutine sorts elements of *in.list* into the order defined by *sort.rule*, returning the sorted list in *out.list*. The value of *in.list* is not changed unless it refers to the same variable as *out.list*.

Right aligned sorts should normally be used when sorting numeric data.

Example

```
CUSTOMER.LIST = ""
SELECT INVOICES
LOOP
   READNEXT ID ELSE EXIT
   READ INVOICE.REC FROM INVOICES, ID THEN
      CUSTOMER.LIST<-1> = INVOICE.REC<CUSTOMER.NAME>
   END
REPEAT
CALL !SORT(CUSTOMER.LIST, CUSTOMER.LIST, "AU")
```

The above program fragment reads all the records from the INVOICE file and builds a list of customer names. This is then sorted, removing duplicates.

This approach will be faster than using **LOCATE** and **INS** to build a sorted list unless there are a very large number of duplicates.

!USERNAME()

The **!USERNAME()** subroutine returns the user login name for a given QM user number.

Format

CALL !USERNAME(*name*, *userno***)**

or

DEFFUN USERNAME(*userno***) CALLING "!USERNAME"**
name = **USERNAME(***userno***)**

where

name is the returned user login name.

userno is the user number to locate.

The **!USERNAME()** subroutine returns *name* as the login name associated with a given user number. If there is no user logged in with that *userno*, a null string is returned.

Example

```
READU INV.REC FROM INV.F, INV.NO
LOCKED
   CALL !USERNAME(UNAME, STATUS())
   PRINTERR "Invoice is locked by user " : UNAME
END THEN
   GOSUB PROCESS.INVOICE
END
```

The above program fragment displays the login name of the user holding the lock if the READU is blocked by another user.

!USERNO()

The **!USERNO()** subroutine returns a list of QM user numbers for a given user name.

Format

CALL !USERNO(*userno***,** *username***)**

or

DEFFUN USERNO(*username***) CALLING "!USERNO"**
userno = **USERNO(***username***)**

where

username is the user name to locate.

userno is a field mark delimited list of QM user numbers for the given user name.

The **!USERNO()** subroutine returns a field mark delimited list of the QM user numbers of processes running with the given user name. The user name is case insensitive. If there is no user logged in with that *username*, a null string is returned.

Example

```
INPUT USERNAME
CALL !USERNO(UNO, USERNAME)
IF UNO # "" THEN
   CRT "User numbers are: " : CHANGE(UNO, @FM, ", ")
END ELSE
   CRT "There are no users logged in with this user name"
END
```

The above program fragment displays a comma separated list of QM users logged in under a given user name.

!VOCREC()

The **!VOCREC()** subroutine reads a VOC record, following links to remote records.

Format

CALL !VOCREC(*rec***,** *id***)**

or

DEFFUN VOCREC(*id***) CALLING "!VOCREC"**
rec = **VOCREC(***id***)**

where

rec	is the variable to receive the result.
id	is the record id of the record to be read.

The **!VOCREC()** subroutine attempts to read record *id* from the VOC file. If not found, it tries again using an uppercase version of *id*.

If the record read from the VOC is an R-type item, the subroutine follows the link, again translating to uppercase if the record is not found exactly as specified in the R-type link.

If the original VOC record or the target of the R-type link is not found, the *rec* variable is set to a null string, otherwise *rec* contains the retrieved data.

The **STATUS()** function returns zero if a record was found or an error code if not.

Example

```
CALL !VOCREC(STYLE.REC, STYLE.NAME)
IF STATUS() THEN STOP 'Style record not found'
```

The above program fragment reads the VOC record identified by STYLE.NAME, following any remote link. If no record can be found, the program terminates with an error message.

6.8 QMBasic Debugger

The QM interactive debugger enables the developer to step through an application program in a convenient manner, stopping at desired points and examining data items.

Programs to be debugged must be compiled with the **DEBUGGING** option to the **BASIC** command or by including the **$DEBUG** compiler directive in the program source. At run time, the debugger will stop at selected places in the execution of these programs but will run normally through programs not compiled in this mode. Catalogued programs and subroutines may be debugged in exactly the same way as other programs.

The debugger is activated either by use of the **DEBUG** command in place of **RUN** or by a **DEBUG** statement encountered during execution of a program. The latter method enables debug mode to be entered part way through execution of the program. The debugger can also be entered from the quit confirmation prompt if any program currently being executed has been compiled in debug mode.

During application development it is often worth compiling the entire application in debug mode. Execution of the program with the **RUN** command will not invoke the debugger unless a **DEBUG** statement is encountered. There is a small performance impact of running a debug mode program in this way but it is usually not significant.

Phantom processes and those acting as the server side of a QMClient connection can be debugged using the **PDEBUG** command.

The debugger will identify the program from which it was entered and locate the source program record. If this is not available, a warning is displayed and execution of the program continues in non-debug mode though other programs and subroutines called by it will still be subject to debugging if their source records are available.

When used with QMConsole on a Windows system, via the QMTerm terminal emulator or the bundled version of AccuTerm, the debugger operates in full screen mode. The display is divided into two areas. The upper portion of the screen shows the source program with the line about to be executed highlighted. The lower portion of the screen is used to echo commands and to display their responses. The top line of the screen displays the program name and current line and element number. The display may be toggled between the debugger and the application by use of the F4 key. Full screen mode also supports a command stack similar to that found at the command prompt.

When used on other terminals, the debugger output is mixed with the application output.

The current position in a program is referenced by a line number and an element number. Most QMBasic source lines hold only a single element (element 0) but lines with multiple statements separated by semicolons or clauses of **IF/THEN/ELSE** constructs, etc, are considered to represent separate execution elements. The debugger can step line by line or element by element through a program.

The debugger cannot step through statements inserted into a program from an include record. In such cases, it will step over the included statements as though they were part of the immediately preceding statement.

Debugger commands fall into two groups; function keys and word based commands. In many cases both forms are available. Not all terminals support function keys.

Function Key Commands

(Some function keys may not be available on all terminal emulations)

F1	Display help screen
F2	Abort program
F3	Stop program
F4	Display user screen (normal program output)
F5	Free run
F6	
F7	Step program element
F8	Step line
Ctrl-F7	Run to parent program / subroutine (internal or external)
Ctrl-F8	Exit program, returning to parent program or external subroutine

If an application dynamically rebinds the codes sent by keys used by the debugger, setting the DEBUG.REBIND.KEYS mode of the **OPTION** command will cause the debugger to reset these to the bindings specified in the terminfo entry for the current terminal type on each entry to the debug screen. Note that the debugger cannot revert to the user bindings on exit as it has no way to determine what these were. This feature is available only with AccuTerm.

Word Based Commands

Where a short form is available, this is the upper case portion of the command as shown. Commands may be entered in any mix of upper and lower case.

ABORT	Quit the program, generating an abort.
BRK *n*	Set a breakpoint on line *n*.
CLR	Clear all breakpoints.
CLR *n*	Clear breakpoint on line *n*.
DUMP *var path*	Dumps a variable to an operating system level file.
EP	Exit program, returning to parent program or external subroutine.
EXit	Exit subroutine, returning to parent program, internal or external subroutine.
Goto *n*	Continue execution at line *n*.
HELP	Display help page.
Quit	Quit the program, generating an abort.
Run	Free run.
Run *n*	Run to line *n*.
SET *var=value*	Change content of a program variable
STACK	Display the call stack. The current program is shown first.
Step *n*	Execute *n* lines.
Step .*n*	Execute *n* elements.

STOP	Quit the program, generating a stop.
UnWatch	Cancels an active watch action.
View	Display user screen (normal program output)
Watch *var*	Watches the named variable.

The following commands apply only to full screen mode debugging:

SRC	Revert to default program source display
SRC *name*	Show source of program *name*.
SRC *n*	Display around line *n* of currently displayed program.
SRC +*n*	Move display forward *n* lines in program.
SRC -*n*	Move display backward *n* lines in program.

The following commands apply only to non-full screen mode debugging:

SRC	Display current source line
SRC *n*	Display source line *n*. Entering a blank debugger command line after this command will display the next source line.
SRC *n,m*	Display *m* lines starting at source line *n*. The value of *m* is limited to three lines less than the screen size. Entering a blank debugger command line after this command will display the next *m* source lines.

Displaying Program Variables

Entering a variable name preceded or followed by a slash (/) or a question mark (?) displays the type and content of the given variable (*var*/, /*var*, *var*?, ?*var*). This name may be a variable in a common block defined in the current program. If the common block has not been linked at the time the command is entered, the variable will appear as unassigned. For programs compiled with case insensitive names, the debugger is also case insensitive.

Private local variables in a subroutine declared using the **LOCAL** statement can be referenced using a name formed by concatenating the subroutine name and variable name with a colon between them. If a subroutine is executed recursively, it is only possible to view the current instance of the variables.

The debugger will not recognise names defined using **EQUATE** or **$DEFINE**.

The debugger recognises variable names **STATUS()**, **INMAT()**, **COL1()**, **COL2()** and **OS.ERROR()** to display the corresponding system variable. All @-variables may also be displayed except for @VOC (which is a file variable) and those representing constants such as @FM and @TRUE.

Display of long strings is broken into short sections to fit the available display space. Entering **Q** at the continuation prompt will terminate display.

When displaying strings with an active remove pointer, the position of this pointer is also shown.

If the variable is a matrix, the name may be followed by the index value(s) for the element to be displayed. Entry of the name without an index will display the dimensions of the matrix. Subsequent presses of the return key display successive elements of the matrix until either all elements have been displayed or another command is entered.

```
CLI.REC/
Array: Dim (20)
<return>
CLI.REC(0) = Unassigned
<return>
CLI.REC(1) = String (8 bytes): "J Watson"
<return>
CLI.REC(2) = 13756
CLI.REC(8)/
Integer: 86
```

The variable name may be followed by a field, value or subvalue reference which will be used to restrict the display if the data is a string. Note that this qualifier has no effect on other data types.

```
REC/
String (11 bytes,R=4): "487FM912VM338"
REC<1>/
String (3 bytes): "487"
REC<2,1>/
String (3 bytes): "912"
```

Entering a slash alone will repeat the most recent display command.

Analysis of very large character strings is sometime easier from outside the debugger. The **DUMP** command can be used to dump the contents of a variable to an operating system level file that can then be processed with other tools.

Changing Program Variables

The **SET** command can be used to alter the value of a variable.

SET *var* = *value*	to set a numeric value
SET *var* = "*string*"	to set a string value. Double quotes, single quotes or backslashes may be used to enclose the string.
SET *var*(*row*,*col*) = *value*	to set a matrix element

Watching Variables

The **WATCH** command causes the debugger to monitor the named variable. Whenever a value is assigned to this variable (even if the value is the same as currently stored), the debugger will stop program execution and display the new value. Only one variable can be watched at a time.

The **UNWATCH** command cancels the watch action. The watch action is automatically cancelled when the watched variable ceases to exist. This might be return from the program in which the

program exists, redimensioning a common block, etc.

6.9 Process Dump Files

QM includes the option to generate a process dump file containing a detailed report of the state of the process. There are three ways to generate a process dump:

A process dump will be created automatically if the DUMP.ON.ERROR mode of the **OPTION** command is active and the process aborts either due to an error detected by QM or from use of the **ABORT** statement in a QMBasic program.

Selection of the P option following use of the break key.

Use of the **PDUMP** command. This can be used to generate a dump of a different process such as a phantom or a QMClient process.

By default, the process dump is directed to an operating system level file named qmdump.*n* in the QMSYS account directory where *n* is the QM user number. The directory to receive the dump file can be changed using the **DUMPDIR** configuration parameter.

The file consists of a number of sections detailing the current state of the user process at the time of the error.

1. Environment data

QM version number

Licence number and site name

User number

Process id

Parent used number (zero except in phantom processes)

User name

2. @-variables

@-variables that are likely to be useful in determining the cause of an error.

3. Locks

The report shows all task locks, file locks and record locks owned by the process.

4. Program stack

This contains an entry for each program, working backwards from the program in which the error occurred.

For each program, the dump shows

Program number (used in some cross-references within the dump)

Program name, instruction address and line number. Line numbers cannot be shown if the program was compiled with no cross reference tables or these were removed when the program was catalogued.

Program status flags showing various special program states.

GOSUB return stack, if not empty.

Variables. Local variables are sorted alphabetically. Elements of a common block are shown in memory order and are only dumped on the first program that references the block. Non-printing characters in strings are replaced by *nn* where *nn* is the hexadecimal character value. Backslash characters are shown as \\. Character string data is not line wrapped to simplify exploration of the data using tools such as the SED editor.

6.10 Error Numbers

Error numbers are defined in the ERR.H record of the SYSCOM file.

1	ER$ARGS	Command arguments invalid or incomplete
2	ER$NCOMO	Como file not active
3	ER$ICOMP	I-type compilation error
4	ER$ACC.EXISTS	Account name already in register
5	ER$NO.DIR	Directory not found
6	ER$NOT.CREATED	Unable to create directory
7	ER$STOPPED	Processing terminated by user in response to a "continue" prompt
8	ER$INVA.PATH	Invalid pathname
9	ER$NOT.CAT	Item not in catalogue
10	ER$PROCESS	Unable to start new process
11	ER$USER.EXISTS	User name already in register
12	ER$UNSUPPORTED	This operation is not supported on this platform
13	ER$TERMINFO	No terminfo definition for this function
14	ER$NO.ACC	Account name not in register
15	ER$TERMINATED	Query command terminated by user.
1000	ER$PARAMS	Invalid parameters
1001	ER$MEM	Cannot allocate memory
1002	ER$LENGTH	Invalid length
1003	ER$BAD.NAME	Bad name
1004	ER$NOT.FOUND	Item not found
1005	ER$IN.USE	Item is in use
1006	ER$BAD.KEY	Bad action key
1007	ER$PRT.UNIT	Bad print unit
1008	ER$FAILED	Action failed
1009	ER$MODE	Bad mode setting
1010	ER$TXN	Operation not allowed in a transaction
1011	ER$TIMEOUT	Timeout
1012	ER$LIMIT	User limit reached
1013	ER$EXPIRED	Package licence has expired
1014	ER$NO.CONFIG	Cannot find configuration file
1015	ER$RDONLY.VAR	Variable is read-only
1016	ER$NOT.PHANTOM	Not a phantom process
1017	ER$CONNECTED	Device already connected
1018	ER$INVA.ITYPE	Invalid I-type
2000	ER$INVA.OBJ	Invalid object code
2001	ER$CFNF	Catalogued function not found

2100 ER$TI.NAME	Invalid terminal type name
2101 ER$TI.NOENT	No terminfo entry for given name
2102 ER$TI.MAGIC	Terminfo magic number check failed
2103 ER$TI.INVHDR	Invalid terminfo header data
2104 ER$TI.STRSZ	Invalid terminfo string length
2105 ER$TI.STRMEM	Error allocating terminfo string memory
2106 ER$TI.NAMEMEM	Error allocating terminfo name memory
2107 ER$TI.BOOLMEM	Error allocating terminfo boolean memory
2108 ER$TI.BOOLRD	Error reading terminfo booleans
2109 ER$TI.NUMMEM	Error allocating terminfo numbers memory
2110 ER$TI.NUMRD	Error reading terminfo numbers
2111 ER$TI.STROMEM	Error allocating terminfo string offsets memory
2112 ER$TI.STRORD	Error reading terminfo string offsets
2113 ER$TI.STRTBL	Error reading terminfo string table
3000 ER$IID	Illegal record id
3001 ER$SFNF	Subfile not found
3002 ER$NAM	Bad file name
3003 ER$FNF	File not found
3004 ER$NDIR	Not a directory file
3005 ER$NDYN	Not a dynamic file
3006 ER$RNF	Record not found
3007 ER$NVR	No VOC record
3008 ER$NPN	No pathname in VOC record
3009 ER$VNF	VOC file record not F type
3010 ER$IOE	I/O error
3011 ER$LCK	Lock is held by another process
3012 ER$NLK	Lock is not held by this process
3013 ER$NSEQ	Not a sequential file
3014 ER$NEOF	Not at end of file
3015 ER$SQRD	Sequential file record read before creation
3016 ER$SQNC	Sequential record not created due to error
3017 ER$SQEX	Sequential record already exists (CREATE)
3018 ER$RDONLY	Update to read only file
3019 ER$AKNF	AK index not found
3020 ER$INVAPATH	Invalid pathname
3021 ER$EXCLUSIVE	Cannot gain exclusive access to file
3022 ER$TRIGGER	Trigger function error
3023 ER$NOLOCK	Attempt to write/delete record with no lock
3024 ER$REMOTE	Open of remote file not allowed
3025 ER$NOTNOW	Action cannot be performed now
3026 ER$PORT	File is a port

3027 ER$NPORT	File is not a port
3028 ER$SQSEEK	Seek to invalid *offset* in sequential file
3029 ER$SQREL	Invalid SEEK *relto* in sequential file
3030 ER$EOF	End of file
3031 ER$CNF	Multifile component not found
3032 ER$MFC	Multifile reference with no component name
3033 ER$PNF	Port not found
3034 ER$BAD.DICT	Bad dictionary entry
3035 ER$PERM	Permissions error
3036 ER$SEEK.ERROR	Seek error
3037 ER$WRITE.ERROR	Write error
3038 ER$VFS.NAME	Bad class name in VFS entry
3039 ER$VFS.CLASS	VFS class routine not found
3040 ER$VFS.NGLBL	VFS class routine is not globally catalogued
3041 ER$ENCRYPTED	Access denied to encrypted file
4000 ER$SRVRMEM	Insufficient memory for packet buffer
5000 ER$NO.DLL	DLL not found
5001 ER$NO.API	API not found
5002 ER$NO.TEMP	Cannot open temporary file
6031 ER$NO.EXIST	Item does not exist
6032 ER$EXISTS	Item already exists
6033 ER$NO.SPACE	No space for entry
6034 ER$INVALID	Validation error
7000 ER$NETWORK	Networked file not allowed for this operation
7001 ER$SERVER	Unknown server name
7002 ER$WSA.ERR	Failed to start Window socket library
7003 ER$HOSTNAME	Invalid host name
7004 ER$NOSOCKET	Cannot open socket
7005 ER$CONNECT	Cannot connect socket
7006 ER$RECV.ERR	Error receiving socket data
7007 ER$RESOLVE	Cannot resolve server name
7008 ER$LOGIN	Login rejected
7009 ER$XREMOTE	Remote server disallowed access
7010 ER$ACCOUNT	Cannot connect to account
7011 ER$HOST.TABLE	Host table is full
7012 ER$BIND	Error binding socket
7013 ER$SKT.CLOSED	Socket has been closed
8001 DHE$FILE.NOT.OPEN	DH.FILE pointer is NULL
8002 DHE$NOT.A.FILE	DH.FILE does not point to a file descriptor
8003 DHE$ID.LEN.ERR	Invalid record id length
8004 DHE$SEEK.ERROR	Error seeking in DH file

8005 DHE$READ.ERROR	Error reading DH file
8006 DHE$WRITE.ERROR	Error writing DH file
8007 DHE$NAME.TOO.LONG	File name is too long
8008 DHE$SIZE	File exceeds maximum allowable size
8009 DHE$STAT.ERR	Error from stat()
8100 DHE$OPEN.NO.MEMORY	No memory for DH.FILE structure
8101 DHE$FILE.NOT.FOUND	Cannot open primary subfile
8102 DHE$OPEN1.ERR	Cannot open overflow subfile
8103 DHE$PSFH.FAULT	Primary subfile header format error
8104 DHE$OSFH.FAULT	Overflow subfile header format error
8105 DHE$NO.BUFFERS	Unable to allocate file buffers
8106 DHE$INVA.FILE.NAME	Invalid file name
8107 DHE$TOO.MANY.FILES	The limit on the number of open files has been reached. See the NUMFILES configuration parameter.
8108 DHE$NO.MEM	No memory to allocate group buffer
8109 DHE$AK.NOT.FOUND	Cannot open AK subfile
8110 DHE$AK.HDR.READ.ERROR	Error reading AK header
8111 DHE$AK.HDR.FAULT	AK subfile header format error
8112 DHE$AK.ITYPE.ERROR	Format error in AK I-type code
8113 DHE$AK.NODE.ERROR	Unrecognised node type
8114 DHE$NO.SUCH.AK	Reference to non-existent AK
8115 DHE$AK.DELETE.ERROR	Error deleting AK subfile
8116 DHE$EXCLUSIVE	File is open for exclusive access
8117 DHE$TRUSTED	Requires trusted program to open
8118 DHE$VERSION	Incompatible file version
8119 DHE$ID.LEN	File may contain id longer than MAXIDLEN
8120 DHE$AK.CROSS.CHECK	Relocated index pathname cross-check failure
8121 DHE$HASH.TYPE	Unsupported hash type
8201 DHE$ILLEGAL.GROUP.SIZE	Group size out of range
8202 DHE$ILLEGAL.MIN.MODULUS	Minimum modulus < 1
8203 DHE$ILLEGAL.BIG.REC.SIZE	Big record size invalid
8204 DHE$ILLEGAL.MERGE.LOAD	Merge load invalid
8205 DHE$ILLEGAL.SPLIT.LOAD	Split load invalid
8206 DHE$FILE.EXISTS	File exists on create
8207 DHE$CREATE.DIR.ERR	Cannot create directory
8208 DHE$CREATE0.ERR	Cannot create primary subfile
8209 DHE$CREATE1.ERR	Cannot create overflow subfile
8210 DHE$PSFH.WRITE.ERROR	Failure writing primary subfile header
8211 DHE$INIT.DATA.ERROR	Failure initialising data bucket
8212 DHE$ILLEGAL.HASH	Invalid hashing algorithm
8213 DHE$OSFH.WRITE.ERROR	Failure writing overflow subfile header

8301 DHE$RECORD.NOT.FOUND	Record not in file
8302 DHE$BIG.CHAIN.END	Found end of big record chain early
8303 DHE$NOT.BIG.REC	Big record pointer does not point to big record block
8401 DHE$NO.SELECT	No select is active
8402 DHE$OPEN2.ERR	Cannot open select list
8403 DHE$GSL.WRITE.ERR	Error from write()
8404 DHE$GSL.TRUNCATE.ERR	Error from chsize()
8501 DHE$AK.NAME.LEN	Index name too long
8502 DHE$AK.EXISTS	AK already exists
8503 DHE$AK.TOO.MANY	Too many AKs to create a new one
8504 DHE$AK.CREATE.ERR	Unable to create AK subfile
8505 DHE$AK.HDR.WRITE.ERROR	Error writing AK subfile header
8506 DHE$AK.WRITE.ERROR	Error writing AK node
8601 DHE$PSF.CHSIZE.ERR	Error compacting primary subfile
8701 DHE$ALL.LOCKED	All buffers are locked
8702 DHE$SPLIT.HASH.ERROR	Record does not hash to either group in split
8703 DHE$WRONG.BIG.REC	Big record chain error
8704 DHE$FREE.COUNT.ZERO	Overflow free count zero in dh.new.overflow()
8705 DHE$FDS.OPEN.ERR	Cannot reopen subfile
8706 DHE$POINTER.ERROR	Internal file pointer fault
8707 DHE$NO.INDICES	File has no AKs

6.11 Building a Self-Installing Application

If you are developing an application to be provided as a complete user-installable package, you probably want to automate as much as possible of this. Ideally, you would like the user to need only to execute a single program to install both QM and the application software. This section describes one way to do this.

On Windows systems, we recommend use of the Astrum InstallWizard from Thraex Software (as used by QM itself) but the following process should map onto other self-installer packages.

Whatever installer package you use, it needs to install both QM and the application. The complication is that this process needs to run QM to create the account that will hold the application. The steps to achieve this are:

1. Unpack all the application files to wherever they need to go. The directory that will become the application account can be created during this process but the only QM specific subdirectory that should be created is the private catalogue (cat). You can place your own application install program into the cat subdirectory for later use. If you need to pre-load dictionary items or data file records, these should be unpacked into a temporary location.

2. The self-extracting file must also include the relevant version of QM as its own self-extracting file. This should be unpacked into a temporary directory.

3. Once everything has been unpacked, the process now needs to install QM by executing the QM self-extracting program. On Windows systems, use of the /silent command line option will suppress most user interaction.

4. Now that QM is installed (or upgraded), you need to use it to create the application account. The process should check whether the account already exists by looking for the VOC file and, if not, execute QM with a single command line option of
   "CREATE.ACCOUNT *account.name account.path* NO.QUERY".
   The quotes are required in this command and the working directory should be the QMSYS account. The **CREATE.ACCOUNT** command will not fail if the cat subdirectory already exists.

5. Next, you need to execute your own application installer program that should have been included in the contents of the unpacked private catalogue directory. This is done by executing QM with a command line option that is the catalogued item name and with a working directory of the newly created account.

6. Finally, you need to remove any temporary files.

So, what does the catalogued install program need to do?

- We recommend that it should start by executing a **COMO** command to create a log file of its progress.
- Create any application files that do not already exist.
- Copy dictionary items from a temporary set of dictionaries unpacked from the install file. By doing this rather than simply overwriting the dictionaries, anything that had been added will not be lost when updating an existing installation.
- Build any indices that are required.

- Create any application specific VOC entries such as paragraphs and sentences.

6.12 Building a Web Server Application

There are advanced web based packages available for QM but for many applications a simple CGI program gives an easy way to achieve web connectivity with no additional software.

The program below requires the qmclilib library to be included when it is compiled and linked. The executable program file should be placed in the cgi-bin subdirectory of the relevant web account.

```
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <\qmsys\syscom\qmclilib.h>        [ Windows ]
#include </usr/qmsys/SYSCOM/qmclilib.h>    [ Linux / FreeBSD ]

// Set the following six lines as appropriate for your system
#define SERVER_ADDRESS "localhost" /* Server network address or
name... */
#define SERVER_PORT 4243           /* ...and port on which to
connect */
#define SERVER_USER "xxx"          /* Server user name... */
#define SERVER_PASSWORD "xxxxx"    /* ...and password */
#define SERVER_ACCOUNT "xxxxx"     /* Web server QM account name
*/
#define SERVER_PROGRAM "xxxxx"     /* Catalogued program to run
on server */

char NullString[] = "";

char InputData[32767] = "";   /* Incoming data stream */
char Response[99999] = "";    /* Response to send */
char * ClientIP;              /* Client IP address */
char * ClientUser;            /* User name if web authentication
used */

/*
=================================================================
====== */

int main()
{
 char * RequestMethod;
 char * p;

 RequestMethod = getenv("REQUEST_METHOD");
 if (RequestMethod == NULL)
  {
   printf("Program must be executed by a Web browser\n");
   return 1;
  }

 ClientIP = ((p = getenv("REMOTE_ADDR")) != NULL)?p:NullString;
 ClientUser = ((p = getenv("REMOTE_USER")) !=
NULL)?p:NullString;

 if (!strcmp(RequestMethod,"GET"))
  {
```

```
    if ((p = getenv("QUERY_STRING")) != NULL) strcpy(InputData,
p);
   }
  else if (!strcmp(RequestMethod,"POST"))
   {
    if ((p = getenv("CONTENT_LENGTH")) != NULL)
     {
      fread(InputData, atoi(p), 1, stdin);
     }
   }

  /* Check for locally processed screens */

  ParseInputData();

if (!QMConnect(SERVER_ADDRESS, SERVER_PORT, SERVER_USER,
SERVER_PASSWORD, SERVER_ACCOUNT))
   {
    strcpy(Response, "Failed to connect. The server may be
offline.");
   }
  else
   {
    QMCall(SERVER_PROGRAM, 4, InputData, ClientIP, ClientUser,
Response);
    QMDisconnect();
   }

  printf("Content-type: text/html\n\n");
  printf("<meta http-equiv=\"Pragma\" content=\"no-cache\">\n");
  printf("%s\n", Response);

 return 0;
}
```

Web requests received by this program will be passed to the catalogued QMBasic subroutine identified by SERVER_PROGRAM. The declaration of this is

SUBROUTINE SERVER(INPUT.DATA, CLIENT.IP, CLIENT.USER, RESPONSE)

When used with HTML forms with the method attribute set to "post" or "get", any data sent with the form will be passed to the QM server program via the first argument (INPUT.DATA). Typically, the form would include an item in this data that can be used to determine the screen being processed.

The CLIENT.IP is the network address of the client user and can be used for simple security checking.

If the user has been authenticated using the conventional web user authentication process, the user name appears in CLIENT.USER. If authentication has not been performed, this will be a null string.

The server subroutine must return valid HTML data to be returned to the web client via the RESPONSE argument. For applications that return very large HTML strings it may be better for the QMBasic component to write the data to a temporary file and pass this name back to the C program. This avoids the need for the Response variable in the above example to be sized to fit the

largest string that could ever be returned.

Part

QMClient API

7 QMClient API

Historically, multi-value databases have used a character based user interface. QM includes a set of Windows OLE compatible functions that enable development of applications in, for example, Visual Basic. This section describes these functions and includes examples of how to use them to develop a Windows style front end to your application.

The same functions are also available in the qmclilib library for use in C programs and as a QMBasic class module for use in QMBasic programs. This help section discusses all of these API sets.

In addition, the QMClient.pb record in the SYSCOM file contains an interface layer for use with the PureBasic product from Fantaisie Software.

Overview

The API functions enable a Visual Basic or C application to access data stored in a QM database or allow connection to remote QM systems from within QMBasic application programs. There are API equivalents to the major file handling statements of QMBasic as well as a range of string functions for dynamic array data manipulations, functions to execute commands and catalogued subroutines on the server, etc.

The secret of writing efficient client server applications is to perform the bulk data processing on the server and only handle user interface issues on the client. This minimises the data transferred between the systems and hence optimises performance.

QMClient has some security issues that need special consideration.

Using the Visual Basic API

The QMClient Windows API consists of two components; a Visual Basic module (QMClient.bas) containing the API function definitions, and a dynamic link library (QMClient.dll) containing the actual interface functions. The C programmers' API is a single library, qmclilib.

To use the API functions in a Visual Basic application, include the QMClient.bas module in your project. This module is placed in the SYSCOM file of the QMSYS account when QM is installed. The QMClient.dll library must be installed on the client system. This library is placed in the Windows directory (not necessarily c:\windows) when QM is installed. These components may be freely copied and distributed as necessary.

From QM release 2.2-8, QMClient allows up to four connections from a single client process. This allows development of applications that transfer data between accounts or servers.

Functions that return boolean values, return 0 for False, -1 for True in the Visual Basic API.

Using the C API

Use of the C programmers' API is different depending on the compiler in use. On Linux and

FreeBSD, programs need to include the qmclilib.o object file when linking the application. The Linux version of QM also includes a shared object version of QMClient API named qmclilib.so. On Windows, the qmclilib.dll dynamic link library is used and two import libraries are provided to include when linking the application; qmcllbbl.lib for Borland C users and qmcllbms.lib for Microsoft C users. All of these components can be found in the bin subdirectory of the QMSYS account. The function definitions can be found in the qmclilib.h include record in the SYSCOM file.

QMClient allows up to four connections from a single client process. This allows development of applications that transfer data between accounts or servers.

Functions that return boolean values, return 0 for False, 1 for True in the C API library.

API calls that return strings dynamically allocate memory to hold the returned data. It is the calling program's responsibility to release this memory using the QMFree() function when it is no longer required. This function must be used in place of the standard **free()** C runtime library routine to ensure compatibility with the memory allocator used by the QMClient library.

Using the QMBasic Class Module API

The QMClient class module is supplied as a globally catalogued item named !QMCLIENT. To create a QMClient session, the object is instantiated with a statement of the form

```
session = object("!qmclient")
```

The session is then connected to a server using the CONNECT method

```
ok = session->connect(hostname, port, user, password, account)
```

The four connection limit that applies to other QMClient API styles does not apply to the QMBasic interface. The limit here is imposed by how many socket connections the underlying system permits.

Functions that return boolean values, return 0 for False, 1 for True in the QMBasic class module API.

API Function Summary

Session Management

QMConnect()	Establishes a QMClient session via a network
QMConnected()	Verifies whether a QMClient session is open
QMConnectLocal()	Establishes a QMClient session on the local system
QMDisconnect	Terminates a QMClient session
QMDisconnectAll	Terminates all QMClient sessions from this client
QMGetSession	Retrieves currently select session number
QMLogto()	Moves to an alternative account
QMSetSession	Selects the session to which subsequent function calls relate

File Handling

QMClearSelect	Clears a select list

QMClose	Closes a file
QMDelete	Deletes a record
QMDeleteu	Deletes a record, retaining the lock
QMMarkMapping()	Enables/disables mark mapping for a directory file
QMOpen()	Opens a file
QMRead()	Reads a record without locking
QMReadl()	Reads a record with a shareable read lock
QMReadList()	Reads a select list
QMReadNext()	Retrieves a record id from a select list
QMReadu()	Reads a record with an exclusive update lock
QMRecordlock()	Locks a record
QMRelease	Releases a record lock
QMSelect()	Generates a select list
QMSelectIndex()	Generates a select list from an alternate key index
QMSelectLeft()	Scan left in an alternate key index
QMSelectRight()	Scan right in an alternate key index
QMSetLeft()	Position at the left in an alternate key index
QMSetRight()	Position at the right in an alternate key index
QMWrite	Writes a record
QMWriteu	Writes a record, retaining the lock

Dynamic Array Manipulation

QMDel()	Deletes a field, value or subvalue
QMExtract()	Extracts a field, value or subvalue
QMIns()	Inserts a field, value or subvalue
QMLocate()	Searches for a field, value or subvalue
QMReplace()	Replaces a field, value or subvalue

String Manipulation

QMChange()	Change substrings
QMDcount()	Count delimited items in a string
QMField()	Extract substring from a delimited string
QMFree()	Free dynamically allocated memory (C API only)
QMMatch()	Test pattern match
QMMatchfield()	Extract data based on pattern match

Command Execution

QMEndCommand	Abort an executed command
QMExecute()	Execute a command on the server
QMRespond()	Respond to a request for input from an executed command

Subroutine Execution

QMCall	Call a catalogued subroutine on the server

Error Handling

QMError()	Returns extended error message text
QMStatus()	Returns STATUS() value

Many functions have an *Errno* argument passed by reference as an Integer variable. This will be set to one of the following values broadly corresponding to the various clauses applicable to the equivalent QMBasic statements.

0	SV_OK	Action successful
1	SV_ON_ERROR	Action took the ON ERROR clause to recover from a situation that would otherwise cause the server process to abort.
2	SV_ELSE	Action took the ELSE clause. In most cases the **QMStatus()** function can be used to determine the error number.
3	SV_ERROR	An error occurred for which extended error text can be retrieved using the **QMError()** function.
4	SV_LOCKED	The action was blocked by a lock held by another user. The **QMStatus()** function can be used to determine the blocking user.
5	SV_PROMPT	A command executed on the server is waiting for input. The only valid client functions when this status is returned are **QMRespond()**, **QMEndCommand**and **QMDisconnect**.

The tokens shown above are defined in the QMClient.bas module and the qmclilib.h C include file.

7.1 Security Issues of the QMClient API

In most systems, a normal terminal user is taken directly into the application on logging in and the application itself controls what the user can do. The ON.ABORT paragraph provides a mechanism to ensure that, even if the application fails, the user cannot fall back to a command prompt.

With QMClient, the client session is effectively at a command prompt from which it can open, read and write files, execute commands, or call subroutines. It becomes the responsibility of the client software to control what the user can do. A knowledgeable user with a valid user name and password could, however, develop a client session that connects in the same way as the application and then goes on to do almost anything. Setting appropriate access rights on files may help but is unlikely to be a perfect solution to this potential security threat.

The **QMCLIENT** configuration parameter can be used to control the level of access that a QMClient session has. It starts with the value defined in the QM configuration parameters and can be modified to a higher level using the **CONFIG** command but cannot be taken to a lower level in this way. Because QMClient sessions execute the LOGIN paragraph on connection, the **CONFIG** command is easily executed from this paragraph.

It may also be useful to validate the client network address (See **@IP.ADDR**) in the LOGIN paragraph.

7.2 QMCall

The **QMCall** function calls a catalogued subroutine on the server.

Format

VB **QMCall ByVal** *SubrName* **as String, ByVal** *ArgCount* **as Integer, Optional ByRef** *Arg1* **as String, ...**

C **QMCall(char *** *SubrName*, **short int** *ArgCount*, *ArgList*...**)**

Obj *Session*->**Call(***SubrName*, *ArgList*...**)**

where

SubrName is the name of the subroutine to be called.

ArgCount is the number of arguments following (not present in the QMBasic class module API).

ArgList is a list of arguments to be passed to the subroutine.

The **QMCall** function calls the named catalogued subroutine on the server system. This subroutine may take up to 20 arguments. QMClient does not provide a method to call subroutines with a greater number of arguments.

In the Visial Basic as C APIs, there may be at most 20 variables named as arguments and these must be declared as strings.

In the C API, the size of any argument variable that may be overwritten by the subroutine must be large enough to receive the updated value. Failure to observe this rule will result in memory corruption.

If the subroutine modifies the values of any of its arguments, this will be reflected in the variables specified in *ArgList*. It is a good idea to ensure that arguments that are only used for values returned from the subroutine are set to empty strings before the call to minimise data unnecessarily sent across the network.

The called subroutine may make use of any of the standard QMBasic programming statements and functions, however, it may not perform terminal input or output as there is no terminal associated with a server process.

7.3 QMChange()

The **QMChange()** function replaces occurrences of one substring with another in a string.

Format

VB **QMChange(ByVal** *Src* **as String, ByVal** *OldStr* **as String, ByVal** *NewStr* **as String, Optional ByRef** *Occurrences* **as Long, Optional ByRef** *Start* **as Long) as String**

C **char * QMChange(char *** *Src***, char *** *OldStr***, char *** *NewStr***, int** *Occurrences***, int** *Start***)**

where

Src	is the string to be processed.
OldStr	is the substring to be replaced.
NewStr	is the replacement substring.
Occurrences	is the number of occurrences of *OldStr* to be replaced. If omitted or specified as less than one, all occurrences are replaced.
Start	is the occurrence number from one of the first occurrence of *OldStr* to be replaced. If omitted or less than one, replacement commences at the first occurrence of *OldStr*.

The **QMChange()** function returns a new string with the specified substrings replaced.

One use of **QMChange()** is to replace mark characters with carriage return / line feed pairs when transferring data from a dynamic array to a multi-line text box.

Note that in the C API library, a statement of the form

```
rec = QMChange(rec, old, new, 0, 0)
```

will return a pointer to a newly allocated memory area, overwriting the *rec* pointer. The old memory is not freed by this call and it is therefore necessary to retain a pointer to the original *rec* string so that it can be freed later.

7.4 QMClearselect

The **QMClearSelect** function clears a select list.

Format

VB **QMClearSelect ByVal** *ListNo* **as Integer**

C **void QMClearSelect(ByVal** *ListNo*)

Obj *Session*->**ClearSelect(***ListNo*)

where

ListNo is a valid select list number (0 to 10)

The **QMClearSelect** function clears the specified select list. No error occurs if the list was not active.

Applications that use select list 0 (the default select list) and could leave unprocessed items in the list should always clear it to avoid unwanted effects on later server processing.

7.5 QMClose

The **QMClose** function closes a file.

Format

VB	**QMClose ByVal** *FileNo* **as Integer**
C	**void QMClose(int** *FileNo*)
Obj	*Session*->**Close**(*FileNo*)

where

FileNo	is the file number returned by a previous QMOpen() call.

The server maintains a list of files open for processing by the client application. The **QMClose** function causes the server to close the specified file. It is not normally necessary to close files as there is no practical limit to the number of files that the server can hold open at once, however, for best performance applications should close files if they are unlikely to be referenced for a considerable time.

7.6 QMConnect()

The **QMConnect()** function establishes a QMClient session.

Format

VB **QMConnect(ByVal** *Host* **as String, ByVal** *Port* **as Integer, ByVal** *UserName* **as String, ByVal** *Password* **as String, ByVal** *Account* **as String) as Boolean**

C **int QMConnect(char *** *Host*, **int** *Port*, **char *** *UserName*, **char *** *Password*, **char *** *Account*)

Obj *Bool* = *Session*->**Connect**(*Host*, *Port*, *UserName*, *Password*, *Account*)

where

Host is the IP address or name of the server system.

Port is the port number to which connection is to be made. Set this to -1 to use the QM default port.

UserName is the user name under which the server process is to run.

Password is the password for the given *UserName*.

Account is the name of the QM account to be accessed.

The **QMConnect()** function attempts to establish a QMClient process on the system identified by the *Host* argument. If successful, the function returns True. If unsuccessful, the function returns False and the **QMError()** function can be used to retrieve a text error message identifying the cause of the failure.

Host can reference the local machine. For an alternative method of starting a local QM session, see the **QMConnectLocal()** function.

A single client may open up to four connections simultaneously. The internal session number associated with the session opened by **QMConnect()** can be retrieved using **QMGetSession()**. All subsequent QMClient function calls relate to the most recently opened session unless **QMSetSession()** is used to select an alternative session.

QMClient sessions run the LOGIN paragraph (if present) but not the MASTER.LOGIN paragraph. A QMClient session can be recognised within this paragraph by testing the value of @TTY which will be "vbsrvr" for QMClient.

7.7 QMConnected()

The **QMConnected()** function confirms whether a QMClient session is open.

Format

VB **QMConnected() as Boolean**

C **int QMConnected()**

Obj *Bool* = *Session*->**Connected**

The **QMConnected()** function can be used by an application to determine whether a client session is open.

7.8 QMConnectLocal()

The **QMConnectLocal**() function establishes a QMClient session on the local system.

Format

VB **QMConnectLocal(ByVal** *Account* **as String) as Boolean**

C **int QMConnectLocal(char *** *Account***)**

where

Account is the name of the QM account to be accessed.

The **QMConnectLocal**() function attempts to establish a QMClient process on the local system. The process runs as the user executing the function. If successful, the function returns True. If unsuccessful, the function returns False and the **QMError()** function can be used to retrieve a text error message identifying the cause of the failure.

A single client may open up to four connections simultaneously. The internal session number associated with the session opened by **QMConnectLocal**() can be retrieved using **QMGetSession()** . All subsequent QMClient function calls relate to the most recently opened session unless **QMSetSession()** is used to select an alternative session.

QMClient sessions run the LOGIN paragraph (if present) but not the MASTER.LOGIN paragraph. A QMClient session can be recognised within this paragraph by testing the value of @TTY which will be "vbsrvr" for QMClient.

NOTE: The underlying operating system call needed by **QMConnectLocal**() is not implemented on Windows 98/ME. It will be necessary to use **QMConnect** for these systems.

QMConnectLocal() is not supported by the QMBasic class module API.

7.9 QMDcount()

The **QMDcount()** function counts delimited items in a string.

Format

VB **QMDcount(ByVal** *Src* **as String, ByVal** *Delim* **as String) as Long**

C **int QMDcount(char *** *Src*, **char *** *Delim*)

where

Src is the string to be processed

Delim is the delimiter character. If *Delim* is more than one character long, only the first character is used.

The **QMDcount()** function is usually used to count fields, values or subvalues in a dynamic array but can be used to count elements in any string that is separated by some single character delimiter.

7.10 QMDel()

The **QMDel()** function deletes a field, value or subvalue from a dynamic array.

Format

VB **QMDel(ByVal** *Src* **as String, ByVal** *Fno* **as Integer, ByVal** *Vno* **as Integer, ByVal** *Svno* **as Integer) as String**

C **char * QMDel(char *** *Src***, int** *Fno***, int** *Vno***, int** *Svno*)

where

Src	is the dynamic array to be processed
Fno	is the number of the field to be deleted. If less than 1, 1 is assumed
Vno	is the number of the value to be deleted. If less than 1, the entire field is deleted.
Svno	is the number of the subvalue to be deleted. If less than 1, the entire value is deleted.

The **QMDel()** function returns a new dynamic array with the given field, value or subvalue deleted. If the required item is not found, the original string is returned unchanged.

Note that in the C API library, a statement of the form

```
rec = QMDel(rec, 2, 1, 0)
```

will return a pointer to a newly allocated memory area, overwriting the *rec* pointer. The old memory is not freed by this call and it is therefore necessary to retain a pointer to the original *rec* string so that it can be freed later.

7.11 QMDelete()

The **QMDelete** function deletes a record from a file.

Format

VB **QMDelete ByVal** *FileNo* **as Integer, ByVal** *Id* **as String**

C **void QMDelete(int** *FileNo*, **char *** *Id***)**

Obj *Session*->**Delete(***FileNo*, *Id***)**

where

FileNo is the file number returned by a previous **QMOpen()** call.

Id is the id of the record to be deleted.

The **QMDelete** function deletes the named record from the file open as *FileNo*. No error occurs if the record does not exist.

Applications should always obtain an update lock for a record before deleting it. The lock is released by this function.

7.12 QMDeleteu()

The **QMDeleteu** function deletes a record from a file, retaining the record lock.

Format

VB **QMDeleteu ByVal** *FileNo* **as Integer, ByVal** *Id* **as String**

C **void QMDeleteu(int** *FileNo*, **char *** *Id*)

Obj *Session*->**Deleteu(***FileNo*, *Id*)

where

FileNo is the file number returned by a previous **QMOpen()** call.

Id is the id of the record to be deleted.

The **QMDeleteu** function deletes the named record from the file open as *FileNo*. No error occurs if the record does not exist.

Applications should always obtain an update lock for a record before deleting it. The lock is retained on return from this function.

7.13 QMDisconnect

The **QMDisconnect** function terminates a QMClient session.

Format

VB **QMDisconnect**

C **void QMDisconnect(void)**

Obj *Session*->**Disconnect**

The **QMDisconnect** function terminates a QMClient session previously established using **QMConnect()**.

7.14 QMDisconnectAll

The **QMDisconnectAll** function terminates all QMClient sessions from a client process.

Format

VB **QMDisconnectAll**

C **void QMDisconnectAll(void)**

A single client may establish multiple QMClient connections. The **QMDisconnectAll** function terminates all such connections.

The **QMDisconnectAll** function has no equivalent in the QMBasic class module API as each session is a separate instantiation of the object.

7.15 QMEndCommand

The **QMEndCommand** function aborts a command executed on the server that is requesting input.

Format

VB **QMEndCommand**

C **void QMEndCommand(void)**

Obj *Session*->**EndCommand**

This function may only be used when an immediately preceding **QMExecute()** or **QMRespond()** function has returned a status of SV_PROMPT.

The **QMEndCommand** function causes the server command to be aborted.

7.16 QMError()

The **QMError()** function returns extended error message text.

Format

VB **QMError() as String**

C char * **QMError(**void)

VB *Str* = *Session*->**error**

Some API functions set extended error text and return an error code of SV_ERROR when an error condition occurs. The **QMError()** function can be used to retrieve this text.

Note that in the C API, this function returns a pointer to a statically allocated error message buffer. The calling program must not attempt to free this memory.

7.17 QMExecute()

The **QMExecute()** function executes a command on the server.

Format

VB **QMExecute(ByVal** *Cmnd* **as String, ByRef** *Errno* **as Integer) as String**

C **char * QMExecute(char *** *Cmnd***, int *** *Errno*)

Obj *Str* = *Session***->Execute(***Cmnd***,** *Errno***)**

where

Cmnd is the command to be executed.

Errno is an integer variable to receive status information.

The **QMExecute()** function executes the specified command on the server. The output from this command is returned as a text string.

If the command completes without requesting input, the *Errno* variable is set to SV_OK.

If the command requests input, any output up to that point is returned and the *Errno* variable is set to SV_PROMPT. The client may respond to this using the **QMRespond()** function or abort the command using the **QMEndCommand()** function.

On completion of the command, **QMStatus()** will return the value of @SYSTEM.RETURN.CODE.

The executed command may perform most functions of the QM database. Specific restrictions are:

Input may be requested from the client using the QMBasic **INPUT** and **INPUT@** statements. Use of the **KEYIN()** function is not allowed.

Testing for input using the QMBasic **KEYREADY()** function or the **INPUT -1** syntax will not show input waiting.

The length parameter of an **INPUT** statement will be ignored if present.

Execution of a further command from within the executed command may not behave correctly.

7.18 QMExtract()

The **QMExtract**() function extracts a field, value or subvalue from a dynamic array.

Format

VB **QMExtract(ByVal** *Src* **as String, ByVal** *Fno* **as Integer, ByVal** *Vno* **as Integer, ByVal** *Svno* **as Integer) as String**

C **char * QMExtract(char *** *Src***, int** *Fno***, int** *Vno***, int** *Svno*)

where

Src is the dynamic array to be processed

Fno is the number of the field to be extracted. If less than 1, 1 is assumed

Vno is the number of the value to be extracted. If less than 1, the entire field is extracted.

Svno is the number of the subvalue to be extracted. If less than 1, the entire value is extracted.

The **QMExtract**() function returns the given field, value or subvalue from the source string. If the required item is not found, a null string is returned.

7.19 QMField()

The **QMField()** function extracts one or more components of a delimited string.

Format

VB **QMField(ByVal** *Src* **as String, ByVal** *Delimiter* **as String, ByVal** *Start* **as Long, Optional ByRef** *Occurrences* **as Long) as String**

C **char * QMField(char *** *Src***, char *** *Delimiter***, int** *Start***, int** *Occurrences***)**

where

Src	is the string to be processed.
Delimiter	is the single character delimiter separating components of the string.
Start	is the number from one of the first component of *Src* to be returned.
Occurrences	is the number of delimited of components of *Src* to be returned. If omitted (VB only) or less than one, one component is returned.

The **QMField()** function returns the specified substring components of *Src*.

7.20 QMFree()

The **QMFree()** function releases memory returned by other functions. It is only used with the C API library.

Format

void QMFree(void * *addr***)**

where

addr is the pointer to a dynamic memory area returned by another API function.

The **QMFree()** function is needed because the memory allocator used within the API functions may not be compatible with that of the calling program.

7.21 QMGetSession()

The **QMGetSession()** function returns the internal session number associated with the currently selected QMClient session.

Format

VB **QMGetSession() as Integer**

C **int QMGetSession(void)**

A single client may open multiple QMClient connections, each identified by a session number. The **QMConnect()** and **QMConnectLocal()** functions select an available session number to use for the newly created session which can be retrieved using **QMGetSession()**. All subsequent QMClient function calls relate to this session until an alternative session is selected using **QMSetSession()**.

The **QMGetSession()** function has no equivalent in the QMBasic class module API as each session is managed as a separate instantiation of the object.

7.22 QMIns()

The **QMIns**() function inserts a field, value or subvalue in a dynamic array.

Format

VB **QMIns(ByVal** *Src* **as String, ByVal** *Fno* **as Integer, ByVal** *Vno* **as Integer, ByVal** *Svno* **as Integer, ByVal** *NewData* **as String) as String**

C **char * QMIns(char *** *Src*, **int** *Fno*, **int** *Vno*, **int** *Svno*, **char *** *NewData*)

where

Src	is the dynamic array to be processed
Fno	is the number of the field to be inserted. If less than 1, 1 is assumed.
Vno	is the number of the value to be inserted. If less than 1, an entire field is inserted.
Svno	is the number of the subvalue to be inserted. If less than 1, an entire value is inserted.
NewData	is the new data to form the new dynamic array element.

The **QMIns**() function returns a new dynamic array with the specified field, value or subvalue inserted.

Note that in the C API library, a statement of the form

```
rec = QMIns(rec, 2, 1, 0, new_data)
```

will return a pointer to a newly allocated memory area, overwriting the *rec* pointer. The old memory is not freed by this call and it is therefore necessary to retain a pointer to the original *rec* string so that it can be freed later.

7.23 QMLocate()

The **QMLocate()** function searches a dynamic array for a field, value or subvalue matching a given string.

Format

VB **QMLocate(ByVal** *Item* **as String, ByVal** *DynArray* **as String, ByVal** *Fno* **as Integer, ByVal** *Vno* **as Integer, ByVal** *Svno* **as Integer, ByRef** *Pos* **as Integer, ByVal** *Order* **as String) as Boolean**

C **int QMLocate(char *** *Item*, **char *** *DynArray*, **int** *Fno*, **int** *Vno*, **int** *Svno*, **int *** *Pos*, **char *** *Order*)

where

Item	is the item to find.
DynArray	is the dynamic array to be processed.
Fno	is the number of the field at which the search is to begin. If less than 1, 1 is assumed.
Vno	is the number of the value at which the search is to begin. If less than 1, the function searches for a field containing *Item*.
Svno	is the number of the subvalue at which the search is to begin. If less than 1, the function searches for a value containing *Item*.
Pos	is an integer variable to receive the position information.
Order	identifies the sort method to the applied. This may be: AL Ascending, left aligned AR Ascending, right aligned DL Descending, left aligned DR Descending, right aligned If omitted, no sort order is applied.

The **QMLocate()** function searches a dynamic array at one of three levels:

If *Vno* is less than 1, the function searches the dynamic array for a field matching *Item*, starting at the field position given by *Fno*.

If *Vno* is given but *Svno* is less than 1, the function searches field *Fno* of the dynamic array for a value matching *Item*, starting at the value position given by *Vno*.

If *Vno* and *Svno* are given, the function searches field *Fno*, value *Vno* of the dynamic array for a subvalue matching *Item*, starting at the value position given by *Svno*.

The *Order* argument determines the sorting system to be applied during the search:

If *Order* is a null string, no sort rules are applied. The function scans all applicable dynamic array elements for a match against *Item*. The *Pos* variable will be returned as the position at which the item was found. If the item is not found, *Pos* will be returned as the position at which a new element could be appended.

If the first character of *Order* is A, an ascending sort is applied. If the first character of *Order* is D, a descending sort is applied. In either case, the search terminates if an entry is found that would be beyond the correct position for *Item*. In this case, if the item is not found, *Pos* will be returned as the position at which to insert *Item* to maintain the correct sort order.

If the second character of *Order* is L, a left aligned comparison is performed. Each entry of the dynamic array is compared with *Item* character by character from the left until a difference is found.

If the second character of *Order* is R, a right aligned comparison is performed. If the two items being compared are of different lengths, spaces are added to the front of the shorter item before comparison.

The **QMLocate()** function returns True if the item is found, False if it is not found.

7.24 QMLogto()

The **QMLogto()** function moves to an alternative account.

Format

VB **QMLogto(ByVal** *Account* **as String) as Boolean**

C **int QMLogto(char *** *Account***)**

Obj *Bool* = *Session***->Logto(***Account***)**

where

Account is the name of the QM account to be accessed.

The **QMConnectLocal()** function attempts to move to the named account. If successful, the function returns True. If unsuccessful, the function returns False and the **QMError()** function can be used to retrieve a text error message identifying the cause of the failure.

If the VOC of the current account contains an executable item named ON.LOGTO, usually a paragraph, this will be executed before moving to the new account.

If the VOC of the new account contains an executable item named LOGIN, this will be executed on arrival in the new account.

A QMClient session can be recognised within these paragraphs by testing the value of @TTY which will be "vbsrvr" for QMClient.

7.25 QMMarkMapping

The **QMMarkMapping** function enables or disables mark mapping for a directory file.

Format

VB **QMMarkMapping ByVal** *FileNo* **as Integer, ByVal** *State* **as Integer**

C **void QMMarkMapping(int** *FileNo*, **int** *State*)

Obj *Session*->**MarkMapping**(*FileNo*, *State*)

where

FileNo is the file number returned by a previous QMOpen() call.

State is non-zero to enable mark mapping, zero to disable.

The **QMMarkMapping** function enables or disables mark character mapping on the file open as *FileNo*. See the QMBasic MARK.MAPPING statement for more details.

7.26 QMMatch()

The **QMMatch()** function matches a string against a pattern template.

Format

VB **QMMatch(ByVal** *Src* **as String, ByVal** *Pattern* **as String) as Boolean**

C **int QMMatch(char *** *Src*, **char *** *Pattern*)

where

Src	is the string to be processed.
Pattern	is the pattern template to be used.

The **QMMatch()** function tests whether *Src* matches the *Pattern* template consisting of one or more concatenated items from the following list.

...	Zero or more characters of any type
0X	Zero or more characters of any type
*n*X	Exactly *n* characters of any type
*n-m*X	Between *n* and *m* characters of any type
0A	Zero or more alphabetic characters
*n*A	Exactly *n* alphabetic characters
*n-m*A	Between *n* and *m* alphabetic characters
0N	Zero or more numeric characters
*n*N	Exactly *n* numeric characters
*n-m*N	Between *n* and *m* numeric characters
"string"	A literal string which must match exactly. Either single or double quotation marks may be used.

The values *n* and *m* are integers with any number of digits. *m* must be greater than or equal to *n*.

The 0A, *n*A, 0N, *n*N and "string" patterns may be preceded by a tilde (~) to invert the match condition. For example, ~4N matches four non-numeric characters such as ABCD (not a string which is not four numeric characters such as 12C4).

A null string matches patterns ..., 0A, 0X, 0N, their inverses (~0A, etc) and "".

The 0X and *n-m*X patterns match against as few characters as necessary before control passes to the next pattern. For example, the string ABC123DEF matched against the pattern 0X2N0X matches the pattern components as ABC, 12 and 3DEF.

The 0N, *n-m*N, 0A, and *n-m*A patterns match against as many characters as possible. For example, the string ABC123DEF matched against the pattern 0X2-3N0X matches the pattern components as ABC, 123 and DEF.

The pattern string may contain alternative templates separated by value marks. The **QMMatch()** function tries each template in turn until one is a successful match against the string.

7.27 QMMatchfield()

The **QMMatchfield()** function matches a character string against a pattern template and extracts the part corresponding to a specified pattern component.

Format

VB **QMMatchfield(ByVal** *Src* **as String, ByVal** *Pattern* **as String, ByVal** *Component* **as Integer) as String**

C **char * QMMatchfield(char *** *Src***, char *** *Pattern***, int** *Component***)**

where

Src	is the string to be processed.
Pattern	is the pattern template to be used.
Component	is the pattern template component number for which the corresponding part of Src is to be returned.

The **QMMatchfield()** function matches *Src* against the *Pattern* template as described for the **QMMatch()** function. If the string matches, the portion corresponding to the specified *Component* is returned. If the string does not match the pattern, a null string is returned.

7.28 QMOpen()

The **QMOpen()** function opens a file.

Format

VB	**QMOpen(ByVal** *FileName* **as String) as Integer**
C	**int QMOpen(char *** *FileName***)**
Obj	*FileNo* = *Session*->**Open(***FileName***)**

where

FileName	is the name of the file to be opened. This must correspond to an F or Q-type entry in the VOC of the QM account in which the server is running.

The **QMOpen()** function opens a QM database file. The returned integer value is the file number which must be used in all subsequent operations against this file. If the file cannot be opened, the function returns zero. The **QMStatus()** function can be used to retrieve the error cause.

To open a dictionary, the *FileName* argument should commence with "DICT" and a single space separating this prefix from the file name, for example:

```
DictNo = QMOpen("DICT READERS")
```

There is no practical limit to the number of files that can be open at one time.

7.29 QMRead()

The **QMRead()** function reads a record without locking.

Format

VB	**QMRead(ByVal** *FileNo* **as Integer, ByVal** *Id* **as String, ByRef** *Errno* **as Integer) as String**
C	**char * QMRead(int** *FileNo*, **char *** *Id*, **int *** *Errno*)
Obj	*Str* = *Session*->**Read**(*FileNo*, *Id*, *Errno*)

where

FileNo	is the file number returned by a previous **QMOpen()** call.
Id	is the id of the record to be read.
Errno	is an integer variable to receive status information.

The **QMRead()** function requests the server to return the record with key *Id* from the file opened as *FileNo*.

If successful, the function returns the record as a dynamic array string and the *Errno* variable is set to SV_OK.

If the record cannot be found, the function returns a null string and the *Errno* variable is set to SV_ELSE. The **QMStatus()** function can be used to retrieve the error number.

Conditions that would normally cause a **QMBasic** program to abort or to take the ON ERROR clause of a **READ** statement return a null string and the *Errno* variable is set to SV_ON_ERROR. The **QMStatus()** function can be used to retrieve the error number.

In the C API library, the dynamic memory allocated for the returned string must subsequently be freed by the calling program.

7.30 QMReadl()

The **QMReadl()** function reads a record with a shareable read lock.

Format

VB **QMReadl(ByVal** *FileNo* **as Integer, ByVal** *Id* **as String, ByVal** *Wait* **as Boolean, ByRef** *Errno* **as Integer) as String**

C **char * QMReadl(int** *FileNo*, **char *** *Id*, **int** *Wait*, **int *** *Errno*)

Obj *Str = Session*->**Readl**(*FileNo*, *Id*, *Wait*, *Errno*)

where

FileNo is the file number returned by a previous **QMOpen()** call.

Id is the id of the record to be read.

Wait is a boolean value indicating the action to be taken if the record is currently locked by another user:
True wait for the record to become available
False return an error code of SV_LOCKED

Errno is an integer variable to receive status information.

The **QMReadl()** function requests the server to return the record with key *Id* from the file opened as *FileNo*. A shareable read lock is applied to the record. Any number of users may hold a shareable read lock on the same record at one time but, while any user has a shareable read lock, no other user can establish an update lock or a file lock.

If the action is blocked by a lock held by another user, the function returns a null string and the *Errno* variable is set to SV_LOCKED. The **QMStatus()** function can be used to retrieve the user number of the process holding the lock.

If successful, the function returns the record as a dynamic array string and the *Errno* variable is set to SV_OK. The record is locked by the server process.

If the record cannot be found, the function returns a null string and the *Errno* variable is set to SV_ELSE. The **QMStatus()** function can be used to retrieve the error number. The record is locked by the server process. If the lock is not required, it should be released using the **QMRelease()** function.

Conditions that would normally cause a QMBasic program to abort or to take the ON ERROR clause of a **READ** statement return a null string and the *Errno* variable is set to SV_ON_ERROR. The **QMStatus()** function can be used to retrieve the error number.

In the C API library, the dynamic memory allocated for the returned string must subsequently be freed by the calling program.

7.31 QMReadList()

The **QMReadList()** function reads a select list into a dynamic array in the client application

Format

VB **QMReadList(ByVal** *ListNo* **as Integer, ByRef** *Errno* **as Integer) as String**

C **char * QMReadList(int** *ListNo*)

Obj *Str* = *Session*->**ReadList**(*ListNo*)

where

ListNo is the number of the select list to be read in the range 0 to 10.

Errno receives an error value indicating the outcome of the request.

If the action is successful, the returned value contains a field mark delimited set of unprocessed entries from the given list. The original list is destroyed by this action.

The Visual Basic API returns an empty string if there is no data to read. The C API returns NULL in this situation.

A server application can read entries from a select list one at a time using the **QMReadNext()** function. Because the select list is maintained on the server, retrieval of each entry requires passing of a message pair between the client and the server. For best performance, the **QMReadList()** function can be used to transfer the entire select list to the client where entries can then be extracted using the **QMExtract()** function.

There are times when use of **QMReadNext()** may give apparently better performance. When QM performs a select operation against a dynamic file, the file is actually processed as each entry is taken from the list. There is, therefore, no lengthy silence while QM constructs the list before entries can be retrieved. Use of **QMReadList()** requires the list to be fully constructed before it can be returned to the client.

There is a further consideration for processes that use **QMReadNext()** and also update the file by adding new records. Because **QMReadNext()** is finding records one by one as processing progresses, any records written during the processing may subsequently be found by **QMReadNext()**. Using **QMReadList()** to construct and retrieve the entire list before processing commences ensures that records added during processing will not be included in the list.

7.32 QMReadNext()

The **QMReadNext()** function retrieves the next entry from a select list

Format

VB	**QMReadNext(ByVal** *ListNo* **as Integer, ByRef** *Errno* **as Integer) as String**
C	**char * QMReadNext(int** *ListNo***)**
Obj	*Str* = *Session*->**ReadNext(***ListNo***)**

where

ListNo	is the number of the select list to be processed in the range 0 to 10.
Errno	receives an error value indicating the outcome of the request. The C API does not have this argument and returns NULL if an error occurs.

The **QMReadNext()** function retrieves the next entry from the select list identified by the *ListNo* argument.

If successful, the function returns the list entry and, in the Visual Basic API, *Errno* is set to SV_OK.

If the list is empty, the Visual Basic API function returns a null string and *Errno* is set to SV_ELSE. In the C API implementation, the function returns NULL.

See also the **QMReadList()** function for a discussion of the relationship between **QMReadNext()** and **QMReadList()**.

Note that in the C API library, the returned string is dynamically allocated. A loop containing a call to this function must free the memory from each call separately.

7.33 QMReadu()

The **QMReadu()** function reads a record with an exclusive update lock.

Format

VB	**QMReadu(ByVal** *FileNo* **as Integer, ByVal** *Id* **as String, ByVal** *Wait* **as Boolean, ByRef** *Errno* **as Integer) as String**
C	**char * QMReadu(int** *FileNo*, **char *** *Id*, **int** *Wait*, **int *** *Errno*)
Obj	*Str* = *Session*->**Readu(***FileNo*, *Id*, *Wait*, *Errno*)

where

FileNo	is the file number returned by a previous **QMOpen()** call.
Id	is the id of the record to be read.
Wait	is a boolean value indicating the action to be taken if the record is currently locked by another user: True wait for the record to become available False return an error code of SV_LOCKED
Errno	is an integer variable to receive status information.

The **QMReadu()** function requests the server to return the record with key *Id* from the file opened as *FileNo*. An exclusive update lock is applied to the record. Only one user may hold an exclusive update lock on any one record at one time. An exclusive update lock also cannot be obtained if another user holds a shareable read lock on the record or a file lock on the entire file.

If the action is blocked by a lock held by another user, the function returns a null string and the *Errno* variable is set to SV_LOCKED. The **QMStatus()** function can be used to retrieve the user number of the process holding the lock.

If successful, the function returns the record as a dynamic array string and the *Errno* variable is set to SV_OK. The record is locked by the server process.

If the record cannot be found, the function returns a null string and the *Errno* variable is set to SV_ELSE. The **QMStatus()** function can be used to retrieve the error number. The record is locked by the server process to allow creation of the record. If the lock is not required, it should be released using the **QMRelease()** function.

Conditions that would normally cause a QMBasic program to abort or to take the ON ERROR clause of a **READ** statement return a null string and the *Errno* variable is set to SV_ON_ERROR. The **QMStatus()** function can be used to retrieve the error number.

In the C API library, the dynamic memory allocated for the returned string must subsequently be freed by the calling program.

7.34 QMRecordlock

The **QMRecordlock** function locks a record.

Format

VB **QMRecordlock ByVal** *FileNo* **as Integer, ByVal** *Id* **as String, ByVal** *Update* **as Integer,**
ByVal *Wait* **as Integer**

C **void QMRecordlock(int** *FileNo*, **char *** *Id*, **int** *Update*, **int** *Wait*)

Obj *Session*->**Recordlock**(*FileNo*, *Id*, *Update*, *Wait*)

where

FileNo is the file number returned by a previous QMOpen() call.

Id is the id of the record to be locked.

Update is a boolean value specifying the type of lock to be obtained:
True Update lock
False Shareable read lock

Wait is a boolean value indicating the action to be taken if the record is currently locked by another user:
True wait for the record to become available
False return an error code of SV_LOCKED

The **QMRecordlock** function can be used to obtain a lock on a record without reading the record.

7.35 QMRelease

The **QMRelease** function releases a record lock.

Format

VB **QMRelease ByVal** *FileNo* **as Integer, ByVal** *Id* **as String**

C **void QMRelease(int** *FileNo*, **char *** *Id*)

Obj *Session*->**Release**(*FileNo*, *Id*)

where

FileNo is the file number returned by a previous **QMOpen()** call. If zero, all locks are released.

Id is the id of the record to be unlocked. If given as a null string, all locks in the file identified by *FileNo* are released.

The **QMRelease** function can be used to release a lock without writing or deleting the record. One common use of this function is to release the lock obtained by a call to **QMReadl()** or **QMReadu()** where the record was not found and the function returned the SV_ELSE status.

7.36 QMReplace()

The **QMReplace()** function replaces the content of a field, value or subvalue in a dynamic array.

Format

VB **QMReplace(ByVal** *Src* **as String, ByVal** *Fno* **as Integer, ByVal** *Vno* **as Integer, ByVal** *Svno* **as Integer, ByVal** *NewData* **as String) as String**

C **char * QMReplace(char *** *Src***, int** *Fno***, int** *Vno***, int** *Svno***, char *** *NewData* **as String)**

where

Src is the dynamic array to be processed

Fno is the number of the field to be replaced. If zero, 1 is assumed. If negative, a new field is appended to the dynamic array.

Vno is the number of the value to be replaced. If zero, the entire field is inserted. If negative, a new value is appended to the specified field.

Svno is the number of the subvalue to be replaced. If zero, the entire value is inserted. If negative, a new subvalue is appended to the specified value.

NewData is the new data to form the new dynamic array element.

The **QMReplace()** function returns a new dynamic array with the specified field, value or subvalue replaced.

Note that in the C API library, a statement of the form

```
rec = QMReplace(rec, 2, 0, 0, new_data)
```

will return a pointer to a newly allocated memory area, overwriting the *rec* pointer. The old memory is not freed by this call and it is therefore necessary to retain a pointer to the original *rec* string so that it can be freed later.

7.37 QMRespond()

The **QMRespond**() function responds to a request for input from a command executed on the server.

Format

VB **QMRespond(ByVal** *Response* **as String, ByRef** *Errno* **as Integer) as String**

C **char * QMRespond(char *** *Response*, **int *** *Errno*)

Obj *Session*->**Respond**(*Response*, *Errno*)

where

Response	is the response to be sent.
Errno	is an integer variable to receive status information.

This function may only be used when an immediately preceding **QMExecute()** or **QMRespond**() function has returned a status of SV_PROMPT.

The **QMRespond**() function returns the given *Response* to the input request from the server command. Further output from this command is returned as a text string.

If the command completes without requesting input, the *Errno* variable is set to SV_OK.

If the command requests further input, any output up to that point is returned and the *Errno* variable is set to SV_PROMPT. The client may respond to this using the **QMRespond()** function or abort the command using the **QMEndCommand()** function.

7.38 QMSelect

The **QMSelect** function generates a select list containing the ids of all records in a file.

Format

VB	**QMSelect ByVal** *FileNo* **as Integer, ByVal** *ListNo* **as Integer**
C	**void QMSelect(int** *FileNo*, **int** *ListNo*)
Obj	*Session*->**Select**(*FileNo*, *ListNo*)

where

FileNo	is the file number returned by a previous **QMOpen()** call.
ListNo	is the select list number (0 to 10).

The **QMSelect** function constructs a list of record ids which can subsequently be processed using the **QMReadNext()** function. Select list 0, the default select list, is used automatically by many QM components to control their action and should, therefore, be used with caution. An unwanted or partially processed select list can be cleared using the **QMClearSelect** function.

See the **QMReadList()** function for a discussion on different ways to process the select list.

The **QMSelect** function does not provide any method to select only those records that meet specific conditions or to sort the list. These features can be accessed by executing query processor commands using the **QMExecute()** function.

7.39 QMSelectIndex

The **QMSelectIndex** function generates a select list from an alternate key index.

Format

VB **QMSelectIndex ByVal** *FileNo* **as Integer, ByVal** *IndexName* **as String, ByVal** *IndexValue* **as String, ByVal** *ListNo* **as Integer**

C **void QMSelectIndex(int** *FileNo*, **char *** *IndexName*, **char *** *IndexValue*, **int** *ListNo*)

Obj *Session*->**SelectIndex**(*FileNo*, *IndexName*, *IndexValue*, *ListNo*)

where

FileNo is the file number returned by a previous **QMOpen()** call.

IndexName is the name of the alternate key index to be used.

IndexValue is the value to be located in the alternate key index.

ListNo is the select list number (0 to 10).

The **QMSelectIndex** function constructs a list of record ids from an entry in an alternate key index. This list can subsequently be processed using the **QMReadNext()** function. Select list 0, the default select list, is used automatically by many QM components to control their action and should, therefore, be used with caution. An unwanted or partially processed select list can be cleared using the **QMClearSelect** function.

See the **QMReadList()** function for a discussion on different ways to process the select list.

7.40 QMSelectLeft and QMSelectRight

The **QMSelectLeft()** and **QMSelectRight()** functions traverse an alternate key index, creating a select list from the entry to the left or right of the last entry processed.

Format

VB	**QMSelectLeft(ByVal** *FileNo* **as Integer, ByVal** *IndexName* **as String, ByVal** *ListNo* **as Integer) as String**
C	**char * QMSelectLeft(int** *FileNo*, **char *** *IndexName*, **int** *ListNo*)
Obj	*Str* = *Session*->**SelectLeft**(*FileNo*, *IndexName*, *ListNo*)

where

Var	is the variable to receive the index key value associated with the returned list.
FileNo	is the file number returned by a previous **QMOpen()** call.
IndexName	is the name of the alternate key index to be used.
ListNo	is the select list number (0 to 10).

The **QMSelectLeft()** and **QMSelectRight()** functions construct a select list from the alternate key index entry to the left or right of the one most recently returned by **QMSelectIndex()**, **QMSelectLeft()** or **QMSelectRight()**. The position of the scan can be set at the extreme left using **QMSetLeft()** or at the extreme right using **QMSetRight()**.

These operations allow a program to find a specific value and then walk through successive values in the sorted data structure that makes up an alternate key index.

If **QMSelectIndex()** is used to locate a value that does not exist in the index, **QMSelectLeft()** will return a list of records for the value immediately before the non-existant one and **QMSelectRight()** will return a list of records for the value immediately after the non-existant one.

The **QMStatus()** function returns zero if the operation is successful, non-zero if it fails because the index does not exist.

7.41 QMSetLeft and QMSetRight

The **QMSetLeft()** and **QMSetRight()** functions set the scanning position of an alternate key index at the extreme left or right of the data.

Format

VB **QMSetLeft ByVal** *FileNo* **as Integer, ByVal** *IndexName* **as String**

C **void QMSetLeft(int** *FileNo*, **char *** *IndexName*)

Obj *Session*->**SetLeft(***FileNo*, *IndexName*)

where

Var	is the variable to receive the index key value associated with the returned list.
FileNo	is the file number returned by a previous **QMOpen()** call.
IndexName	is the name of the alternate key index to be used.
ListNo	is the select list number (0 to 10).

The **QMSetLeft** and **QMSetRight** functions are used with **QMSelectLeft()** and **QMSelectRight** to set the scan position to the first or last entry in an alternate key index.

The **QMStatus()** function returns zero if the operation is successful, non-zero if it fails because the index does not exist.

7.42 QMSetSession()

The **QMSetSession()** function selects an active QMClient session to be referenced by subsequent function calls.

Format

VB **QMSetSession(***Session* **as Integer) as Boolean**

C **int QMSetSession(int** *session***)**

A single client may open multiple QMClient connections, each identified by a session number. The **QMSetSession()** function determines to which session subsequent QMClient function calls relate.

The **QMSetSession()** function has no equivalent in the QMBasic class module API as each session is managed by a separate instantiation of the object.

7.43 QMStatus()

The **QMStatus()** function returns the value of the QMBasic **STATUS()** function for the last server function executed.

Format

VB	**QMStatus() as Long**
C	**int QMStatus(void)**
Obj	*Var* = *Session*->**ServerStatus**

Many server actions set the QMBasic **STATUS()** value and return it to the client process. The **QMStatus()** function retrieves this value. This function does not require passing of a client server message pair as the value is held on the client system.

7.44 QMWrite

The **QMWrite** function writes a record.

Format

VB **QMWrite ByVal** *FileNo* **as Integer, ByVal** *Id* **as String, ByVal** *Rec* **as String**

C **void QMWrite(int** *FileNo*, **char *** *Id*, **char *** *Rec*)

Obj *Session*->**Write(***FileNo*, *Id*, *Rec*)

where

FileNo is the file number returned by a previous **QMOpen()** call.

Id is the id of the record to be written.

Rec is the data to be written to this record.

The **QMWrite** function writes the given data to the file opened as *FileNo*. If a record with this *Id* already exists, it is replaced. If the record does not already exist, it is added.

An application should always obtain an update lock on the record before writing it. This function releases the lock.

7.45 QMWriteu

The **QMWriteu** function writes a record, retaining the lock.

Format

VB	**QMWriteu ByVal** *FileNo* **as Integer, ByVal** *Id* **as String, ByVal** *Rec* **as String**
C	**void QMWriteu(int** *FileNo*, **char** * *Id*, **char** * *Rec*)
Obj	*Session*->**Writeu(***FileNo*, *Id*, *Rec*)

where

FileNo	is the file number returned by a previous **QMOpen()** call.
Id	is the id of the record to be written.
Rec	is the data to be written to this record.

The **QMWriteu** function writes the given data to the file opened as *FileNo*. If a record with this *Id* already exists, it is replaced. If the record does not already exist, it is added.

An application should always obtain an update lock on the record before writing it. The lock is retained on return from this function.

Part

System Administration

8 System Administration

System Configuration

Configuration Parameters	Parameter descriptions
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The Terminfo Database	Terminal configuration
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Account Management

Accounts	What is an account?
CREATE.ACCOUNT	Create an account
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The Login Process	What happens when a user logs in

System Security

ADMIN.USER	User administration
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DELETE.USER	Delete a user
LIST.USERS	List user name details
PASSWORD	Password management (Windows 98/ME)
SECURITY	Enable, disable or report security settings

Process Management

LISTU	Who is logged in?
PSTAT	Monitoring processes
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Monitoring the File System

LIST.FILES	Determining the files in use
LIST.LOCKS	Monitoring task locks
LIST.READU	Monitoring record and file locks
UNLOCK	Releasing a lock
FSTAT	Monitoring file activity
ANALYSE.FILE	File analysis

8.1 Configuration parameters

QM has a number of configuration parameters that determine major settings for the system. On Windows systems, these are stored in a file named QM.INI in the Windows directory. Modifications should preferably be made using the Configuration Editor from the QM program menu rather than by editing the file itself because the Configuration Editor includes some validation of the parameter values. On other platforms, the configuration parameters are stored in /etc/qmconfig.

The file is divided into a number of sections, each with a section title enclosed in square brackets.

Configuration parameters may be global or private. Global parameters apply to all users of QM. Private parameters, although initially set to the state defined in the configuration file, may be updated for an individual process using the **CONFIG** command. Private configuration parameters are marked with an asterisk in the table below.

The QM configuration parameters are:

CMDSTACK	Determines the size of the command stack for all users. The value must be in the range 20 to 999 and defaults to 99 if this parameter is not present.
CODEPAGE *	Windows only. Specifies the code page to be used for QMConsole connections. If omitted, QM uses the default console code page. Note that a restriction in Windows requires that the console session is set to use Lucida Console font for this feature to work. This parameter is not applicable to the PDA version of QM.
DEADLOCK	If set to 1, QM aborts any program that attempts to wait for a lock that would result in a deadlock situation. The default value (0) allows deadlocks to occur. This parameter is not applicable to the PDA version of QM.
DUMPDIR *	The pathname of the directory to receive process dump files. If this parameter is null, the QMSYS directory is used. On some systems, users may not have write access to this directory. DUMPDIR may be specified as a full pathname or relative to the account directory.
ERRLOG	Sets the maximum size in kilobytes of the error log maintained in the errlog file in the QMSYS account directory. When the file reaches this size, the first half of the logged data is discarded. If set to zero, error logging is disabled. The minimum non-zero value is 10. A lower value will be treated as 10. This parameter is not applicable to the PDA version of QM.
EXCLREM *	If set to 1, remote files are omitted from **ACCOUNT.SAVE** unless this exclusion is over-ridden by other mechanisms within the **ACCOUNT.SAVE** command processing. This parameter is not applicable to the PDA version of QM.
FILERULE *	Sets rules for special filename syntax usage. This value is formed by adding together the following options as required: 1 Allow *account:file*

2 Allow *server*:*account*:*file*

4 Allow PATH:*pathname*

The **CONFIG** command can be used to modify this value within an individual process but only to remove options. Thus, the setting of this parameter in the configuration file represents the most powerful set of filename option rules that can be used.

FIXUSERS

Reserves a range of user numbers for exclusive use of users specifying a fixed user number when logging in using qm -*n* where *n* is the required user number.

The format of this parameter is

FIXUSERS=u,n

where

u is the lowest user number in the reserved range.

n is the number of user numbers to be reserved.

The highest available QM user number is normally 1023. Therefore, the value of u + n must not exceed 1024.

This feature is provided for compatibility with other environments in applications that rely on a fixed user numbers to recognise users. It is recommended that user login names should be used for this purpose in new applications as this gives a more secure system. This parameter is not applicable to the PDA version of QM.

FLTDIFF *

The FLTDIFF configuration parameter determines how floating point values are compared.

Just as some numbers such as one third cannot be represented accurately in decimal, there are numbers that cannot be represented accurately in the binary notation used in computer systems. Often, numbers that are accurate in one number base, are inaccurate in the other. The inaccuracy is extremely small, typically at about the fourteenth decimal place.

A program that tests a floating point value for equality with some other value must allow for this inaccuracy rather than enforcing a strict equality. The FLTDIFF parameter determines how close two values must be to be considered as equal. The default value, 2.91E-11 (2^{-35}), is an industry standard but this can be set to any positive value less than one.

The format of the data in the parameter setting may be either a simple number (0.0000000000291) or a number with an exponent (2.91E-11).

FSYNC *

Additive values determining when an fsync operation is performed to flush all updated data to disk:

1 Every time that a file's header is updated. This corresponds to all structural changes within the file (overflow, split, merge, etc) and on closing the file.

2 At transaction commit.

Use of FSYNC can have a severe effect on performance but gives greater resilience to system failures.

File synchronisation always occurs on use of the QMBasic **WRITESEQF** or **FLUSH** statements regardless of the setting of this parameter. This parameter is not applicable to the PDA version of QM.

GDI * — Setting this parameter non-zero on Windows systems causes the **SETPTR** command to use GDI mode by default. This parameter is not applicable to the PDA version of QM.

GRPSIZE * — Determines the default group size in units of 1kb used when creating a dynamic file. This parameter must be in the range 1 - 8 and defaults to 1. For best performance, it should be a multiple of the operating system disk block size.

INTPREC * — Determines the rounding applied when converting a floating point number to an integer.

Just as there are numbers that cannot be written accurately in decimal such as one third, so there are numbers that cannot be stored accurately in the floating point formats used by computer systems. For example, entering a value of 17.9 will actually result in a stored value of approximately 17.8999999999999986.

The language definition for conversion of floating point values to integers states that the fractional part is discarded. To do so without rounding would mean that

```
DISPLAY INT(17.9 * 100)
```

would display the value 1789 rather than the more intuitively obvious 1790.

To avoid this problem, QM applies rounding to the floating point value based on the INTPREC setting when converting floating point values to integers in the **INT()** function or any implicit conversion such as dynamic array indices.

The parameter value identifies the decimal place at which rounding is applied. The default value is 13. Setting a value of 0 causes no rounding to be applied.

LICENCE — Licence parameters. Use the **UPDATE.LICENCE** command in the QMSYS account to apply new licence parameters.

LPTRHIGH * — Determines the default number of lines per page when a print unit is first referenced. This must be in the range 1 to 32767 and may be overridden using the **SETPTR** command or equivalent QMBasic print unit modification functions. This parameter is not applicable to the PDA version of QM.

LPTRWIDE * — Determines the default number of characters per line when a print unit is first referenced. This must be in the range 1 to 1000 and may be overridden using the **SETPTR** command or equivalent QMBasic print unit modification functions. This parameter is not applicable to the PDA version of QM.

MAXCALL *	Sets the maximum depth of nested subroutine calls including internal components of QM such as the command processor. If this limit is reached due to, for example, a program error resulting in a recursive call loop, QM will abort the program gracefully rather than failing in unpredictable ways when it runs out of memory. The value must be in the range 10 to 1000000 and defaults to 1000. This parameter is not applicable to the PDA version of QM.
MAXIDLEN	Sets the maximum allowed length of a record id. This must be in the range 63 to 255 and defaults to 63. Increasing this value has a significant effect on the size of the internal lock tables. It is therefore recommended that the value used should be consistent with the needs of the application. QM tracks the length of the longest id ever written to a file. Attempting to access a file where this exceeds the value of the MAXIDLEN parameter will cause the operation to fail. The qmfix utility will correct the recorded longest id value if records have been deleted from the file.
MUSTLOCK *	Setting this parameter to 1 enforces use of locks when writing or deleting records. If a program attempts to write or delete a record when it does not own a record update (**READU**) lock on the record or a file lock on the file being updated, the program will abort with error ER$NOLOCK. The ON ERROR clause can be used to trap this error. Leaving the parameter at its default value of 0 allows writes or deletes when no lock is in place. This parameter is not applicable to the PDA version of QM.
NETFILES	By default QM does not allow access to files on remote drives. This is because the locking system cannot detect that two systems are accessing the file simultaneously. Where it is certain that a file will never be opened from two systems concurrently, setting this parameter to 1 will enable access to remote files. Incorrect use of this feature can result in corrupt data files. Setting NETFILES to 2 enables incoming connections from other QM servers accessing files via the QMNet interface. These two mode settings are additive and can be used together. This parameter is not applicable to the PDA version of QM.
NUMFILES	The maximum number of QM data files that may be opened at one time. This is a system wide limit. Use of the same file by multiple users counts as one file. Attempting to open more than this number of files will cause an application to fail. Setting the parameter significantly too high may have a small performance impact. The **LIST.FILES** command can be used to determine whether the value of this parameter is appropriate.
NUMLOCKS	The maximum number of record locks that can be held at one time as a system wide limit. If the limit is reached, processes attempting to get locks will wait for space to become available in the lock table. Setting the parameter significantly too high may have a small performance impact. The DETAIL option of the **LIST.READU** command can be used to determine whether the value of this parameter is appropriate.
OBJECTS *	The maximum number of programs which may be loaded into memory before discard is attempted. A program is a candidate to be discarded

when it is not part of the call stack and it is not referenced from any subroutine variables from indirect calls. Setting this parameter to zero implies no limit on the number of concurrently loaded programs.

OBJMEM * — The maximum size of all loaded programs in Kb before discard is attempted. Setting this parameter to zero implies no limit on the size of concurrently loaded programs.

PDUMP — Additive flags to configure **PDUMP** (process dump) features. At this release the only flag value is

1 Ban use of PDUMP to dump processes running under other user names except when performed by a user with administrator rights.

PORTMAP — Allows users to create a fixed mapping between tcp/ip port numbers and QM user numbers. The format of this parameter is

PORTMAP=p,u,n

where

p is the lowest port number to be mapped.

u is the lowest corresponding user number.

n is the number of ports to be mapped.

The highest available QM user number is 1023. Therefore, the value of u + n must not exceed 1024.

Use of PORTMAP does not prevent users entering QM via the normal shared port defined by the QMSRVR PORT configuration parameter.

Note that this parameter appears in the QM section of the configuration file as it relates to both QM and QMSvc.

This feature is provided for compatibility with other environments in applications that rely on a fixed port number to user number relationship to recognise users. It is recommended that user login names should be used for this purpose in new applications as this gives a more secure system.

This feature is not supported on Windows 98/ME or on the PDA version of QM.

On a Linux system, it will be necessary to create corresponding files in the /etc/xinetd.d directory for each port to be monitored. The format of these is

```
service qmsrvr
{
 id               = qmsrvr4001
 port             = 4001
 bind             = 0.0.0.0
 type             = UNLISTED
 protocol         = tcp
 flags            = REUSE
 socket_type      = stream
 wait             = no
 user             = root
 server           = /usr/qmsys/bin/qm
```

```
 server_args     = -n
 log_on_failure  += USERID
 disable         = no
}
```

where the value 4001 in the above example is replaced by the port number.

QMCLIENT

Provides additional security control for QMClient sessions. This parameter has one of three values:

0 No restrictions.

1 Bans use of **QMOpen()** and **QMExecute()**, limiting clients to calling subroutines.

2 In addition to the level 1 restrictions, **QMCall()** can only be used to call subroutines compiled with the $QMCALL compiler directive.

This parameter can be modified to a higher level in an individual process using the CONFIG command but cannot be taken to a lower level in this way. This parameter is not applicable to the PDA version of QM.

QMSYS

Identifies the location of the QMSYS account directory. If the QMSYS directory is moved for any reason, change this parameter to point to the new location and the system should operate with no other changes. This parameter is not applicable to the PDA version of QM.

RECCACHE *

Sets the size of the record cache (default zero, maximum 32). When a QM process reads a record, a copy of this record is retained in the cache. A subsequent read for the same record can find it from the cache rather than requiring an operating system call. The cache mechanism is most likely to benefit an application that makes heavy use of the **TRANS()** function to read the same record many times during a long query, for example when looking up a tax rate that is applied to every record processed.

RINGWAIT *

QM uses a ring buffer to hold type-ahead characters received from the keyboard. If this becomes full, incoming data is thrown away and a bell character is sent back to the terminal. Some applications may need to send a large burst of data which would fill the ring buffer and hence be truncated. Setting the RINGWAIT parameter to 1 causes QM to wait for space to become available in the buffer rather than rejecting input. Enabling this feature could result in the inability to use the break key if the ring buffer is full. The AccuTerm terminal emulator requires this parameter to be set to 1. (This parameter currently only applies to the Windows version of QM).

SAFEDIR *

Setting this parameter to 1 causes QM to adopt a careful update process when writing records to directory files. The new record is written to a temporary file, the old record is deleted (if it exists) and the temporary item is renamed to replace it.

This mechanism results in reduced performance but ensures that the original data is not lost if the write fails because, for example, there is insufficient disk space available. This parameter is not applicable to the PDA version of QM.

SH *

(Not Windows) Determines the shell processor and its options to be used when the SH command is used to start an interactive shell. If not set, this parameter defaults to "/bin/bash -i" on Linux and "/bin/sh -i" on

FreeBSD. This parameter is not applicable to the PDA version of QM.

SH1 * (Not Windows) Determines the shell processor and its options to be used when the SH command or the QMBasic **OS.EXECUTE** statement is used to execute a single command. If not set, this parameter defaults to "/bin/bash -c" on Linux and "/bin/sh -c" on FreeBSD. This parameter is not applicable to the PDA version of QM.

SORTMEM * The size in kilobytes at which a sort switches from memory based to disk based. The default value is 1024 (1Mb). Setting values lower than this may lead to poorer performance unless you are severely restricted by memory size. Setting values larger than this will require more memory for large sorts.

SORTMRG * A disk based sort produces a series of intermediate files that must be merged to produce the final result. The SORTMRG parameter specifies the number of files merged in each pass. This must be in the range 2 to 10 and defaults to 4. The effect of changes to this parameter on sort times is dependant on the relative performance of the disk and processor.

SORTWORK * The pathname of the directory to hold temporary sort workfiles. These are automatically deleted on normal completion of a sort. If this parameter is null or the specified directory does not exist, the directory defined by the TEMPDIR parameter is used. This parameter is not applicable to the PDA version of QM.

SPOOLER * Sets the name of the default spooler on non-Windows platforms. If this parameter is not specified or is a null string, the lp spooler is used. The name specific may be another standard spooler (e.g. lpr) or a user written program or shell script to perform custom print management.

The qualifying data to this configuration parameter can include other options to be passed to the selected spooler. This parameter is not applicable to the PDA version of QM.

STARTUP Sets a command to be executed when QM starts. This may not exceed 80 characters and may not contain double quotes. This parameter is not applicable to the PDA version of QM.

This process will run the MASTER.LOGIN and LOGIN paragraphs in the same way as any other QM session.

On Windows. persistent shared memory must be enabled with the QMSRVR OPTIONS parameter. The command will be executed when the QMSvc service starts. Note that it will run as the powerful System user which could represent a security risk.

TEMPDIR * The pathname of the directory to hold temporary files. These are normally automatically deleted when no longer required but it is recommended that this parameter points to a directory that is cleared on restart of the system so that any files left behind at a system failure will be deleted. If this parameter is null or the specified directory does not exist, QM uses the TEMP subdirectory of the QMSYS account on Windows or the operating system temporary directory on other platforms. This parameter is not applicable to the PDA version of QM.

TERMINFO *	The pathname of the directory holding the terminfo database. This defaults to a subdirectory named terminfo under the QMSYS directory. This parameter is not applicable to the PDA version of QM.
YEARBASE *	The earliest year in the 100 year range of dates entered with two digit year numbers. This parameter is optional and defaults to 1930.

The QMSRVR configuration parameters control the QMSvc service (Windows NT and later) or its predecessor, QMSrvr (Windows 98/ME and USB installations). They are not used on other platforms. These parameters are:

MAXLOG
: Sets the maximum size of the log file (QMSvc only). A value of zero causes QMSvc to start a new log each time the service is started, saving the previous log as QMSvcLog.old. A non-zero value sets the maximum size of the QMSvc.log file in kb. When this size is reached, the first half of the data in the file is removed.

OPTIONS
: An additive value formed from QMSvc/QMSrvr option flags:

1 Log client disconnection (QMSvc only). There is a very small system overhead for this but it should be negligible.

2 Persistent shared memory (QMSvc only). With this mode set, the shared memory structures used by QM are created by QMSvc (unless they already exist) and remain present until all user have logged out of QM and QMSvc is shut down. This mode of operation gives faster entry to QM and may be of use in web servers or other applications that use frequent, short life QM sessions..

PORT
: The port for incoming client telnet connections. Leave blank to use the default port (4242). If QM is the only telnet style service used on the host system, it may be useful to set this to 23, the standard port used by telnet software.

Setting this port to zero disables incoming telnet client connections. See also the PORTMAP QM configuration parameter described above.

QMCLIENT
: The port for incoming QMClient telnet connections. Leave blank to use the default port (4243).

Setting this port to zero disables incoming QMClient connections.

RETRIES
: The maximum number of attempts allowed for entry of a valid username and password on QMSvc connections. This parameter defaults to 3.

SERIAL
: Defines a serial port to be monitored for incoming QM connections. Multiple SERIAL parameters may be specified. The format is

SERIAL=*port*,*rate*,*parity*,*bits*,*stop*

where

port = the port name (e.g. COM1)

rate = baud rate (e.g. 9600)

parity = none(0), odd(1), even(2)

bits = bits per byte (7 or 8)

stop = number of stop bits (1 or 2)

TIMEOUT	The maximum wait period in seconds allowed during entry of a valid username and password on QMSvc connections. This parameter defaults to 30.

8.2 The Terminfo Database

Control sequences and other characteristics of terminal devices are defined in the terminfo database. This is normally a subdirectory structure under the QMSYS account but can be moved elsewhere if required by use of the TERMINFO configuration parameter. The structure of the terminfo database closely mimics that found as a standard component on Linux and other operating systems though QM has some private extensions to the internal library format.

This feature does not apply to the PDA version of QM.

Location and Structure

The terminfo directory contains a set of subdirectories named using the first character of the terminal types stored within them. Each of these directories then contains a file for each terminal type. Thus, for example, the definition for a vt100 terminal on a Windows system with the default QMSYS location would be found in c:\qmsys\terminfo\v\vt100.

The definition files are stored in an encoded form that closely reflects the way in which QM uses the data internally. QM provides a utility, qmtic, to compile or decompile terminfo entries.

A master source for a variety of terminals is in the QMSYS account directory as terminfo.src and the entire set of definitions is compiled when QM is installed. To simplify maintenance of a private set of new or modified terminal definitions, the QM installation process will look for a file named terminfo.mods in the QMSYS account directory and, if it exists, will compile it after the standard source.

Linux users wishing to transfer entries from the standard Linux terminfo database to the QM terminfo database should use the Linux **infocmp** tool to decompile the Linux definition and then recompile it using qmtic, removing any entries that are not supported on QM.

Source Format

Terminfo entries contain three types of item; booleans, numbers and strings.

A boolean item is present in the terminfo entry if the feature or capability that it represents is supported by the terminal. QM currently does not make use of any of the boolean items.

A number entry holds the value of a numeric parameter. For example, the cols item defines the normal number of columns per line.

A string item holds a control string. These may be codes to be sent to the terminal to perform a specific task such as clearing the screen or moving the cursor, or may be a code sent by the terminal when a specific key is pressed by the user. Strings representing commands sent to the terminal device often include parameterised information such as screen positions or counts.

A terminfo source file consists of one or more terminal definitions separated by at least one blank line. Lines commencing with a hash character (#) are comments and are totally ignored during compilation. Each definition consists of a number of comma separated items. A definition can be split over multiple lines by inserting a newline after a comma.

The first line of each entry contains a list of terminal types defined by that entry and a text

description. For example:

```
vt100|vt100-am|dec vt100 (w/advanced video),
```

This line is separated into a number of fields using the vertical bar (|) character. The last field is the text description. All preceding fields are terminal device names. Thus, the entry introduced by the line shown above defines the vt100 and vt100-am terminal types. There will be separate compiled files for each of these terminals in the final terminfo database.

The remaining lines of the entry define the characteristics of the device. Although the order is not fixed, terminfo entries normally have the booleans first, followed by the numbers, followed by the strings.

A boolean entry consists only of its name. A number consists of the name, a hash character, and the value of the parameter. A string consists of the name, an equals character (=), and the value of the parameter. For example, the first few lines of the vt100 definition are:

```
vt100|vt100-am|dec vt100 (w/advanced video),
    am, xenl, msgr, xon,
    cols#80, it#8, lines#24, vt#3,
    bel=^G, cr=\r, csr=\E[%i%p1%d;%p2%dr, tbc=\E[3g,
    clear=\E[H\E[J$<50>, el=\E[K$<3>, ed=\E[J$<50>,
    cup=\E[%i%p1%d;%p2%dH$<5>, cud1=\n, home=\E[H,
```

String tokens may contain the following special character sequences:

Sequence	Meaning
\b	Backspace (char 8)
\e	Escape (char 27)
\f	Formfeed (char 12)
\l	Linefeed (char 10)
\n	Linefeed (char 10)
\r	Carriage return (char 13)
\s	Space (char 32)
\t	Tab (char 9)
\^	Caret (^)
\\	Backslash (\)
x	Ctrl-*x* (chars 0 - 31)
%*x*	Parameter action as described below
%%	Percent sign (%)
$<*n*>	Insert an *n* millisecond delay. This code is ignored by QM, removing it from the final string.

The %*x* parameter notation performs run time manipulation of the character string, often inserting parameter values. These operations use a stack for intermediate results and are described in terms of their C programming language equivalents:

Code	Action
%c	pop top stack item and print it as a character (like %c in printf())
%d	pop top stack item and print it as an integer (like %d in printf())
%s	pop top stack item and print it as a string (like %s in printf())
%[[:]flags][width[.precision]][doxXs]	as in printf, flags are [-+#] and space. The ':' is used to avoid making %+ or %- patterns (see below).
%p[1-9]	push ith parm
%P[a-z]	set dynamic variable [a-z] from top stack item
%g[a-z]	get dynamic variable [a-z] and push it onto stack
%P[A-Z]	set static variable [A-Z] from top stack item

%g[A-Z] get static variable [A-Z] and push it onto stack
%l replace topmost stack item with its string length
%'c' push char constant c
%{nn} push integer constant nn
%+ replace top two stack items with their sum
%- replace top two stack items with their difference
%* replace top two stack items with their product
%/ replace top two stack items with their quotient
%m replace top two stack items with the remainder from division
%& replace top two stack items with their logical AND
%| replace top two stack items with their logical OR
%^ replace top two stack items with their logical exclusive OR
%= replace top two stack items with the result of an equality test
%> replace top two stack items with the result of a greater than test
%< replace top two stack items with the result of a less than test
%A %O logical and & or operations for conditionals
%! replace top stack item with its logical inverse
%~ replace top stack item with its bitwise inverse
%i add 1 to first two parms (for ANSI terminals)
%? expr %t thenpart %e elsepart %;
if-then-else, %e elsepart is optional.

For those of the above operators which are binary and not commutative, the stack works in the usual way, with
%gx %gy %m
resulting in x mod y, not the reverse.

For example, the QMBasic @(*col*,*row*) function translates to the cup (cursor position) terminfo entry. For the vt100 definition shown above this is

```
cup=\E[%i%p1%d;%p2%dH$<5>
```

Taking this apart, element by element for a usage as @(10,5):

\E Escape character
[[character
%i Increment both arguments to allow for positions numbered from 1 rather than 0. The argument values 10 and 5 thus become 11 and 6.
%p1 Push parameter 1 (11) onto the stack
%d Print top item from stack as an integer
; ; character
%p2 Push parameter 2 (6) onto the stack
%d Print top item from stack as an integer
H H character
$<5> Delay - Ignored by QM.

The end result is thus "Esc[11;6H".

Colour Mapping

Different terminal emulators use variations on the numeric values used to represent colours (see the QMBasic @(-37) and @(-38) functions). To enable users to employ a consistent set of colour values in application programs whilst working with different terminal emulators, the terminfo

definition may include an optional element named colourmap (British spelling) that provides a translation between internal colour values and the actual colour number transmitted to the terminal. The format of this entry is

```
colourmap=0|1|2|3|7|5|6|4|8|9|10|11|12|13|14|15
```

where the elements correspond to internal colour values zero upwards and the number in each element is the colour value to be sent to the terminal. In this example, colours 4 and 7 have been swapped.

Colours for which the value is not to be changed may be left blank and trailing unchanged values may be omitted. Thus, the above example could be shortened to

```
colourmap=||||7|||4
```

User Definable Entries

The terminfo database includes 10 entries (u0 to u9) for user use. QM pre-defines the function of two of these, the remaining eight are available for any purpose that the user wishes.

u0 - u7	@(-100) to @(-107)		Undefined. Users may adopt these for any purpose.
u8	@(-108)	IT$ACMD	Asynchronous command execution prefix. This code prefixes a command to be executed on the client system followed by a newline. The QM session is not suspended while the command is executed.
u9	@(-109)	IT$SCMD	Synchronous command execution prefix. This code prefixes a command to be executed on the client system followed by a newline. The QM session is suspended while the command is executed.

The u8 code is used internally by some parts of QM. The remaining codes will only be used as defined in user written application software.

AccuTerm Extensions

The AccuTerm terminal emulator includes support for additional special functions that are not part of the standard terminal definitions for industry standard terminal types. These extra functions include

Client side command execution (synchronous and asynchronous)

Screen region save and restore (used by the QMBasic debugger)

Mouse click detection

QM ships with extended definitions for some devices using terminal type names with a -at suffix (e.g. vt100-at). Users can easily add similar extensions to other terminal definitions.

The qmtic Utility

The qmtic tool can be used to compile new terminal definitions or to decompile existing ones. Although it is possible to store separate source definitions of each terminal type, QM includes a single master source file, terminfo.src, in the QMSYS directory. To simplify maintenance of a private set of new or modified terminal definitions, the QM installation process will look for a file named terminfo.mods in the QMSYS account directory and, if it exists, will compile it after the standard source.

The format of the qmtic command to compile terminfo data is:

qmtic {*options*} *src...*

where

src... is a list of one or more source files to be processed.

options are any of the following:

- **-p***path* Use the terminfo database at the specified path.
- **-t***name* Compile only the specified terminal definition. This option may be repeated to compile several definitions.
- **-v** Verbose mode. Displays progress information.
- **-x** Do not overwrite existing entries. Only definitions for terminals not already in the database will be written.

The format of the qmtic command to decompile terminfo data is:

qmtic {*options*} **-d** *name...*

where

name... is a list of one or more terminal names to be processed.

options are any of the following:

- **-p***path* Use the terminfo database at the specified path.
- **-v** Verbose mode. Displays progress information.

Replacing the **-d** option with **-dall** will decompile all terminfo entries to produce a new master source file.

The format of the qmtic command to display an index of terminal types is:

qmtic {*options*} **-i**

8.3 Application Level Security

A well designed application never allows an end user to reach a command prompt. This leaves restriction of what a user may do within the control of the application itself. Where it is necessary to provide differing levels of access to different users, QM provides several ways to identify attributes of the current user:

@IP.ADDR	User's IP address for network connections. This is also available in QMBasic as **SYSTEM(42)**.
@LOGNAME	User's login name.
@TTY	Terminal device name.
SYSTEM(1017)	Port number for network connection.

A user could potentially escape from the controlled environment provided by the application if the application were to abort. This can be avoided by a combination of the following techniques:

Disable the break key. The break key is automatically disabled until completion of the LOGIN paragraph unless it is enabled within that paragraph by use of the **BREAK ON** command. There should never be a need for use of the break key in a working application. In the unlikely event of needing to re-enable it for a specific user as a result of an application fault, the system administrator can use an extended form of the **BREAK** command to do this.

Use **OPTION NO.USER.ABORTS** to suppress all options through which a user can cause an abort to occur. This removes the A option from the "Press return to continue" prompt, the query processor pagination prompt and the break key options.

Implement the ON.ABORT paragraph. Despite the above techniques, an application may still abort as a result of a run time error or use of the **ABORT** statement within the application itself. When an abort occurs, QM discards all programs, menus, paragraphs, etc that are running in the process and returns to the lowest level command processor. Before this displays the command prompt, it checks in the VOC file for an executable item named ON.ABORT and, if this is found, executes it. A typical ON.ABORT paragraph terminates the user's session after, perhaps, logging the incident.

Some users such as application developers may need to be able to reach a command prompt. In this case, security subroutines can be attached to R or V-type VOC entries to provide control over what can be done.

8.4 Permissions

QM uses the underlying operating system to manage processes, files, devices, etc. Therefore, all issues of access permissions ultimately lie with the operating system. This section gives some guidance on setting permissions within a QM system but individual application needs should be taken into account.

The QMSYS Account

The only users who should be working in the QMSYS account are system administrators. It is reasonable that these people should have write access to QMSYS. No other user ever needs to create an item in the QMSYS directory itself. Therefore the directory can be protected so that only administrators can write to it.

System administrators need write access to all items in the QMSYS account. The following table sets out the additional access rights needed for other users.

		Developers	**Others**
$FORMS	Form queue definitions created with SET.QUEUE for use with SP.ASSIGN.	Full	Full
$HOLD	Hold file for QMSYS account	None	None
$HOLD.DIC	Dictionary for $HOLD	None	None
$IPC	Inter-process communication file	Full	Full
$LOGINS	User name database	Full	Full
$MAP	Catalogue map	Full (note 1)	None
$MAP.DIC	Dictionary for $MAP	Read	Read
$SCREENS	Screens database	Read	Read
$SVLISTS	$SAVEDLISTS file	None	None
$VAULT	Encryption key vault	Read	Read
ACCOUNTS	Accounts database	Read (note 2)	Read (note 2)
ACCOUNTS.DIC	Dictionary for ACCOUNTS	Read	Read
audit.log	Encryption audit log	None	None
bin	Executable files	Read	Read
BP	Sample QMBasic items	Read	Read
cat	Private catalogue	None	None

		Developers	Others
DICT.DIC	Dictionary for dictionaries	Read	Read
DIR_DICT	Dictionary for directory files	Read	Read
DOCS	Documentation (Windows only)	Read	Read
errlog	Optional error log file	Full (note 3)	Full (note 3)
ERRMSG	Pick style error message file	Read (note 4)	Read (note 4)
ERRMSG.DIC	Dictionary for ERRMSG	Read	Read
gcat	Global catalogue	Full	Read (note 5)
MESSAGES	Message database	Read	Read
NEWVOC	Template VOC file	Read	Read
QM.VOCLIB	VOC extension	Read	Read
stacks	Command stack repository	None	None
SYSCOM	System include records	Read	None
temp	Temporary directory (Windows only)	Full	Full
terminfo	Terminfo database	Read	Read
terminfo.src	Terminfo definitions	None	None
VOC	Vocabulary file	Read	Read
VOC.DIC	Dictionary for VOC	None	None
errlog	Error log	Full	Full
qm.hlp	Help text (Windows only)	Read	Read
QMSvc.log	QMSvc log (Windows only)	None	None

1. Write access to $MAP is only needed by users who execute the MAP command to create a catalogue map with the default destination file name.
2. Any user who is to be allowed to create new accounts will need write access to this file. Restricting write access on this file closes a potential security risk by preventing users creating synonyms to existing accounts that might subvert application level security mechanisms.
3. If error logging is enabled (see the ERRLOG configuration parameter), all users need full access to the optional errlog file. Any user that does not have write access will not log errors.
4. This file contains standard Pick style messages. Although rare, some applications may

write to this file.

5. It is possible to restrict access to individual items in the gcat subdirectory. Users need read access (not execute access) to run a compiled QMBasic program.

Application Accounts

In general, users should have free access to all files. Taking write access away on the VOC can be used to prevent users modifying its content but beware that some applications modify the VOC as part of their normal operation.

Other System Files

The only QM file located outside of account structures is the configuration file (qm.ini in the Windows directory on Windows, /etc/qmconfig on other platforms). All users need read access to this file.

The configuration file is updated by the QMTerm terminal emulator and by the QMNet server related commands. Users of these features therefore need write access.

8.5 Backup and Restore

QM does not provide any special backup and restore utilities but relies instead on use of standard operating system level backup tools. This section sets out some points to consider in planning a backup strategy. Hopefully, you have already thought of these...

- Determine what to backup. If your backup needs to be as quick as possible, remember that it is usually unnecessary to back up system files that can easily be recreated.
- Do not forget that distributed applications sometimes have critical data stored on client PCs. These need to be backed up at the same time as the server to preserve data integrity across the entire backup.
- How often will you back up? You need to make a sensible trade-off between the time it takes to backup and the difficulty of bringing the system up to date in the event of a restore.
- Consider when to backup in relation to your business routine. It is unsafe to backup a database while it is being used except as described below. You will end up with data integrity problems and, possibly, structural integrity problems in files that were being modified while the backup progressed. The safest approach is to log all users off while the backup is performed. It is not necessary to shutdown QM.
- Use a cycle of backup media rather than continuously overwriting the same media so that you are secure from failures during the backup and also have multiple points in time to which you can revert.
- Ensure that your backup media is kept away from the system that it represents. A fireproof safe or an offsite store is best.
- Think carefully about how long you will keep your backups. There are often legal requirements to be able to restore business data for several years. Remember that technology moves on at a rapid pace. You need to ensure that you still have the appropriate drives to read your old backups.
- Test your backups. Check that you really can restore your data if the need arises.

Backup Tools

Although it would be possible to use the **ACCOUNT.SAVE** command to create a backup of a QM account, it is recommended that operating system level tools are used for this purpose. The account transfer tools and **T.xxx** commands do, however, have the advantage that they can be used to merge data with existing files.

Because individual records in hashed files cannot be accessed from outside of QM, operating system level backup tools can only save and restore an entire file. The **T.DUMP** command can take a select list specifying the records to be saved.

Live Backup

Sometimes there is no alternative to backing up a system while users are logged in. As mentioned above, simply copying the database files while they are being updated will almost certainly lead to inconsistent data, perhaps with structural problems that make restore impossible.

QM provides the ability to suspend database updates by use of qm -suspend from the operating

system command prompt. When this mode is in effect, applications will pause at any attempt to modify a file until updates are enabled using qm -resume.

Rather than pausing the database for the duration of a full backup, various mechanisms are available to minimise the time for which updates are suspended. If using mirrored disks, it would be possible to suspend updates, break the mirror, resume updates, backup the offline half of the mirrored data and then reconnect the mirror to catch up with changes during the backup.

Some environments provide snapshot backup systems where updates can be suspended, the snapshot initiated and updates resumed. The actual backup process performed by the snapshot will handle the complexities of database updates that occur during the backup.

Regardless of the technique used, beware that suspending updates will ensure structural integrity of the saved files but will not ensure business level data integrity as the suspension may occur part way through a series of related updates. Use of transaction programming techniques will help as the suspension will occur on committal of the transaction but it is still possible that a business level transaction is formed from multiple database transactions.

8.6 Monitoring the System

QM provides several tools to aid System Administrators in monitoring the system and locating problems.

LISTU	Displays a list of users currently logged in to QM
LIST.FILES	Shows the names of all files currently open in the system. This command can also help in determining the optimum value for the NUMFILES configuration parameter.
LIST.LOCKS	Lists process synchronisation (task) locks.
LIST.READU	Lists all active record and file locks. Includes a report of who is waiting for locks. The DETAIL option to this command can also help in determining the optimum value for the NUMLOCKS configuration parameter.
FSTAT	Shows file system performance related data.
PSTAT	Displays process status information including the command or program being executed.
HSM	More useful for programmers than administrators, the **HSM** (hot spot monitor) command shows the processing time spent in each module of an application.

Releasing Locks

Sometimes a QM process may fail to release a lock. In most cases, QM will tidy up automatically if the program or process terminates but there may be times when it is necessary to release a lock manually.

Be careful to consider the implications before releasing a lock. The lock was taken to protect something from simultaneous update. Releasing a lock always carries the risk of data integrity problems.

Record, file locks and process synchronisation (task) locks can be released with the **UNLOCK** command. This command can only be executed from the QMSYS account and requires administrator rights.

Terminating QM Sessions

A System Administrator can terminate a QM session using the **LOGOUT** command. Also, the qm command has a three special options that may be of use to System Administrators.

qm -k *uid*	Kill process with QM user id *uid*.
qm -k all	Kill all QM processes.
qm -u	List all active QM processes

QM will attempt to tidy up, releasing any resources owned by the terminated process. Note that

terminating a process carries the risk of data integrity problems if the termination occurs in the middle of an update that affects multiple files.

The Windows Task Manager or the kill command on other platforms with signal number 9 (kill -9) should only be used as a last resort if **LOGOUT** fails to kill the process. QM cannot catch this event and hence cannot free resources assigned to the terminated process. If this style of process termination is used while a QM process is updating a file, loss of data could occur.

The **RECOVER.USERS** command can be used to perform a limited automated cleanup after forced termination but there are some resources that it cannot release.

8.7 Multi-Language Applications

QM includes support for text message output in multiple languages. The standard message library installed with QM contains English messages texts. Additional language libraries may be available from Ladybridge Systems or from QM dealers. Users can also perform their own translations of the source text downloaded from the product web site.

The message text source file includes comment lines detailing the rules for successful translation. It is highly recommended that users should use the two letter international country code as the language identifier in the PREFIX line (e.g. FR for French).

Having obtained a suitable set of message texts by download of a pre-translated file or by translation of the master source, this is installed by executing

```
LOAD.LANGUAGE pathname
```

in the QMSYS account where *pathname* points to the message text file to be installed. A single system may have any number of languages installed and the non-English messages will be preserved at an upgrade.

To select operation in a particular language, a QM process should execute

```
SET.LANGUAGE language.code
```

where *language.code* is the identifier used in the PREFIX line when the language was loaded. This would typically be included in the LOGIN or MASTER.LOGIN paragraph. If an application attempts to display a message for which there is no version in the selected language, the English version will be used.

8.8 Error Logging

QM includes an error logging system that records brief details of errors that may require investigation by system administrators or application developers. These include:

- Run time program errors (e.g. unassigned variables)
- User authentication errors (failed logins)
- Forced logout
- Internal file system errors.

The error log is maintained in a text file named errlog in the QMSYS directory. Although it can be written directly by programs using the sequential file processing statements, this should be avoided as the buffering used by these statements may result in lost messages. Application developers should use the QMBasic **LOGMSG** statement or the **LOGMSG** command if they wish to add their own messages to the log file.

To avoid faulty programs generating very large log files and to remove the need for file maintenance, the **ERRLOG** configuration parameter sets the maximum size in kilobytes to which the error log file may grow. When this size is reached, the first half of the data in the file is discarded. The minimum acceptable non-zero value of the **ERRLOG** configuration parameter is 10. A smaller value will be treated as 10. Setting the **ERRLOG** parameter to zero disables error logging.

Each log message consists of two lines of text. The first gives the date, time, QM user number, process id and login name of the user generating the error. The second line gives the actual message, indented by three spaces to make the file more readable. This format is easy to process using user written tools if required.

8.9 QM Command Options

The QM executable stored in the bin subdirectory of the QMSYS account has a number of command line options. The command option letters shown below are all case insensitive. Note that to comply with Linux conventions, some of the options have a double hyphen prefix.

-*n*	Logs the user in as user *n* where the value of *n* must be in the range of user numbers reserved with the FIXUSERS configuration parameter. If there is already a user logged in with this user number, the login fails. If the value of *n* is not within the reserved range, the parameter is ignored.
-A	Causes QM to prompt for the account name on entry.
-A*name*	Enters account *name* unless there is a fixed account name defined for the user name of the user entering QM. Note that there is no space before the account name.
-K *n*	Kill the QM process for user *n*.
-K *user*	Kill all QM processes for login id *user*.
-K all	Kill all QM processes.
-L	Apply a new licence.
-U	List current QM users.
-QUIET	Suppresses display of release information, etc on entry to QM. Useful in some scripted sessions.
-RESTART	Restart QM (not Windows).
-RESUME	Resume database updates.
-START	Start QM (not Windows).
-STDOUT	(Windows only) QM normally uses the Windows console APIs to output data to the screen. This option causes it to use the stdout file handle and is of use when capturing the output or piping it into other processes. It should not be used for normal terminal output as some display features may not work with this option.
-STOP	Stop QM (not Windows).
-SUSPEND	Suspend database updates.
-TERM xxx	Sets the initial terminal type. This may be changed later from within the application. If this option is not used, QM defaults to the value of the operating system TERM environment variable or, if this is not defined, vt100.
--HELP	Display usage help.
--VERSION	Displays version information.

It is also possible to execute a QM command directly from the operating system command prompt by appending it to the start up of the QM session, after any other command options. For example:

```
qm RUN OVERNIGHT
```

Note that quotes may be needed if the QM command contains any characters with special meaning to the operating system.

8.10 The qmfix Utility

The QM file system is designed to be robust, however, there are situations when power failures, hardware failures or abnormal termination of a process might lead to structural integrity problems within a file.

The qmfix utility can be used to check the structural integrity of a file and, if an error is detected, then apply an automated correction. Although qmfix should always result in the file being usable, there are error situations where data will be lost because it simply was not in the file.

To use qmfix, firstly ensure that no users have the file(s) to be processed open. It is safest to run qmfix when no users are using QM. The qmfix utility is run from the operating system command prompt, not from within QM. The command line is

qmfix *options pathanme*

where

options are case insensitive option codes from the following set:

-B	Suppresses progress bar display. This can be of use when capturing the output for later review as repainting of the progress bars may make the captured data less easy to read.
-C	Check file for errors (implied if B, F, Q and R options all absent)
-F	Fix errors without querying
-L	Log the screen output in qmfix.log
-L*path*	Log the screen output in *path*
-Q	Query before fixing errors
-R	Recover space from unused primary and overflow blocks. Occasional use of this function may improve performance of some large files.

pathname is the pathname of the file to be processed. This may be a list of may include wildcard characters. qmfix will ignore names that do not correspond to QM files. Thus, to check all files in a directory, simply type

qmfix *

Do not run qmfix with the -F option without running it to check for errors first.

Note that qmfix may report that a dynamic has an incorrect load value or record count if the file was not closed properly at a system failure. These errors are unlikely to cause any serious problems and will be corrected by qmfix if the -F option is used and automatically by select operations that complete without any intervening file updates.

No automated error recovery tool can ever be 100% accurate in its decisions about the nature of errors so there is a very small risk that qmfix could make the situation worse. **Always backup a file before fixing any errors in it.**

Ladybridge Systems aim to provide software of the highest quality. We would be very interested to receive copies of any files that are reported as faulty by qmfix so that we can investigate the cause and improve the resilience of the QM product.

8.11 The qmidx Utility

The QM file system supports alternate key indices for retrieval of data based on the content of a non-key field. Normally, these indices reside in the directory that represents the data file. This helps to ensure that the entire file and its indices are handled as one object when performing backup and restore operations

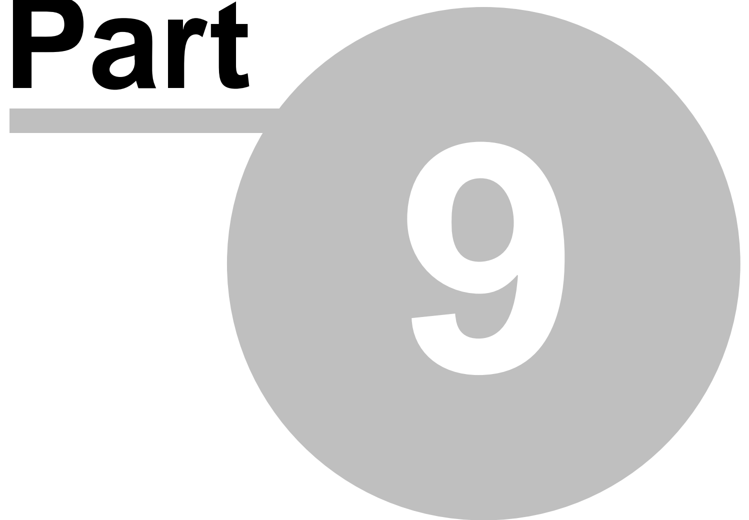
Sometimes it may be useful to place the indices elsewhere. This could be to improve load balancing across multiple disk drives or to simplify exclusion of large indices from backups since they can always be recreated from the data file. This separation of the indices from the data can be achieved using the PATHNAME option of the **CREATE.INDEX** or **MAKE.INDEX** commands when the first index is created.

The qmidx program is an operating system level command that allows users to report or modify the location of the indices. It has four modes of operation:

qmidx -d *data.path*	Deletes all indices for the named file.
qmidx -m *data.path index.path*	Moves the indices for the named file to the new location specified by *index.path*. If the index path is omitted, the indices are returned to their default location in the directory identified by *data.path*.
qmidx -p *data.path index.path*	Sets the index path for the given data file. This operation is required after use of an operating system level tool to copy or move a data file to a new location. **Failure to perform this step when duplicating a file may result in any changes to the copied file updating the indices of the original file.**
qmidx -q *data.path*	Queries the location of the indices for the given data file.

This program must only be used when the file is not in use. Failure to adhere to this rule may lead to data corruption or process failure.

Part



System Limits

9 System Limits

Maximum number of users	Determined by the licence
Maximum number of phantoms	Determined by the licence
Maximum hashed file size	16384Gb
Maximum sequential file size	Limited only by the operating system
Maximum records in a file	Limited only by file size
Maximum record key size	63 bytes, configurable to 255 bytes (MAXIDLEN parameter)
Maximum record size	A little under 2Gb or available memory space
Maximum indices per file	32
Maximum AK index key size	255 bytes
Maximum record locks	Set system wide by NUMLOCKS parameter. The upper limit is determined only by available memory.
Maximum number of open files	Set system wide by NUMFILES parameter. The upper limit is determined only by available memory. A single file opened by multiple users counts as one in this calculation.
Maximum program size	8Mb per program module
Maximum character string size	A little under 2Gb or available memory space
Maximum integer value	32 bits (2147483647). The QM run machine will switch to floating point representation for larger values
Maximum floating point value	IEEE 64 bit representation. Upper limit 2^{1024}.

Part 10

Glossary of Terms

10 Glossary of Terms

Term	Definition
Abort	An event that occurs at a major application failure. Aborts can be generated by QM internally if it detects a serious error, by application software, or by the end user (though this can be disabled). All programs, *menus*, *paragraphs*, etc active in the user's process are discarded and the user returns to the *command prompt*. The ON.ABORT *VOC* item can be used to capture this event and take special action.
Account	A collection of database *files*, programs, etc that form an application. Viewed from outside QM, an account is an operating system directory.
AK	See Alternate Key Index
Alias	A way to assign an alternative name to a command, perhaps only within specific QM sessions. For example, users migrating from Pick style environments frequently use **ALIAS** to make **COPY** run the **COPYP** command.
Alternate Key Index	An index structure that allows applications to identify all records that have a particular value in for a *secondary key* item. The index contains a list of *primary key* values for each secondary key value.
Association	The relationship between two or more *multivalued* data items where the values belong together. For example, an order processing system might have two associated *fields*, one holding a list of product codes, the other a list of quantities ordered.
Attribute	An alternative name for a *field*.
B-tree files	A file structure used to store *alternate key indices*. B-tree (balanced tree) files use an internal structure that stores data in sorted order and hence allow efficient access to ranges of *key* values.
Catalog(ue)	A repository for application programs. QM supports three modes of cataloguing; local, private and global. Local and private cataloguing normally restrict access to the program to the one *account*. Globally catalogued programs can be accessed from all accounts.
Class module	A program source module that acts as a container for persistent data definitions and public functions/subroutines in object oriented programming.
Command prompt	A prompt (a colon) displayed by the command processor when it is waiting for a command to be entered. This prompt changes to a double colon if the default *select list* is active.
Command stack	A list of the most recent commands executed by a user. The command stack editor allows a user to look back at this historic data, modify commands and repeat commands. (In strict computing terms, the command stack isn't a stack at all. It's a queue but the incorrect term is widely used.)
Common block	A block of data items used by an application that are to be shared between programs in the one user process.
COMO File	A record in a special file ($COMO) that stores a copy of all output sent to the user's terminal. **COMO** (command output) trapping is enabled/disabled with the **COMO** command.

Conversion code	A code describing how data must be transformed from its internal representation within the database before displaying it to a user. For example, dates are usually stored internally as the number of days since 31 December 1967.
Correlative	A rather limited equivalent to *I-type* dictionary items supported by QM in A and S-type items to simplify migration from other multivalue database products.
Database	A collection of data stored in a form that enables easy access to specific items.
Debugger	A development tool for debugging QMBasic programs.
Dictionary	A secondary component attached to most database *files* that contains a description of the format of *records* stored in the file and default settings controlling how the query processor will display this data.
Directory files	A simple file structure that makes use of the underlying operating system's files to represent database *records*. Directory files do not offer high performance but can be accessed from outside QM and are therefore frequently used to exchange data with other software.
Dynamic array	A character *string* divided into *fields*, *values* and *subvalues* using the mark characters. A database *record* is stored in this way but dynamic arrays can be used by application developers for other lists of items.
Dynamic file	A type of *hashed file* that automatically changes its *modulus* value to react to changes in the volume of data stored.
errlog	An error log file in the QMSYS account. QM writes entries to this log whenever an error is detected. Applications can also write to the log using the QMBasic **LOGMSG** statement.
Field	A column from the tabular representation of a database *file*.
File	A database *table*. QM supports *hashed files* for high performance and *directory files* for data exchange.
Format code	A code describing the way in which a data item is to be displayed or printed specifying, for example, the number of characters and justification.
Group	A portion of a *hashed file*. The number of groups in a file varies automatically according to the volume of data stored in it.
Group size	The size of a *group* in multiples of 1024 bytes. QM allows group size values in the range 1 to 8.
Hashed files	High performance files in which the location of a record is calculated by applying the *hashing algorithm*.
Hashing algorithm	A mathematical calculation applied to the characters of a record *key* to deduce the *group* in which that record will be stored.
Hot Spot Monitor	A tool for identifying the number of times each module of an application is executed and the processing time spent in them.
ID	Another name for the *primary key* of a record.
I-descriptor	Another name for an *I-type*.
Information style	A reference to the command and programming language style found in the Prime Information multivalue database product and others that adopt this

	style.
Inline prompt	A special syntax in a QM command that allows substitution of data into the command. Although the name implies that the construct will prompt the user for this data, there are many variants that retrieve data from elsewhere.
I-type	A dictionary item that describes a calculation that yields a result that can then be used exactly as though the value was stored in the database.
Key	A shortened term for the *primary key* of a record.
Keyword	A word or symbol affecting the behaviour of a command. Keywords correspond to K-type VOC entries.
Laws of Normalisation	A set of rules that govern the construction of relational databases. Multivalue databases discard the first law of normalisation, allowing them to store multivalued data. This results in a data model that more accurately reflects the real world than a fully normalised database, usually requires fewer tables and is quicker to develop.
Locking	A mechanism used to ensure that two users cannot update the same data item simultaneously, a situation that would usually result in errors.
Mark characters	Characters used within the QM to separate *field*, *value* and *subvalues* within a database *record* or other *dynamic array*.
Menu	A M-type *VOC* record that describes a numbered list of options to be displayed to the user. Each option would have an associated *sentence* to be executed and, optionally, some help text.
Modulus	The number of *groups* in a *hashed file*.
Multi-file	A file that is made up from multiple subfiles that share a single dictionary. For example, a sales application might have a multi-file with a subfile for each business region.
Multivalue	Breaking a simple data item (typically a *field*) into multiple instances of the same type of data.
Overflow	QM uses high performance *hashed files* in which the location of a record can be deduced from its *primary key*. If there is insufficient space to store the record at its calculated location, the file system extends the group by adding one or more *overflow* blocks.
Object	A run time instance of a *class module*.
Paragraph	A *VOC record* containing a script of commands to be executed. Paragraphs can include special commands to provide conditional execution, loops, jumps, prompts, etc.
Phantom	A QM process that runs in the background without a terminal. Phantom processes are started with the **PHANTOM** command and store a copy of all output that would normally have gone to the terminal in the $COMO file.
Phrase	A part of a *sentence*, excluding the *verb*. Phrase entries may appear in the *VOC* or in *dictionaries*. Phrases are used as short forms in commands, to set defaults for the query processor, and to link *fields* within an *association*.
Pick style	A reference to the command and programming language style found in the

	Pick multivalue database product and others that adopt this style. (The first multivalue database environment was created by Dick Pick).
Primary key	A character *string* that uniquely identifies a *record* in a *file*. QM supports keys from 1 to 255 characters in length but lengths over 63 characters require the MAXIDLEN configuration parameter to be amended.
Proc	The predecessor of *paragraphs* found in other multivalue database products and supported in QM for ease of migration. Development of new Procs is discouraged.
Process dump file	A text file optionally generated at a run time application error. This file contains a full report on the state of the application at the time of the error.
QMAdmin	A Windows graphical tool for simple monitoring of a QM system.
QMBasic	The programming language used to develop QM applications.
QMClient	An interface that allows access to QM from other languages such as Visual Basic or C.
QMFix	A tool for checking the internal structure of QM *files* after a system crash.
QMIdx	A tool for updating internal pointers if an *alternate key index* file is moved.
qmlnxd	A daemon process that runs on non-Windows system to perform background system monitoring tasks.
QMNet	An integrated component of QM that allows access to data stored on another QM server with full support for *locking*.
Record	An item stored in a *database file*. The file system accesses data at the record level. Interpretation and manipulation of the content of the record is up to the application and related system tools. A record is usually formed from multiple *fields* which may in turn be broken down into *values* and *subvalues*.
Relational Database	A style of database that represents data in the form of *tables* (relations).
Secondary key	A data item in a *record*, or a value calculated from data in the record, that is to be used to construct an *alternate key index* so that records can be selected based on this value.
Select list	A list of items, usually *primary keys*, to be processed. QM provides memory resident numbered select lists that are private to the process using them and disk based named lists that can be shared or retained for later use.
Sentence	A complete QM command or the start of one. A sentence may be typed at the *command prompt* or it may be stored in the *VOC* for later execution simply by typing the name of the VOC record.
String	A sequence of characters stored as a data item.
Subvalue	A subdivision of a *value* to represent multiple instances of the same type of data within the value. For example, an order processing system might have a pair of associated multivalued fields storing the product number and quantity for each item ordered. If it was necessary to store the serial number of each item shipped, this would be a subvalued field in the same *association*.
Table	Another name for a database *file*.

Terminfo	An internal database that stores details of the control codes appropriate to all terminal types supported by QM.
Transaction	A related set up updates to a *database* that must either all happen or none must happen.
Trigger	A user written QMBasic subroutine that is executed whenever selected operations are performed against a *file*. Triggers get their name from their use to trigger other related updates but they can also be used for data validation.
Value	A subdivision of a *field* to represent multiple instances of the same type of data. For example, an order processing system might have multiple values stored in the product number field of an order.
Verb	The command word in a *sentence*. This is always the first word and corresponds to a V-type VOC entry.
VOC	A *file* found in all *accounts* that contains a list of all the words and symbols that can be used in commands and details of how they should be processed. By changing the VOC, it is possible to extend or modify the QM command language.
Vocabulary	See VOC.

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