

QL-Paint

by Talent Computer Systems
A graphics program for the QL

Foreword

As the designers of a graphics package for the Sinclair QL we had a difficult task. The QL has a large memory and a processor at least ten times more powerful than you would find on most other personal computers. It would have been easy to fill up the memory with a huge, complex package with hundreds of different facilities. Instead, we have deliberately aimed for elegance and simplicity. We believe that good design lies not in the sheer number of facilities, but in the way a few 'key' features can be combined together to produce versatile, effective results.

Following this idea, we have deliberately restricted QL Paint to about 50 different commands. These are easily learned and quickly accessible. At first, the user is given a series of icons with drop-down menus and the appropriate command can be selected by pointing to it. At a later stage the icons and menus can be bypassed and the commands typed directly onto the keyboard. This two level approach gives the user help and support while he is learning to use the system, and the necessary speed and flexibility when he becomes proficient.

Many of the commands can be combined in sensible ways so that you have over 4000 different graphics operations at your fingertips.

Many of the features in QL Paint have not been seen in other packages - even in those for machines costing many times more. We are sure you will have as much pleasure using our system as we had in developing it.

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1 Introduction

The QL Paint graphics system is a software tool for drawing pictures on the Sinclair QL computer. QL Paint is based on the successful Panorama (H) program.

With QL Paint you can draw full screen pictures using up to eight colours. Any picture can be saved on a Microdrive cartridge, or on any other suitable device such as a disk drive. Pictures drawn with QL Paint can be incorporated into other programs: for example, as the background to an industrial mimic diagram, or an illustration to an educational program. Finally, the system includes a facility to reproduce your picture on a dot matrix printer.

This manual is divided into two sections. First comes a tutorial introduction to QL Paint. As you read it, you should try out the various commands and facilities on your QL. At the end of the first section, Mike Masters, TALENT's graphic consultant, gives hints on how to obtain top-quality professional results.

Second, there is a reference section. Like all reference charts, it states but does not explain: it is intended to provide a memory jog for someone who is already familiar with the system.

2 Fundamentals

The screen supported by QL Paint consists of 256x 256 'dots'. Each dot is called a pixel. With QL Paint you can colour each pixel individually with one of eight colours.

Each pixel has an 'address' consisting of two numbers. The screen addressing is arranged as shown in Figure 1.

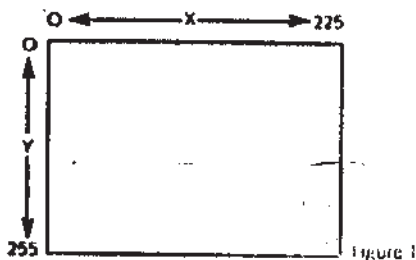


Figure 1

2.1 Starting up

This section assumes that you have read enough of the QL User Guide to know how to set your machine up and load a program from a Microdrive cartridge.

To run QL Paint you will need:

- A Sinclair QL
- A television or monitor (preferably colour)
- A blank Microdrive cartridge

Later, you may also need:

- A second Microdrive cartridge - to save your picture.

A joystick is useful but not essential.

Before running QL Paint you are strongly advised to make at least one backup copy of the program master cartridge marked 'QL Paint - Prog'.

To make a backup copy

- Switch on your QL
- Press [F 1] or [F 2]
- Load the cartridge marked QL Paint - Prog into drive one
- Place a blank Microdrive cartridge into drive two. (You don't need to use a blank cartridge as long as the write enable tag is intact and you don't mind losing any information already recorded on it).
- Type the command
`(run adv1-backup`

This will copy QL Paint from drive one to drive two. You will now have a back-up copy of the graphics program on your blank cartridge. Should the process fail for any reason, you will be given an informative message so that you can try again.

You can make as many backup copies of QL Paint as you wish. As a security measure, it is impossible to run QL Paint from a backup copy unless the original cartridge is present in one of the Microdrives. This is done by recording a secret and uncopyable password on the master cartridge. The password is repeated many times over, so that even if the original cartridge is damaged it can still be used as a 'key' for the system - provided you've made a backup!

You may wish to break the write permit tab off the right hand side of the backup cartridge to stop you from corrupting it by accident.

The second master cartridge (marked QL Paint - Pics) contains three

demonstration pictures. It also contains a backup program, and you can back it up if you wish.

Once you have made a backup the normal procedure for starting the program is this:

- Switch on your QL
- Put your backup cartridge in drive one
- Put the original master cartridge in drive two
- Press [F 1] or [F 2] on your machine

Once the program has loaded and you have been presented with the title screen, both cartridges can be removed and replaced in their holders.

If you wish to save the sketches you are preparing, you should place a fresh cartridge in one of the drives - preferably drive one.

If you have a joystick, plug it into socket CTL1 on the back of your QL.

2.2 Commands

When you load the system you are presented with a title page. On pressing any key, you get an initial screen which is black, with a white cursor in the centre.

The system responds to a number of commands which can be selected in one of two ways:

- By choosing an item on a drop-down menu
- By typing in two or three characters on the keyboard

The first method has been designed to make it easy for you to learn to use QL Paint. As you become more familiar with the system you may prefer to dispense with the menus and type in the commands yourself.

2.3 Icons and drop-down menus

Press the [F 5] key on the left of the keyboard. You will see a row of eight small pictures at the top of the screen.



Figure 2

The pictures are known as icons and refer to groups of commands within QL Paint - line drawing, colour selection, textures etc. Below the first icon on the left you will see its associated drop-down menu. Press the [→] cursor key once. You move along to the next icon in the display. The first menu vanishes and is immediately replaced by the menu belonging to the next icon. Take the cursor right along the line of icons and inspect the various menus. You will see these illustrated in Figure 3.

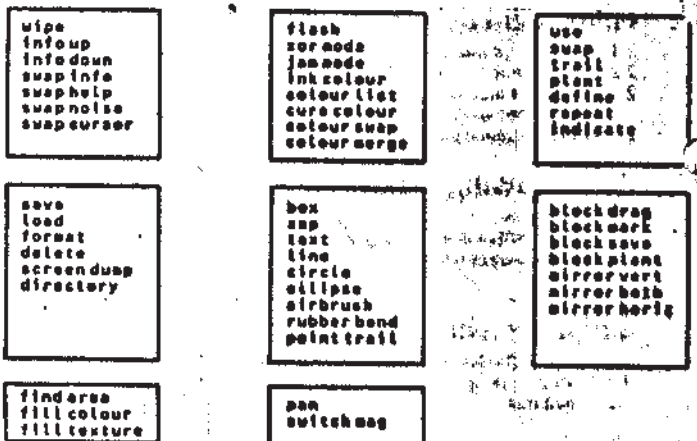


Figure 3

The cursor keys can move you forwards or backwards along the line of icons - if you go beyond the end of the line, you will 'roll-around' to the beginning of the line again.

To enter a menu, press the [] cursor once. The first item at the top of the list is highlighted. Continue down the menu and then up again, (using the [] cursor) noticing how each item is highlighted in turn. When the option you want is highlighted, press the space bar. The icon screen immediately clears and you are returned to the main drawing screen with the white cursor still exactly where you left it. Any picture being composed on the screen is not affected by calling up the icon interface.

If you make a mistake and go down into the wrong menu, you can always get out by pressing the [ESC] key once. This will take you back to the icon screen

and you can travel along to the menu you want and try again. Press the [ESC] key twice and you are returned to the main drawing screen. You should note that once you have started to highlight the items on a menu, you can only get out of the menu by taking a specific action - by accepting an item (with the space bar) or by aborting (with the [ESC] key).

When you choose certain options on the drop-down menus, you are given a sub-menu. For example, if you select colour swap, you must then choose which colours you want to swap. Figure 4 gives examples of all the sub-menus it is possible to encounter. Don't worry if they don't mean much to you at this stage. All will become clear to you as you progress through the manual.

As a general rule, commands you select via the icons and menus allow you to position the cursor where you want it after you've chosen the option. Typed commands are for those who know the system well and who want to skip this stage.

It is possible to call the icon screen and select subcommands while in the middle of carrying out certain operations. For example, while drawing a line, you can select magnification to let you position the line accurately.

Not all subcommands will work when used 'inside' other commands. If you try to select an invalid subcommand, the machine will groan at you and refuse to obey it.

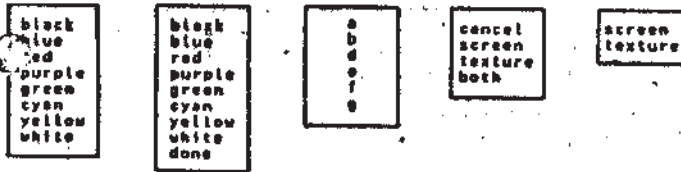


Figure 4

2.4 The accept and abort keys

The accept key (the space bar) is pressed to select an option on one of the drop-down menus. It is also used to 'freeze' a graphics operation. For example, you may want to draw a circle. You have selected the circle option, fixed the centre of the circle by pressing the space bar, and are using the cursor keys, to expand and contract your shape until it is the size you want. As soon as you are satisfied with it, press the space bar and the circle is drawn permanently on your screen.


As a general rule you can always get out of trouble by pressing the abort key, [ESC] one or more times. It sometimes happens that you select an option which you did not really want. Sometimes the machine appears to be stuck because it is waiting for you to complete a command, and sometimes it will 'groan' at you because you have made a mistake. The [ESC] key allows you to start afresh, returning you to the icon screen or to the drawing screen.

2.5 The demonstration pictures

Before continuing with this introductory manual you may wish to load and inspect some of the demonstration pictures.

There are three demonstration pictures on the cartridge marked QL Paint - Pics. They are called DEMO, ZKUL and WEST. Follow the instructions given below step by step; besides seeing the results a professional artist can achieve with QL Paint, you will also get practice in using icons and drop-down menus.

to load a picture

- Load QL Paint and remove the cartridges.
- Place the QL Paint - Pics cartridge into drive one.
- Use the [←] cursor key to move along to the  icon. The file menu will appear.
- Use the [↓] cursor key to move down the menu until you reach the load option. Press the space bar to select it.
- A sub-menu now appears. Select screen by using the [↓] cursor and then the space bar.
- A yellow window now appears. Type in the name of the picture you want to view after the nd v 1 - prompt. Use the standard QL editing sequence to edit the name if necessary ([CTRL]-[←-]).
- Press [ENTER] and wait for the picture to be loaded from the demo cartridge. Repeat the operation for each picture.

3 Basic drawing tools

3.1 The cursor

The cursor is your pencil or paint-brush. It shows the system exactly where the points, lines and areas you draw are to be placed.

You have a choice of two different flashing cursors - one shaped like a cross, and the other like an arrow. There is a third 'cursor' which is completely invisible. It is useful if you want to see how your picture looks when you take the cursor away.

Remember: in all the following sections you may choose options either via the icons and menus, or by pressing a combination of letter keys.



You can swap between three pointing cursors by choosing swap cursor on the first (or only) menu. Typing S C (Swap Cursor) has the same effect. Later when you use this command the system will move between cursor 1, cursor 2, cursor 3 (which is blank), then back to cursor 1.

The cursor can be moved about the screen by using the arrow keys on either side of the space bar. Try them now. You will see that the actual movement of the cursor is very small. Each keystroke represents a single QL pixel.

If you have a joystick, you can use it to move the cursor around the screen. Just push the stick in the direction you want to go. The fire button on your joystick is equivalent to the space bar.

You can move the cursor a number of pixels at a time by holding down the [SHIFT] or the [CTRL] key while you use the arrow keys. [SHIFT] and an arrow key move the cursor a large distance (32 pixels), whilst [CTRL] and an arrow key move the cursor a smaller distance (8 pixels).

Try running the cursor off the top of the screen. You will see the cursor appear at the bottom. This effect is called 'wraparound', and it works for left and right movement as well as for up and down.

Remember that it will sometimes be quicker to use wraparound to get from one side of the screen to the other than to use the most obvious across-screen route.

The cursor just described is sometimes called the 'pixel cursor' to distinguish it from the other types of cursor yet to be described.

3.2 The information line

In some kinds of artwork you may find it useful to have information about the exact position of the cursor, and certain other important aspects of the system. This information can be provided by a line of text. Once the information line has been switched on, it will appear whenever you are not typing a command. It contains several items of data, most of which you don't need to understand until you've read the appropriate section. Don't worry about this!

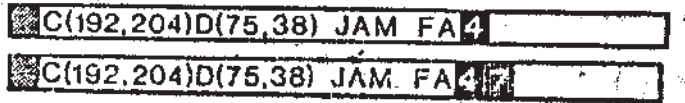


Figure 5

The information line includes:

- A block of the current ink colour. (See Section 4).
- C: the present position of the cursor, as X and Y coordinates. Note that X counts the number of pixels from the left, while Y counts the number of pixels from the top of the picture.
- D: the distance from a point you have marked as X and Y coordinates. (See Section 15.7).
- The plotting mode, as 'JAM' or 'XOR' (see Section 5).
- FA if an area has been defined (see Section 14.1) or BM if a block has been marked (see Section 12.1).
- A list of enabled colours (see Section 15.5).

Select the command swap info to switch the line on. Select swap info again to turn it off. The command can also be typed in at the keyboard with the two characters, \$ I.

You can choose whether to have the line near the top of the screen, or near the bottom. The commands you need are:

- info up (or type IU for Information Up)
- and
- info down (or type ID for Information Down)

3.3 The help command

Whenever you choose an option which requires you to carry out one or more actions, the computer will 'talk you through' the sequence with a pop-up help line. This option is switched on automatically when you load QL Paint. The help line is independent of the information line, but its position on the screen depends on whether the information line is at the top or the bottom of the screen. If you have the information line switched on, the help line appears immediately below it. As you become more familiar with QL Paint, you may want to dispense with these prompts. To do this, choose the swap help option on the first menu or type SH.

4 Simple drawing

There are many ways of drawing the elements of pictures such as points, lines, areas and so on. In every case you must begin by choosing the 'ink' colour; this is rather like the artist putting paint on his brush before making the first stroke.

4.1 Choosing colours

The QL gives you a choice of eight different colours. Each colour has its own number in the range 0 to 7. Table 1 shows the association between a number and the colour it represents:

0	black
1	blue
2	red
3	purple
4	green
5	cyan
6	yellow
7	white

Table 1

Notice that the larger numbers correspond to 'brighter' colours.

To select a colour simply choose **ink colour** on the second drop-down menu and then pick the colour you want on the following menu. If you are working without the icon screens, simply type the appropriate number. For example, 2 will choose red ink.

The cursor is always drawn in white unless you specify a different colour (see Section 15.3).

4.2 Plotting points

When you have chosen a colour, press the space bar. This will put a dot of that colour into the pixel under the cursor.

4.3 Point trail

A much faster way to draw lines is to select **point trail** on the **Z** menu, (or type PT). This is like freehand drawing — every time you move the cursor the new pixel will be changed to the current colour immediately.

You can come out of the point trail option by pressing either the space bar or the **[ESC]** key.

We shall see later that there are faster and more accurate methods of drawing straight lines.

5 Screen plotting modes: the J and X commands

In all of the examples used so far, the colour of any pixel is determined by the colour of the most recent ink used to paint it. This seems so obvious that it is hardly worth saying! This is called 'JAM' or 'FORCED' mode. However, there is another mode for colouring pixels on the screen. This is called the XOR mode (pronounced 'EXOR'). With this mode, the new colour depends on the old colour as well as the colour of the ink, but not in the way you expect! The full details are given in Table 2.

INK	black	blue	red	purple
OLD COLOUR				
black	black	blue	red	purple
blue	blue	black	purple	red
red	red	purple	black	blue
purple	purple	red	blue	black
green	green	cyan	yellow	white
cyan	cyan	green	white	yellow
yellow	yellow	white	green	cyan
white	white	yellow	cyan	green

INK	green	cyan	yellow	white
OLD COLOUR				
black	green	cyan	yellow	white
blue	cyan	green	white	yellow
red	yellow	white	green	cyan
purple	white	yellow	cyan	green
green	black	blue	red	purple
cyan	blue	black	purple	red
yellow	red	purple	black	blue
white	purple	red	blue	black

Table 2

This table shows that if — for example — you paint a red pixel with yellow ink, you get green. As you will see, mixing black with any colour gives that colour, but mixing any colour with itself gives black! You will have to accept that the rules for mixing electronic paints are simply different from those which you may have learned with the real thing! In particular, if you paint over an area the second time with the same colour (using XOR mode) the first picture reappears.

Select XOR mode on the menu (or type X) and then try the following experiment.

Set the ink to yellow (colour 6). Construct a solid rectangle by plotting a series of horizontal lines, one below the other. It is easiest to use **point trail**. As you would expect, the rectangle will appear in yellow. Now change the ink to red (colour 2) and draw some vertical bars over your box.

Notice that, where the lines intersect, another colour becomes visible (green, colour 4). This is in keeping with the entry for yellow and red in the table.

You can now demonstrate one of the more interesting properties of the XOR mode. With the ink still set to red, go back and redraw over the red lines you have just put on the screen. You will see that the lines are 'erased' and the previous pixels of the yellow box, which were obscured by the green lines, are again revealed!

You have just shown that if you carry out an operation on the screen in the XOR mode, and then repeat exactly the same operation, the screen reverts back to the original picture. This is true no matter how complex an operation you carry out. You will often be able to use this knowledge to your advantage.

To switch the system back into the JAM mode select **Jam mode** on the menu or type J.

6 The box cursor and the box command

Some of the commands in QL Paint work on a rectangular area rather than a single pixel. The cursor used for these commands is called the **box cursor**.

To make a box cursor, move the pixel cursor to the top left of the screen and then choose the **box** option or type the **code** and **BO** (short for **BOX**). Now move the cursor down and to the right. As you do so you will see the pixel cursor being followed by an 'elastic' box. If drawing the box is just what you want to do, press the space bar and the box will be left on the screen. Alternatively, you can get rid of the box by pressing the **[ESC]** key.

7 Magnification

The QL screen has very small pixels even in its eight colour mode. It can often be difficult to position the cursor exactly.

To overcome this problem, a magnification facility has been provided. Choose the **switch mag** option to turn it on. If you are typing directly on to the keyboard, the command **SM** (which stands for **Switch Magnification**) gives an enlarged picture of the area surrounding the cursor.

With magnification on, you will see how large the cursor has become. The 'gap' in the cursor still refers to a single pixel.

You can return to a normal picture by selecting the **switch mag** option or by typing **SM** again.

Magnification can be switched in and out at any sensible time — even in the middle of other commands. Occasionally the system will revert to an unmagnified picture automatically.

The screen magnification is 16 times, and only a small section of screen can be seen at any time. You can move about the magnified screen. Place the cursor at the point you wish to become the new centre of screen and type **PA** (for **PAUSE**). The entire screen will be panned accordingly. You may use **PA** whenever the magnified screen is on. The command has no effect on an unmagnified screen.

For technical reasons there may be a short delay before a cursor movement or any other change is fully reflected in the magnified picture. This delay will never be more than half a second.

The QL screen format is unusual in that it is possible to plant pixels right up to the edge of the screen — there is no need to have a screen border. However, depending on the TV or monitor you are using, it may not be possible to view the entire picture on the screen at one time.

Near the edge of the screen the cursor is treated in a special manner to help you to position it accurately. This is particularly noticeable on the magnified screen.

As you approach one of the edges of the screen, the limbs of the cursor slide 'under' the edge. The cursor —, positioned at the left-hand edge, will appear as —. It is treated similarly at the top, bottom and right-hand edge of the screen.

8 Clearing the screen

At any time, you can clear the entire screen by using the **wipe** command on the first menu. The sub-menu will ask you whether you want to clear the screen or the texture screen or both. Since this manual hasn't yet dealt with textures, choose the first option and the screen will be wiped clean. The command works by turning every pixel black, thus destroying any existing work on the screen.

Some of the QL Paint commands are 'irreversible' because they can destroy a lot of work very quickly. If you are typing them directly onto the keyboard you must include an asterisk in the name — this makes it more difficult to type them by mistake. The command for clearing the screen is **W* S***, for wiping the texture

screen, **WT** and for clearing both, **WB**.


If you start typing a command, such as **WS**, which you then decide to abandon, just press the **[ESC]** key.

9 Drawing and erasing lines

All of the line drawing commands work equally well in either **JAM** or **XOR** mode. This makes it possible for you to draw a trial line with **XOR** mode selected. If you do not like the result you can repeat the command to put the screen back as it was.

9.1 Drawing a straight line

The **Line** command is used to draw a straight line. To draw a line:

- Select an ink colour
- Choose **Line** from the  menu, and then, in response to the prompts, take the cursor to one of the end-points of the line.
- Move the cursor to the other end-point and press the space bar.

The system will draw a straight line between the two points you have chosen. The line can be at any angle, and in any colour, but if it is almost horizontal or almost vertical, it will appear rather jagged. This is a limitation of all computer displays which use rows of pixels.

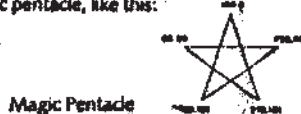
You can also select the line-drawing command by typing **LI**. The computer will assume that the first cursor is positioned exactly where you want it so do this before you type the command.

As a general rule, all commands you select via the icons and menus allow you to position the first cursor where you want it after you've chosen the option. Typed commands are for those who know the system well and who want to skip this stage.

Remember that if you press the **[ESC]** key after choosing **Line** or typing **LI**, but before pressing the space bar, you will cancel the line drawing process.

If you are drawing a series of lines you wish to be connected, you will have to select **Line** (or **LI**) at the first point, the space bar and **Line** (or **LI**) at the intermediate points, and the space bar by itself at the last one.

Clear your screen and draw a magic pentacle, like this:



9.2 Rubber banding

The rubber band is also used to draw straight lines between points, but in a different way. As you move the cursor, a 'rubber band' will follow you, indicating the course of your proposed line.

To draw a line, select **rubber band**. In response to the help prompts, put the cursor on one end of the line and press the space bar. This 'anchors' one end of the line. Then move the cursor to the other end point. As you go, you will see a line following you from the anchored end. The line is drawn in white and uses the **XOR** mode. When you have positioned the line just where you want it, press the space bar again. The line then changes into the current ink colour and mode (**JAM** or **XOR**).

When typing directly onto the keyboard, first position the cursor at the start point and type **RB**. Then move the cursor to the other end point and press the space bar when the line has been drawn correctly.

Since the trial line is drawn in **XOR** mode you can move it over detail already present on the screen without destroying anything. It is only when you terminate a rubber band command that the line is drawn permanently.

Occasionally you may wish to abandon the current rubber banding operation without drawing any lines. You can do this by pressing the **[ESC]** key.

Remember that it is possible to select and deselect magnification during rubber banding. This will help you to position the cursor accurately.

Rubber banding is much easier to experiment with than to describe. Make up and try out a few experiments for yourself.

9.3 Circles

To plot a circle, choose the **Circle** command. In response to the help prompts, put the cursor on the centre of the circle you want to draw and press the space bar. Then move the cursor to any point on the circumference. As you move the cursor you will see a white 'rubber' circle follow you, just like the band in the **RB** command. This will help you to position the circle just where you want it. When you have got the position right, press the space bar and the circle will be drawn permanently, in the selected colour and mode. The cursor will return to the centre of the circle. This can be useful when drawing concentric circles.

When typing directly onto the keyboard, first position your cursor at the centre of the circle and then type **C**. Moving the cursor creates a rubber circle which you

can 'freeze' with the space bar.

As always, you can abandon the circle drawing command by pressing the **[ESC]** key. The trial rubber circle will vanish.

Magnification is disabled whenever you enter the circle drawing mode.

9.4 Ellipses

Drawing an ellipse is similar to drawing a circle, but requires an extra step. The help line will prompt you through the sequence.

- Select **ellipse** on the drop-down menu.
- Put the cursor in the centre of the ellipse and press the space bar.
- Move the cursor by a distance which specifies one of the radii of the ellipse and hit the space bar. The cursor will then automatically return to the centre.
- Move the cursor anywhere you want. The ellipse you are defining will grow and follow it. When the ellipse is correct press the space bar and it will be drawn permanently. Alternatively, you can cancel the command with the **[ESC]** key.

When typing directly onto the keyboard, first position the cursor in the centre of your proposed ellipse and type **EL**. Then move the cursor out to one of the radii of the ellipse and press the space bar. Now move the cursor in any direction and the ellipse will grow and follow you. You can 'freeze' it with the space bar.

Magnification is disabled whenever the system is drawing an ellipse.

9.5 Erasing lines

You can use the **zap** command to change the colour of segments of lines. In the specific case where a line is drawn over a single colour background, the command will let you delete sections of a line.

Select **zap** on the menu and, in response to the prompts, take the cursor to the line you want to remove. Choose the new colour for the line on the sub-menu. The system will change the colour of the line until it comes to one of the following:

- the end of the line
- the edge of the screen
- a junction where the line splits into a number of parts

A line is taken as any unbroken sequence of pixels of the same colour running in any direction.

To give an example, suppose you want to plot a straight line with a large circular kink in it, like this:

One simple way to get this figure is to plot a line and a circle, and then use **zap** to erase the two unwanted segments:

When typing directly onto the keyboard, use the command **ZA**, first placing the cursor on the line you want to remove. Then type the new colour number.

10 The airbrush

The airbrush is an alternative to a paint-brush. It produces a splattered circular pattern in a slightly haphazard way — rather like the spray produced by an almost exhausted aerosol. Because of the randomness in an airbrush, it is possible to merge a number of colours, without producing a 'hard' line.

The airbrush can be switched on by choosing **airbrush** on the **Z** menu. When the airbrush is enabled, the system behaves just as in the point-trail mode, but instead of colouring individual pixels and lines the machine will leave a swathe of splattered ink.

The keyboard command is **A**. It is switched off by pressing **[ESC]** or the space bar.

You should normally select **JAM** mode before using the airbrush. If you wish to produce a solid pattern you will need to move the brush over the same area a number of times. Use **XOR** mode to produce a less dense airbrush.

11 Set flash: the FL command

QL Paint gives you direct access to the flash features found in the **QL** hardware. These flash features are limited to horizontal sections of a row of pixels — individual pixels cannot be flashed. However, flash can be used to give interesting effects.

Try the following experiment to demonstrate the effect of flashing.

- Select yellow ink (colour 6).
- Move the cursor to a point and press the space bar.
- Choose the **Flash** command or type **FL**.

Press the space bar.

Now move the cursor away from the point you planted. You will see a yellow horizontal flashing line appear.

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Notice that the line is non-destructive. When 'on' all detail beneath the line is obscured; but when 'off' the underlying picture reappears.

Move the cursor onto the yellow line and select **f l a s h** again. Now as you move away, you will see that you have reduced the length of the flashing line.

To make full use of flashing, it is best to understand something about the internal mechanism of the computer. As you probably know, the QL draws the picture on the screen as a series of 256 horizontal lines, working from left to right and from the top down. Each line is a row of 256 pixels. The entire picture is drawn afresh fifty times a second.

The **f l a s h** command makes the system attach a special 'flash' marker to the pixel under the cursor. As the computer is drawing a line of pixels it may come across one that has been marked to flash. At this point it switches on the flashing, and keeps it on until either it meets another marked pixel or it comes to the end of the line. This means that one marked pixel can cause a whole row to flash.

Since flashing lines can make it difficult to edit a sketch it is advisable to make setting flashing pixels the last step you carry out on a picture.

The cursor will interfere with flash bits on the screen. You can use this knowledge to your advantage to position the cursor accurately.

Flashing is disabled on the magnification screen, to make editing pictures easier.

12 Rectangular areas

A useful feature of QL Paint is the ability to define an area so that it can be filled with texture or colour. Areas can be either rectangular, or irregular. This manual considers rectangular areas first.

12.1 To mark a rectangle

To carry out an operation on a rectangular area you must first identify the block of interest. To do this, use the **b l o c k m a r k** command to put a box cursor round the area. The keyboard command is **BM**.

The box cursor will disappear as soon as you press the space bar to accept the area, but the system will make an internal memo of the area you have outlined. You can verify this fact by choosing **f i l l c o l o u r** (or **FC**). Your selected area will be filled with the current colour. More detail about the **f i l l c o l o u r** command will be given later.

12.2 To save a block

Sometimes it is useful to be able to take a copy of a section of screen. Before any of the following commands are used you must identify the block and store it using the **b l o c k s a v e** command (or type **BS**).

This command is used in the same way as **b l o c k m a r k**, except the area marked is copied into an internal buffer. The copy is safe against damage by every subsequent command, with the exception of another **b l o c k s a v e**. For example if you save a block, and then clear the screen with **W S ***, the block will still be retained.

On an unexpanded QL the **b l o c k s a v e** command uses a buffer of limited size (about 4000 pixels). Furthermore only one block can be remembered at any one time, no matter how small it may be. When you use the **b l o c k s a v e** command you will be given the box cursor to mark the area you wish to preserve. If the area you try to outline is too big for the internal buffer, the cursor will refuse to move and the machine will groan at you.

The **[ESC]** key can be used to leave the **b l o c k s a v e** command without storing a new area.

12.3 To plant a block

The command **b l o c k p l a n t** lets you make a copy of the area you have saved with **b l o c k s a v e**. For example, if your picture is to consist of a row of houses you could draw one in great detail and copy the drawing over and over again.

To plant a saved block, select **b l o c k p l a n t**, then move the cursor to the top left-hand of the position you wish to place the copy and press the space bar. The saved block will be repainted at the current position. The keyboard command is **BP**.

The **IAM** and **XOR** modes of operation also apply to this command. For example, select **XOR** mode and plant a block into an area of the screen which already has some detail. If you select **b l o c k p l a n t** again, the block will be removed, and reveal all the detail which used to be underneath it. If you had chosen **IAM** mode, the new block would have been planted on the screen and the previous detail would have been lost.

12.4 Mirror horizontal

This command — (keyboard command, **MH**) — is similar to block plant, except that the copy is drawn upside-down, reflected about a horizontal line. Notice that the copy is reflected, not rotated.

12.5 Mirror vertical

This command, (keyboard command, **MV**) is similar to mirror horizontal, except that the block is reflected in a vertical line.

12.6 Mirror both

This command (keyboard command, **MB**) will replant an area of screen after rotating it by 180 degrees.

12.7 Moving a block

The **b l o c k d r a g** command (keyboard command, **BD**) is used to move parts of the picture about the screen, while leaving all other areas stationary. For example, you might have drawn a bird too high in the sky. **b l o c k d r a g** will let you bring it nearer the ground.

Before you use **b l o c k d r a g** you must first identify the area you wish to move using the **b l o c k s a v e** command. The block should contain only the object you wish to move.

Once the area has been saved, the **b l o c k d r a g** command will replant a copy of the area at the current cursor position and replace the old area with the current ink colour.


Later on, you will see some more sophisticated ways to move sub-sections of the screen.

13 Textures

QL Paint provides you with powerful and sophisticated methods of filling areas with colours and textures.

In this manual, the word 'texture' is given a special technical meaning. It is an area, usually rectangular, filled with any pattern you choose. As we shall see, such a pattern can be used, in various ways, to fill up whole areas of the screen no matter what their shape and size.

At any one time there can be up to 26 different textures defined in QL Paint. They are known by the letters of the alphabet a to z.

Most of the texture commands can be found on the  drop-down menu. When typing directly on to the keyboard nearly every texture command starts with a **T**. Many of them finish with the name of the texture referred to — a single letter.

13.1 Texture screen

Many artists keep pads of scrap paper on which to scribble, and to try out patterns and colour effects before putting them into the picture being painted. In the same way, QL Paint gives you an alternative area of screen in which to define textures, to try out sketches, or just to doodle harmlessly. This area is totally distinct from any drawing you may have on the main screen.

Before going any further, clear the screen, and draw four or five vertical lines down the length of the screen.

Now select **s w a p** on the texture menu. The keyboard command is **TS**. Textures are now available on the screen, but the area being masked, and replaced by a blank screen. Do not worry, your original screen has not been lost — simply replaced with a doodle pad. The single horizontal line near the middle of the screen shows the divide between the texture screen and the drawing screen.

Now move to the bottom half of the screen and draw some horizontal lines in it. If you now choose **s w a p** or type **TS** again, the texture screen will disappear and be replaced by your original picture. As you can see, no damage has been done.

Put the texture screen on once more and notice that your previous doodles have reappeared.

Apart from showing you where the texture screen begins, there is no special meaning to the horizontal line. With a few exceptions, commands will work above and below the line. Thus, if you want, you can draw a line from the normal screen straight through to the texture screen. For the most part such operations are unlikely to be useful but, so as not to limit your ingenuity we have permitted commands to cross this line. All exceptions will be described.

We are now going to define a simple texture.

13.2 Texture definition

Any rectangular area of the texture screen can be identified as a texture. As a simple example set up a **32 x 32** square of red (Colour 2) pixels.

A quick way to do this is:

- Switch on the texture screen with **s w a p** — (or type **TS**).
- Select **IAM** mode (or type **J**).
- Select red ink (colour 2).
- Mark a rectangle with **b l o c k m a r k** (or type **BM**).

7
Fill it with colour with `fill colour` (or type `FC`).

Next select a part of this block and define it as a texture. Select `define` on the texture menu and a sub-menu will appear listing the letters of the alphabet, `a` to `g`. Choose `a`. Move the box cursor to one diagonal of your red texture block and press the space bar. Then move the cursor right and down a bit. Make your rectangular block 10×4 pixels (say) and press the space bar. This completes the command and leaves texture 'a' defined as a 10 by 4 block of red pixels.

You can call this command from the keyboard using `Tb` which will work with any letter of the alphabet and is not limited to the first seven letters. For example, `Td q` defines texture 'q'. If you redefine a texture, the old definition will be lost.

The command `Tb` calls up the texture screen if it isn't already there.

Although we have given you a simple example, there are no restrictions whatever on the complexity of textures. For example you could have a texture with a picture of a bird, or even a tartan texture. If you feel so inclined, you could set up `QL Paint` to draw instant pictures of Scotsmen from any of 26 different clans.

When you have defined a texture the system will set it up as the 'current texture' for use with other texture commands.

13.3 Texture trail

Switch the texture screen off with `swap` or `TS` and then select `trail` on the same menu (keyboard command is `TT`). A rectangular red blob will appear under the cursor.

Move the cursor about the screen and you will see a swathe of red. The texture you have defined is being used as the paintbrush. Every time you make a cursor movement, a copy of the texture is planted and the cursor is moved the size of the texture block in the appropriate direction.

When you have finished experimenting with this command you can come out of it by pressing the space bar or `[ESC]` key.

Remember that `JAM` and `XOR` modes also apply to texture trailing. You can create some very interesting effects by `XORing` different textures on top of one another.

As always, you can switch between `JAM` and `XOR` mode while you are in texture trail. You can also enable and disable magnification.

If you define a rectangular area of background colour, you can use it in `trail` (`TT`) mode as an eraser.

13.4 Planting one block of texture

The `plant` command (keyboard command `TP`) will put a single block of the current texture so that its top left-hand corner coincides with the current cursor position. This command is useful for filling small regular areas, or for dropping single items in particular places. For example the texture might be a sketch of a tree, and you could plant a tree anywhere on the screen using `plant`.

13.5 Texture information

If you are using many different textures, you may find it hard to remember the area associated with each one. The system provides you with the `indicate` command (`TI` on the keyboard). This command will switch on the texture screen if it isn't already on.

When `indicate` is selected, a box will appear around the area of screen which is the current texture. If you type a letter (`a-z`) the box will move to that texture.

If you press the space bar you will leave `indicate` mode and the last texture you examined will become the current texture. If you press the `[ESC]` key you will leave the `indicate` mode without changing the current texture.

13.6 Selecting textures

When you define a new texture it automatically becomes the current texture.

You will sometimes want to return to a previous texture. The `use` command (keyboard command `TU`) selects a previous texture.

`use` must always be followed by the one-letter name of the texture. The sub-menu gives you letters `a` to `g`, but of course you can specify other letters if you are using the keyboard.

If you can't remember which texture to choose, select `indicate` to remind yourself.

13.7 Texture repeat

Until now each texture trailed or planted with the `TT` command caused the cursor to move a distance determined by the size of the texture block.

If you wish, you may specify the step distance for a texture trail. This will give you control over the distance the cursor moves whenever a texture block is planted.

To set a step size for a texture use the `TR` (Texture Repeat) command. `TR a` sets the step size for texture `a`, `TR b` for texture `b`, and so on.

When you give the `TR` command you will be shown the rectangular cursor. Use it

to outline the repeated step size. Press the space bar when you have selected the step size you want.

The `TR` command can be used whether the texture screen is on or off. You do not need to have the cursor on or near the texture of which you are defining the size. This lets you set up a step distance which relates to some other area or shape. The only restriction is that the size of the step must be equal to or less than the original size of the texture, in both directions.

When you have defined a step distance for a texture, try the `TT` command and see the result.

13.8 Texture definition revisited

Now you have been introduced to the texture commands, you should look at the following points of detail:

A 'texture' is defined as an area of the texture screen. If that area is altered after a texture has been set up, then the texture definition itself is altered.

This means that there is no need to redefine a texture just because you have modified it slightly - of course there is no harm in doing so.

Similarly there is nothing special about an area of screen which holds a texture. For example you may define one texture to overlap with another, or to be a part of another.

Notice that almost all of the `QL Paint` commands are available for use on the texture screen.

Thus you can use `trail` to construct a larger texture out of existing textures. You can also use `switch mag` to zoom in on sections of the screen.

Occasionally you might find that you have created an interesting pattern on the full screen, and you would like to use this pattern as a texture. You can use the `block save` (`BS`) and `block plant` (`BP`) commands to take a copy of a pattern and plant it onto the texture screen.

At first, using textures may seem rather complex. You will soon get used to them, and find them a powerful, flexible and rapid way of painting complicated pictures.

Remember that a texture can be used as a paintbrush with the `trail` (`TT`) command. This lets you paint areas in stipple, or patterns or even tartan.

13.9 Sample textures

One of the files on the `QL Paint-Prog` cartridge - `TEXTURE` - contains nothing but a block of 64 assorted textures. To use any of these textures, load the textures using the file commands described in Section 16.

Now you can define as many of them as you wish.

14 Filling enclosed areas

Before proceeding with this section, please set up a small texture definition as texture `a`. Put in as much detail as you wish.

14.1 To mark an enclosed area

The `find area` command is used to mark an area which consists of pixels of a single colour. The area is bounded either by the edge of the screen, or by any pixels which are not of the same colour as the one under the cursor when the command is invoked.

To mark an area, put the cursor anywhere inside the area you wish to mark, and select `find area` (keyboard command `FA`) then move to the area you want to fill, and press the space bar. You will see the area 'flood' with the inverse of the background colour. When the area has been filled, the tide runs out leaving the area empty. However, the exact shape of the whole area is remembered by the system.

Take great care in creating an area to be marked, since if even one pixel is missing from the border, the colour will leak out and flood the whole screen. If this happens, cancel the command by holding down the `[ESC]` key. Repair the breach, and try again. Because of the possibility of a breach, magnification is disabled when the `find area` command is used.

The `find area` command is rather like `block save`: in both cases, the system remembers the exact shape and position of a screen area.

If you switch on magnification, the record of the shape of the area is lost.

14.2 Filling an area with texture

Once an area has been marked, the `fill texture` command will fill it with the current texture.

To illustrate the command, begin by filling a rectangular area with a texture. Clear your screen and mark a rectangular block (using `block mark` or `BM`). Now select `fill texture` (keyboard command `FT`) and the area will be filled with copies of the texture you defined at the beginning of this section.

Carry out some more experiments and see if you can draw a brick wall using texture and fill.

8

The XOR and JAM modes work with the fill texture command in their usual way. Some interesting effects can be achieved with the XOR mode by repeatedly filling an area with different textures.

Now clear your screen and try the following experiment:

- Draw two circles, one inside the other.
- Put the cursor between the circles and type find area. The ring-shaped area between the circles will be marked.
- Select the command fill texture. You will see the ring-shaped area fill up with your selected texture.

To consolidate the ideas explained in this section, draw a few more shapes, and fill them with various textures.

14.3 Filling an area with colour

The fill colour command (keyboard command FC) is similar to 'fill texture', except that it fills the selected area with a solid colour. The colour used is the one currently selected.

Colour fill works even when you have filled an area with one or more textures. You can create interesting patterns by:

- filling an area with texture
- selecting a colour
- selecting XOR mode
- selecting the command fill colour which will recolour an area.

If you make a serious mistake in filling an area, such as choosing the wrong texture, there are two options available

- select JAM mode
- select, but do not define, another texture
- select fill texture again

OR

- select JAM mode
- select a colour
- select fill colour

The former sequence will refill your area with a new texture, the latter will recolour the entire marked area.

It is important to note that the texture command is 'pitch matched'. That is to say, if you find several adjacent areas with the find area command and fill them with the same texture, the patterns connect up correctly like matching wallpaper. If you do not wish the textures in adjacent areas to meet in this way, define a second texture which overlaps the first, and fill the area with this new texture.

15 Miscellaneous commands

15.1 The text command

You will sometimes want to label a picture with letters or words. If you choose text (keyboard command TE), most symbols you type on the keyboard will appear in the picture. The help line will prompt you on where to place your first character which will appear just above the current cursor position.

You can use upper and lower case letters as well as digits and mathematical symbols. Characters are printed using either XOR or JAM mode. If you are using XOR mode the QL deletes sequence ([CTRL]-[←]) will remove any characters you type incorrectly. There is no easy way to remove characters written on the screen in JAM mode.

A line of text must be ended with [ENTER] or the [ESC] key. The space bar, which terminates most commands, does not work in this context.

A text command can only fill a single line with text. There is no automatic way to wrap onto the next line. Once a line has been filled, the system will groan at you if you try to enter more text without finishing the command and moving the cursor to the beginning of the next line. Since text appears just above the cursor, and the minimum letter height is eight pixels, the cursor must be below the 9th row of pixels before the text command can be used.

The attributes of height, flash and underlining can be controlled. As you type your text, the following keys are specially detected.

- [CTRL] and [H] switch height
- [CTRL] and [F] switch flash
- [CTRL] and [U] switch underline

Each time you type one of these characters the previous state is changed or

'toggled'. Thus the first time you type [CTRL] and [H] you will get double height characters. The next time, you will make the characters go back to single height. The same applies to the other two properties.

If you select double height characters and try to place them too near the top of the screen, the machine will groan at you.

The text command always starts with small, non-flashing, non-underlined characters.

15.2 Colour swap

By now you will have seen that the QL Paint system supports eight colours. The colour swap command (keyboard command CS) brings up a sub-menu, listing all eight colours. This allows you to swap a pair of colours in a selected part of the screen (the rectangle defined by the most recent use of the box cursor). For example, you can turn green pixels white while at the same time turning white pixels green. If you want to swap a number of colours you must use the colour swap command several times - once for each colour pair.

colour swap requires you to select two colours from the sub-menu. Move to one colour and press the space bar. The colour will be marked by an asterisk. Move to the second colour, press the space bar again and the command will be carried out.

If you are using the keyboard, you must choose two digits to follow the command CS to identify the colours to be swapped. The digits are those used to select the ink colours. Thus CS07 will turn all white pixels black, while changing all black pixels to white.

If you press the [ESC] key at any time before entering the second ink colour, the command is aborted.

15.3 Cursor colour

Initially the cursor appears white on a black background. The cursor colour can be changed by use of the cursor colour command (keyboard command CC).

This command is followed by a sub-menu listing the eight available colours with an asterisk against the current used colour - which, if you haven't used this command before, will be white. On the keyboard CC followed by an ink number will change the colour of the cursor. It is possible (if strange) to set the cursor to the same colour as the background. In this case the cursor will become invisible. It is possible to change the cursor colour at any time - even in the middle of other commands. For example, if you have started to draw a line using rubber banding, you can change the colour of the cursor before fixing the line with the space bar.

15.4 Colour merge

It is possible to merge two colours with the colour merge command (keyboard command CM). Like colour swap, colour merge requires two colour choices. If you are using the keyboard you need to enter two digits indicating colours. All pixels of the first colour are turned into the second.

As with colour swap, the change to the screen is limited to the area defined by the last use of the box cursor.

15.5 Colour lists

A sophistication in QL Paint is the ability to associate a colour list with the texture and block commands. The basic commands work on all colours of a block or texture, but a colour list permits you to specify that only some colours on a block or texture are to be used.

Here is how you set up the colour list.

Choose the command colour list. You will then get the sub-menu which will give you all eight colours, ending with the word done. The colours already in the list are marked with an asterisk. If you move to a marked colour and press the space bar, the colour is removed from the list and the asterisk disappears. If you move to a colour without an asterisk and press the space bar the colour is put into the list. You can change your mind as often as you like. When you are satisfied with your choice, select done and you will be returned to the main drawing screen.

The keyboard command is CL+. This puts all colours into the colour list - the initial setting. Likewise, CL- removes all colours from the list. In this latter case the texture and block commands will appear not to work at all.

You can add and subtract colours from the list using the separate commands + and - both followed by digits. + and a digit will add the selected colour to the colour list, while - and a digit removes a colour from the list. Do not preface these commands with CL as they will then add or remove all colours as detailed above.

To see the effect of the colour list command, define a texture which is a pair of concentric circles on a black background. Colour the circles differently - perhaps red (colour 2) and blue (colour 1). Ensure that the texture you have defined incorporates both circles. Now return to the normal screen and fill a rectangular area in yellow. If you place the cursor in this area and select texture trail, you will see that the entire (rectangular) texture is planted in the yellow box. Draw the yellow box again, and remove the black colour from the colour list (-0). If you repeat the texture trail (TT) experiment you will now see that only the circles are planted - there is no hint of a rectangular box.

By using a combination of a texture definition, a texture repeat and the colour list it is possible to produce paintbrushes with defined widths and shapes. Try this

experiment

- Create the shape shown below using rubber banding



- Fill the shape with red ink



- Define it as a texture



- Set the texture repeat distance as the actual width of the brush



- Select only red ink for use with the colour list
- Call the TT command.

You will have a red angled paintbrush. Vary these operations to obtain more complex shapes and widths of brush.

15.6 Swap noise

The `swap noise` command allows you to control the noise response generated by the system. By default the system generates a blip to confirm a correct command and a groan to signal an error. You can change the response to any of:

- 1 Both noises
- 2 Groans only
- 3 No noise

Each time you issue the `swap noise` command the system moves to the next state, with 1 coming after 3. The keyboard command is `SN`.

15.7 The ruler

You saw earlier that the system provides a `delta` command. This gives you the effect of a measure or ruler.

- Switch on the information line
- Move the cursor to any position on the screen
- Type '.' (dot)
- Now move the cursor


You will notice that the `D:` coordinates on the information line reports the difference between the cursor position you marked with the '.' and the current cursor position.

16 Saving and restoring pictures

QL Paint lets you save your artwork on Microdrive cartridge or floppy disk so that you can bring it back later.

Normally you will save onto a Microdrive cartridge. The system has been set up to make this the default device. However if you want to send your pictures over the network terminals or to some other device you may do so.

16.1 Using icons and menus

The  icon gives you a set of file handling commands, `save`, `load`, `format`, `delete` and `directory`. Both `save` and `load` will bring down sub-menus asking you to specify whether the command refers to the screen or textures. When you have made your selection a special file menu appears.

A. Saving a picture

Choose the `save` option on the drop-down menu and then specify screen or textures on the sub-menu. The file menu then appears:

```
Save screen
Name: mdv1_
```

Make sure that a freshly formatted Microdrive cartridge is in drive one (you can format a Microdrive cartridge from within the program as detailed below) and then enter the name of your picture/file at the keyboard. You can give it any name you like.

```
Save screen
Name: mdv1-plan
```

When the file name is typed in correctly, (use the standard QL editing sequence of `[CTRL]-[←]` if necessary), press `[ENTER]` and your picture will be saved on to Microdrive 1. You can of course specify Microdrive 2 - change `mdv1_` to `mdv2_` - by deleting with `[CTRL]` and `[←]` and typing in the new number - or your disk drive by specifying the appropriate name, such as `fdk1_`.

Saving `screen` saves the current sketch only. If you were to switch your computer off, all the texture definition information is lost.

Saving `texture` saves the current texture screen only.

B. Loading a picture

Choose the `load` option on the drop-down menu and then select `screen` or `textures` on the sub-menu. The file menu then appears:

```
Load screen
Name: mdv1_
```

Change the destination name if necessary, enter the name of the picture you want to load in response to the prompt and then press `ENTER`.

Loading `screen` loads a screen picture only. This file should have been made by the `save` and `screen` options.

Loading `texture` loads a texture screen only.

C. Formatting a Microdrive

QL Paint allows you to format a Microdrive cartridge while you are running the system. This is useful if you forget to have a blank one handy. Choose the `format` option on the menu.

```
**FORMAT DRIVE**
Hit 'S' to confirm!
```

The file menu asks you to press a key to confirm this choice, since formatting a drive is an irreversible action. When the formatting is complete you will be told how many good sectors there are on a cartridge. It is recommended that new cartridges should be formatted at least five or six times before they are used to store your files.

The result of the format is shown in the window and gives you the total number of good blocks on the cartridge.

D. Deleting a file

To delete a file, select the `delete` option.

```
**DELETE FILE**
Name: mdv1_
```

In response to the prompt, type in the file name and press `[ENTER]`.

E. Displaying a directory

This option allows you to inspect the directory of a Microdrive cartridge. Select the `directory` option and change `mdv1_` if necessary on the file menu. Then press `[ENTER]`. The contents of the directory will be displayed. If the list of files takes up more than one screenful, you will see the word 'more'. Press any key to see the next page.

General notes on file commands

Saving and formatting may take 3 or 4 minutes to complete. Please be patient. Restoring a picture is much faster, and takes 30 seconds.

Saving screen or textures or both will not destroy (or delete) any existing files of the same name. It is up to you to delete an old file explicitly before saving a new version. We recommend that you keep at least two backups of important sketches on different Microdrive cartridges. A saved sketch requires 64 blocks of data; a saved texture area 16.

If you change `mdv1_` to `mdv2_` on one of the file menus, you will find that your choice is remembered by the system and reappears next time you choose this option.

Note that it is possible to save and load files to/from the RS232 link, or over the network by using an appropriate file name.

The yellow file menus are different from the other menus in QL Paint in that the `[ESC]` key cannot be used to escape from them. If you have made the wrong choice, you must press `[CTRL]` and the space bar to get back to the main menu.

16.2 Keyboard commands

All the file commands can be typed in at the keyboard.

- SS - Save current screen
- ST - Save current texture
- LS - Load screen
- LT - Load texture
- FO - Format a Microdrive cartridge
- DE - Delete a file
- DI - List a directory

In each case you will be asked to enter a file name. Initially the prompt will start with `adv1_`. If you want to specify a different device, (such as a disk drive) you can erase the prompt characters with [CTRL] and [-] and substitute your own choice. Use [CTRL] and the space bar to abort the command - the [ESC] key will not work in this instance.

You may reload any file (provided it is not too big) back into QL Paint. This allows you to generate part of a picture in another way - perhaps from BASIC - and to read the file into QL Paint for editing. A screen file can be up to 32K bytes long and should normally have been saved by the Superbasic command:

```
sbytes "filename", 128*1024, 32768
```

In normal use, each file option will finish with the message:

OK hit any key

You should press a key to acknowledge the message.

If the option fails for some reason, you will get an error message. Possible error strings and probable causes are given below.

operation not complete

A file to be loaded was too short, or the Microdrive cartridge was removed before the operation was completed, or the [ESC] key was hit to abort an operation.

out of memory

The system memory space is temporarily exhausted. Please repeat the operation.

channel not open

An 'impossible' error. Please repeat the operation.

file not found

A file was not found. For example, an attempt was made to load a non-existent file.

file already exists

An attempt was made to save a file which already exists. Delete the file explicitly.

file in use

If you issue two SAVE commands in quick succession you may obtain this error. Please repeat the second operation.

end of file

You have attempted to load a file which is shorter than that required. The entire file will be loaded. The bottom of the screen will remain unchanged.

drive full

You have attempted to save a file on to a Microdrive cartridge which has insufficient free space. Try saving on another cartridge.

bad name

You have given a file name which is incorrect in some detail - for example, `adv7_`.

format failed

An attempt to format a Microdrive cartridge failed. Has the write protect tab been removed?

bad or changed medium

The Microdrive cartridge has become corrupt. Have you touched the tape with your fingers?

17 Putting your pictures into SuperBASIC programs

It is possible to display screens which have been saved as detailed above from within SuperBASIC. Each screen is saved in a named file as 32K bytes of binary data and is a complete map of the screen.

The SuperBASIC program

```
5 mode 8
10 lbytes "filename", 128*1024
20 goto 20
```

will cause the picture saved in "filename" to be displayed on the screen.

Because the save format is so simple and straightforward, it is possible to transfer pictures into spare areas of memory before they are displayed.

17.1 Displaying a loading screen with SuperBASIC

It is possible to prepare a "loading screen" picture, which will appear while a SuperBASIC program is being loaded. Create the picture using QL Paint in the normal manner.

Prepare a one line boot program

```
1 lbytes adv1_picture, 128*1024:run adv1_prog
```

where `adv1_picture` is the name of the file you wish to display, and `adv1_prog` is the name of your SuperBASIC program.

You must ensure that line number 1 does not appear in `adv1_prog`.

17.2 Using buffers to hold pictures

It takes quite a while to load pictures from Microdrives. In some applications you may wish to pre-load a picture into a buffer and 'flash it up' onto the screen quickly.

The sequence of code

```
10 buff=respr(32*1024)
20 lbytes adv1_picture, buff
```

will reserve space for a screen image, and load a picture into it.

You could try copying the picture onto the screen using SuperBASIC.

```
30 for t=0 to 32767 STEP 4
40 poke_l 128*1024+J, PEEK_L(I+buff)
50 next I
```

However, due to the speed of SuperBASIC and the size of the QL screen, these three lines are very slow.

You can instead replace lines 30-50 by the machine code equivalent. To do so include the following procedure in your BASIC program.

```
100 DEFINE PROCEDURE mcode
110 a=RESPR(32)
120 addr=a
130 REPEAT loop
140 READ b
150 POKE_Wa,b
160 a=a+2
170 IF b=20085 THEN EXIT loop
180 END REPEAT loop
190 END DEFINE
200 DATA 8257,8828,2,0,12860,8191,8920,
20937,65532,28672,20085
```

Arrange to call the procedure `mcode` once only from your own program. The procedure `mcode` puts a fast copy machine code program into the QL's memory. Each time you wish to copy a picture to the screen use

call buffer, buffname

The parameter to the call statement gives the address of the buffer which contains the picture.

Thus if you wish you can have two, or more, pictures in-store, and flash them up one after another.

Here is a listing of the machine code which you are running

```
; listing of 'fastcopy' code
fastcopy: movl d1, a0 ; pointer to buffer
          movl #128*1024, a1 ; base of screen
          movw #8191, d1 ; no of longs to copy-1
loop:     movl a0a+, a1a+ ; copy data
          dbf d1, loop ; loop until done
          moveq #0, d0
          rts ; return to basic
```

17.3 Reducing picture size

You can use QL Paint to prepare a number of pictures on the one screen, and subsequently use a SuperBASIC Program to split the large picture into a number of smaller ones.

If you decide to do this the picture must be split horizontally and will occupy the entire width of the screen.

The code

```
10 size = 128: start=0
20 lbytes adv1_picture, 128*1024
30 sbytes adv1_new 128*1024+start*128, size*128
```

will save the top half of an existing picture into a new file.

Each QL picture consists of 256 lines, and each line is 128 bytes wide. Therefore in the above program the variable start gives the line number to start saving a picture from, and the variable size gives the number of lines you want in the new picture.

17.4 Screen blanking

A trick which can be used to 'flash up' a picture is to use screen blanking. With this, you switch off the screen display, load a picture onto the screen, then switch the display back on again:

Try

```
10 poke 98403, peek(98403) | 2
20 l bytes mdv1 - picture, 128*1024
30 poke 98403, peek(98403) &&253
```

WARNING: make sure the picture file exists first, otherwise the BASIC program fails at line 20 and since the screen is switched off you see no message!

To recover from this situation you must type `poke 98403, peek(98403) &&253` on the keyboard. You will not see any echo, so be very careful. If all else fails you will have to press reset to restart the system.

18 The screen dump utility

QL Paint has a built-in screen dump option. This can only be used with Sinclair or Epson 80/100 compatible printers.

The screen dump option is available by calling up the file submenu or by typing the keyboard command, `SD`. This command enables you to dump a copy of the current picture screen directly to the printer. You should answer the "Name:" prompt by giving the full name of the port to which your printer is connected.

There is no way for QL Paint to detect whether you have specified an incorrect name. If this is the case, the program may freeze up - take care. Use the `[ESC]` key to abort the output.

Try the screen dump option on a demo picture. If the printer output is incorrect, it means that your printer is not Sinclair or Epson-compatible. In this case it will only be possible to obtain a screen dump by saving the screen and modifying the supplied SuperBASIC printer dump program - see Sections 18.1 and 18.2.

By default, QL Paint assumes that your line printer runs at 9600 baud. If this is not the case, you should modify line 20 of the boot program to set up your own baud rate. If you do not have a printer, you need not alter or remove this line.

You may, if you wish, save a copy of a printer dump to a disk file, network channel or other device by specifying its name. A printer image dump file is approximately 128K bytes long.

As a general rule, it is sensible always to save your screen before printing it out.

18.1 The printer dump program

The built-in screen dump utility described above will dump any screen picture directly on to the Sinclair and Epson 80/100 range of line printers. However, if your printer is not compatible you will need to save your picture file and then print it out using a modified version of the SuperBASIC program, `dump`, supplied with QL Paint.

To run the printer dump program:

- Connect your printer up to port SER1 at the rear of the computer
- Power up your QL and press `[F1]` or `[F2]`
- Place the program cartridge QL Paint - Prog (or a backup version) into drive one
- Place the cartridge containing the picture file into drive two
- Issue the command:

```
l run mdv1 - dump
```

In reply to the prompt

```
Filename?
```

enter the full name of the file which contains the picture you wish to dump. This name will normally start

```
mdv2-
```

and will be terminated with the `[ENTER]` key.

The picture will appear on the screen before being dumped.

If any error occurs - such as `file not found`, run the program again but take care to enter a correct file name.

18.2 Modifying the printer dump program

There is a large number of different printer types available for use with the QL. It

would be very difficult for us to provide you with a program to suit every possible printer. Instead we have chosen to provide you with a simple, and easily modified, BASIC program. By default this program will drive the range of Sinclair and Epson printers. With modification this program can be adapted to drive any pixel-based printer.

Since QL SuperBASIC is rather slow, and the QL screen format is complex, we have incorporated a machine code subroutine into the printer dump program. This subroutine transforms one line of screen pixels into a format which can be easily processed by SuperBASIC.

Do not worry if you do not understand machine code - in order to modify the program you need only understand the function of the machine code.

SuperBASIC

The following printer specific routines may need to be modified to work with your printer.

`openprinter`

This subroutine should open channel 10 for output to your printer. This subroutine is called once in each program run.

`closeprinter`

Called at the end of a printer dump. This subroutine should close down channel 10 and, if necessary, see to flushing the buffer.

`startline`

Called before each line is sent to the printer. For the Epson printers this subroutine is null.

`endline`

This subroutine is called after each line has been processed. It would be usual for this subroutine to advance the paper, and reset the carriage head.

This subroutine is called with a parameter which gives the address of a line of screen pixels to be processed. The machine code subroutine converts this line of the screen into an array of 256 bytes. Each byte has a value of between 0 and 7. These values have the same meaning as those given in Table 1.

The `processline` subroutine thus far should be independent of the printer type being used.

The actual generation of pixel patterns is achieved by the loop:

```
for I = 0 to 255
print #10 cols(peek(pes + I));
next I
```

This causes the string `cols(0)` to be sent whenever a pixel of colour 0 is to be printed, similarly for colours 1 to 7.

Other printers can be driven by suitable choice of these strings.

The initialisation of the `cols` strings is performed in the `init` subroutine. Should any control string for a given colour contain more than 20 characters, the definition of `cols` will need to be expanded (line 130).

A Simple Worked Example

As a hypothetical example, consider the case of an 'ink jet' colour printer. Assume that the printer has three jets of coloured ink which it can 'fire' at the paper, to form a small colour dot. The three jet colours are RED, GREEN and BLUE.

By firing two ink jets at a time an intermediate colour can be formed.

By firing all three jets a black (or dark) colour will appear. The software interface to the printer involves sending 3 bytes of information indicating the duration of time each jet should remain on for. Each sequence of 3 bytes is preceded by a special marker byte "255".

To convert the printer dump program we could:

- Change `openprinter` subroutine to use the correct device driver name - say

```
open #10, colprint
```

- Change the `endline` subroutine to take a single pixel feed

```
print #10, chr$(1);
```

- Redefine the strings `cols(0)` to `cols(7)` in the `init` subroutine.

Since string 0 corresponds to a black pixel, we will want to drive all jets for a long period of time. A suitable string could be:

```
cols(0) = chr$(255)
&chr$(255) & chr$(255) & chr$(255)
```

(Remember the first 255 is a special marker byte).

Similarly colour 7 represents white, so we want no jets to fire. We must cause the printer head to move, though, so a suitable string could be:

```
cols(7) = chr$(255) & chr$(0) & chr$(0) & chr$(0)
```

By experimenting with other strings you could determine 'good' values for the intermediate colours.

Should any other printer, apart from the Sinclair printer and the Epson range, become widely available for the QL, TALENT may well consider developing a suitable dump program.

If you write, enclosing a SAE, to

Talent Computer Systems
Curran Building
101 St James Road
Glasgow G4 0NS

we will send you a list of currently supported printers.

19 Advice to artists *by Mike Masters*

Broadly speaking, there are two approaches to producing pictures with QL Paint.

a Freestyle

By this, I mean simply producing designs on screen without any rigid framework in mind. Combinations of texture blocks, filled areas and linework can produce designs quickly and with surprising effect. Experience with the package will lead to a certain 'design sense' but the main appeal I find is the surprise element—arriving at a pleasing design without much foresight being employed.

b Structured

This approach involves having a good idea of what you wish to produce and making an accurate sketch of the main outlines of the picture. Drawings made on paper can be transferred onto the screen directly using 'audio visual' type felt marker pens. (The ink dries quickly but can be easily removed with a damp cloth). The transfer can be aided by constructing a grid of points on the screen. [C T R L] or [S H I F T] and the space bar and an arrow key held together can be used to produce successive rows of evenly spaced dots. (Using the [C T R L] option will produce 32 x 32 dots, and the [S H I F T] option, 8 x 8 dots).

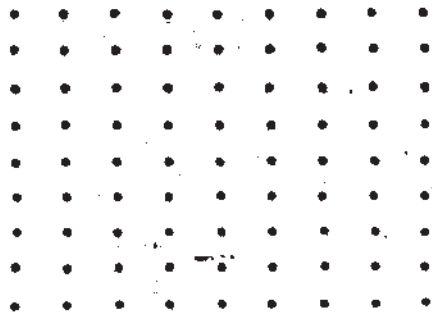


Figure 1

Note the approximate ratio of long to short sides is 7.5 and each pixel has this proportion too.



Figure 2

A correspondingly proportioned grid overlaid or drawn onto the sketch will enable key points in the drawing to be transferred accurately.

A grid whose points of intersection correspond to the points in Figure 1 drawn over the sketch will enable key proportions to be accurately copied on to the TV screen.

Another method of placing a sketch on screen is to trace the drawing onto a sheet of acetate film which can then be stuck on to the TV screen with adhesive tape. (Acetate film is available from any good artists' suppliers).

With the sketch now on the screen, the drawing can be followed with the cursor and points plotted under the felt tip lines. Complex areas must be entered point by point but smooth curves can often be constructed using short successive rubber band line operations. Care must be taken when copying from the felt tip drawing to avoid parallax errors due to the thickness of the screen. Simply maintaining a constant viewing angle will avoid any problems.

One final method available for accurate transfer of pictures from paper to pixels is to draw on to graph paper (with at least 256 x 256 squares on the sheet!) and then 'round off' the lines to the nearest pixel locations.

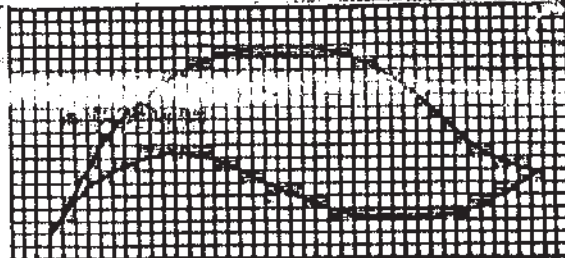


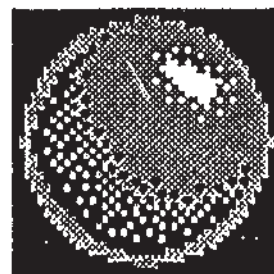
Figure 3

Care must be taken when using the graph paper approach as the pixels are represented as square: on screen they are flattened. Drawings must be made 'taller' when making the sketch to avoid distortion when viewed on the TV.

It is not always desirable to colour every pixel square that is touched by a line in complex and twisting areas. Sometimes it is best only to fill those squares which are 'well cut' by a line and leave out those which are just touched on a corner.

Finally the cursor can be placed as necessary using the crib co-ordinate as a guide. This method is very useful for either accurate geometric constructions or smaller but detailed elements in any drawing.

Objects can be given dimensional form in a similar way to the 'dot shading' approach of some pen and ink artwork. Building up areas of dark dots in shaded regions and light dots in highlight areas will produce very effective results.



Quasi-realism throughout a picture can be achieved by using 'dot shading', rather than line drawings filled with colour and/or textures. As in the circle example above, any object can be thus represented and a whole picture built up.

Areas requiring much stippling or shading can be produced most efficiently by first laying down a small area of coloured dots as required and then copying this to adjacent areas using the colour list facility and block copy. Repeated copies which include already overlaid areas will eliminate any obvious repetition in the stippling and also help to build up the textures quickly (i.e. increase the density of the stipple).

When all of the chosen region of the picture has been covered with approximately the correct density of pixels of appropriate colour(s), then this area can finally be tidied up and trimmed pixel by pixel until the desired result is obtained.

When aiming for shading effects it is worth considering the relative luminance of each colour, as, due to the limited palette, colours often must be chosen simply for their brightness.

Sometimes it most useful to be able to use an element of an existing picture in another composition and much tedious copy effort can be saved as follows:

a Load up the picture from which an element might be required for inclusion in another picture and copy the necessary area onto the texture screen using the block save facility. It may be necessary to make several copies of different parts if the element to be transferred is large. Please note that the area copied in the BS mode includes the pixels under the marker rectangle.

b Save this texture screen on a Microdrive cartridge

c Load up the new picture, and then the texture screen from b

d Copy the required element off the texture screen on to the main screen as a defined texture block.

Careful use of the colour list feature will help efficient merging (as above). Provided at least one pixel type is missing from the element being transferred, then setting the surrounding background area of the element to the absent pixel type at the 'texture doodle pad' stage will enable irregular elements to be placed anywhere over any existing picture without producing a 'copy rectangle'. Areas outside the irregular object but inside the rectangular copy area will behave as if transparent.

Lastly, it is probably worth noting that frequent saving of work in progress will avoid expensive disasters!!

19.1 Photographing completed work

Photographing screens can produce many interesting results and the following hints will, hopefully, help produce pleasing copies.

A television tube is scanned at a fairly slow rate (about 30 frames per second). Thus, if a shot were taken at, say 1/60th of a second, half the screen will have been freshly scanned and appear bright, and half the screen would consist of residual brightness and appear much duller. This consideration leads to the conclusion that the shutter speed should be as slow as possible—usually use around 1/2 of a second. In this situation, only part of the screen is seen to have been scanned about

15 times - some areas might only have been touched 14 times but the relative differences from area to area cannot be seen on the film.

Using such a slow shutter speed means adequate camera support (such as a tripod) is essential and a cable release is also desirable.

Aperture settings should, ideally, be set with the aid of a light meter, either hand held (which enables easier averaging of results from screen areas of different brightness) or that contained within the camera.

Film of ASA between 64-200 will usually enable suitable camera settings to be used.

A TV tube is self-illuminated and no additional external lighting can aid its photography. Quite the reverse is true, in fact, and I usually check exposure settings and shoot in a fully darkened room which removes all possibility of reflections on the screen.

Many unusual effects can be obtained by changing the relative brightness, contrast and colour settings on the television and even setting the picture tuning off the norm gives some interesting results.

20 Ready reference

This section contains a brief description of the facilities in QL Paint together with a list of the commands used to access them from the keyboard. This description will be useful if you already know how to use the system with the icons and drop-down menus and now want the speed and immediacy which the keyboard commands provide.

It should be noted that the drawing cursor should be correctly positioned before typing in a command at the keyboard, since the command comes into effect immediately. Many icon-selected commands give the user a chance to move the cursor after selection.

Loading

To load the system from Microdrive, press the reset button and place the cartridge in drive one. Use function key [F1] or [F2] to select the screen format.

The help line

This 'pop-up' line talks the user through certain operations in QL Paint. It is switched on automatically when the system is loaded. To switch it off, type SH. The same command will switch it on again. The help line is independent of the information line but its position on the screen is affected by whatever the information line is at the top or bottom of the screen.

The information line

The information line may show the following items:

```
 C(X,Y) D(X,Y) IAM/XOR FA/BH 01234567
```

where:

- is a box of the current ink colour
- C gives the X coordinate
- Y gives the Y coordinate
- X,Y coordinates is the position of the cursor as X,Y coordinates
- D is the distance from the point you have marked as X,Y coordinates.
- FA is present if a block has been marked
- BH is present if an area has been marked
- IAM is present if XOR mode is in operation
- XOR is present if IAM mode is in operation
- 01234567 are the colours in the colour list

The information line is switched on and off by the command SI. IU puts it at the top of the screen, whilst ID puts it at the bottom.

The accept key

The accept key (the space bar) is used to 'freeze' a graphics option.

The abort key

The abort key [ESC] cancels or terminates any command.

Cursor movement

The arrow keys around the space bar move the cursor in one of the eight directions. Holding two keys together produces the diagonal movements.

A joystick moves the cursor continuously in any of the eight principal directions.

If [SHIFT] is held down at the same time as an arrow key the cursor movement is in steps of 32 units. If [CTRL] is held down at the same time as an arrow key then the cursor movement is in steps of eight units.

Alternative cursor

SC changes between three possible cursors.

Colour selection

An ink colour can be selected by typing a digit 0-7. The colours are indicated in the table below.

0 black	4 green
1 blue	5 cyan
2 red	6 yellow
3 purple	7 white

Plotting points

Points of the current ink colour can be plotted by

Pressing the space bar

Pressing the fire button on the joystick.

Switching on the point trail feature PT and moving the cursor.

Magnification

Magnification is switched on and off by the SM command. You can walk about a magnified picture with the PA command. Switching on magnification causes the current 'found' area to be lost.

Clearing the screen

The screen can be cleared by the WS* command. Textures can be cleared by the WT* command and both screen and textures by WB*.

Drawing straight lines

The LI Command will draw a straight line between any two points. Move the cursor to one end of the line and type LI, move the cursor to the other and press the space bar.

Lines can be plotted in IAM or XOR mode.

Rubber banding can be used to draw lines. Move the cursor to one end of the line and type RD. As you move the cursor a line will follow. To complete the line press the space bar. To abandon rubber banding press the [ESC] key.

Circles

To draw a circle, move the cursor to the centre of the circle and type CI. Move the cursor to any point on the circumference of the circle and press the space bar.

IAM or XOR mode can be used to plant circles.

Ellipses

To draw an ellipse, take the following steps:

- 1. Put the cursor in the centre and type EL.
- 2. Move the cursor a distance which represents one of the axes of the ellipse and press the space bar.
- 3. Move the cursor until the ellipse is drawn as you want it; then press the space bar again. The [ESC] key will cancel the command.

Erasing lines

This is done with the ZA command. Put the cursor over the line to be removed and type ZA and a digit giving the new line colour.

Airbrush

The airbrush is enabled by the AJ command and produces a broad random swathe. It should only be used in the IAM mode. The same area may be painted over several times, possibly in different colours. The airbrush is switched off by the space bar or the [ESC] key.

Flashing

The FL command will set a 'flash bit' in a given pixel. This causes the rest of the line of pixels to flash, unless a further flash bit is encountered.

Textures

The system can store a number of user-defined texture patterns. There are 26 texture definitions available and they are known by the letters of the alphabet.

A special texture screen must be used to hold textures. This screen is turned on or off by the TS command. When the texture screen is on a horizontal line appears across the screen.

A texture can be of any size which fits on to the texture screen. It need not be square. Textures are defined (or redefined) with the TD command. This

Command, like many others, is followed by a single letter to indicate the texture to be used. Typing TD will call up the texture screen if it isn't there already.

When the command TI is used, it will flash a box about the currently selected texture. This command calls up the texture screen if it isn't already on.

Any texture can be selected by typing TU followed by its name.

A block of texture can be planted at the current cursor position by typing a TP.

The TT command switches on the texture trail. When on, a block of texture is planted at the current cursor position. As the cursor moves, each time it is placed in a pixel which is an exact multiple of the texture step size, the texture is planted again.

You may define the step size for each texture. By default the texture step size is the same as the texture size. The TR command lets you define a texture step size. This command takes the name of the texture and gives you the box cursor to mark out the horizontal and vertical step size. Press the space bar when you have done so.

The FT command fills any marked area (see FA and BM) with a regular repeating pattern of the current texture.

Defining areas

It is often useful to mark areas for later use.

Marking blocks

A rectangle area is marked using the BM command. Place the cursor on one of the diagonals of the block and type BM. You will be given the box cursor. Go to the other end of the diagonal and press the space bar. Once an area has been marked it may be filled with texture (FT) or with colour (FC).

An alternative feature permits a rectangular area to be remembered for later use. Use the command BS and treat the rectangular cursor as BM.

Planting blocks

An area remembered by the BR command may be planted to another position on the screen. Move the cursor to the position of the new copy and type BP.

Reflecting and rotating blocks

The MN command causes a block of data to be copied (as with BC) but the picture is reflected about a horizontal line. The MV command causes a block of data to be copied but reflected about a vertical line, and MB rotates the block by 180 degrees.

Shifting blocks

Once a block has been identified with the BR command it may be moved to a new screen position and the old block removed. Move the cursor to the top left-hand corner where you wish to see the block and type BD. The old area occupied by the block is overwritten by pixels in the current ink colour.

If you erase a remembered block by accident you can recover the situation by placing the cursor at the top left-hand of where the picture used to be, and typing BP.

Marking irregular areas

The FA command marks any contiguous area of pixels of a single colour. Such an area can be filled with texture (FT) or with colour (FC). Move the cursor into the area to be marked and type FA.

Text insertion

Text may be placed anywhere within the text using the TE command. Move the cursor to the place you want the text to start before using this command. The [ENTER] key or the [ESC] key is used to end the text.

Text is either XORed or JAMmed onto the screen depending on the current setting. Characters cannot easily be deleted in JAM mode. In XOR mode the Sinclair delete [CTRL] [←] will remove the previous character.

[CTRL] [H] [CTRL] [U] and [CTRL] [F]

toggle character height, underline and flash respectively.

Colour control

It is possible to swap around the colours which you are using in a picture. Any pair of colours can be swapped by the CS command. Two digits giving the colours to be swapped are required. Thus you may turn all green pixels red, while turning all red pixels green.

Colours may be merged by using the CM command. Like CS, this command is followed by a pair of digits which give the colours to be merged. Both CS and CM apply to the last rectangle defined by the box cursor.

Cursor colour

The cursor colour may be changed with the command CC, followed by a colour number.

Colour list

Colour lists are used with textures and block commands. Any pixels in colours not on the list will not be moved when a block or texture is transferred.

CL+ — puts the colour on the colour list

CL- — empties the colour list

+ followed by a colour number adds a colour

- followed by a colour number removes a colour

Alternative noise

SN moves the system round three possible noise response patterns:

1. Blips and groans
2. Groans only
3. Silence

Saving and restoring pictures

Various file commands allow you to save some or all of your picture onto Microdrive cartridges, RS232 links or over the network. These pictures can be incorporated into programs in most other languages, such as BASIC, C, STAB or assembler.

Microdrive cartridges can also be formatted, files deleted and directory contents listed.

SB saves both screen and textures

SS saves screen only

ST saves textures

LB loads both screen and textures

LS loads screen only

LT loads textures

FO formats a Microdrive cartridge

DE deletes a file

DI lists a directory

Dumping the screen

SD allows you to dump the screen on to a Sinclair or Epson-compatible printer.

Command summary

QL Paint can be used with either menu driven commands or by entering the commands in a shorthand form from the keyboard. Each of QL Paint's keyboard commands is explained in detail in the program manual, and this list is intended to be a handy reminder for use when you are familiar with all the various operations.

AJ	Airbrush	J	Jam mode
BD	Block drag	LB	Load both (screen and textures)
BM	Block mark	LJ	Line
BP	Block plant	LS	Load screen
BS	Block save	LT	Load texture
CC	Cursor colour	MB	Mirror both
CI	Circle	MH	Mirror horizontal
CL+	Fill colour list	MV	Mirror vertical
CL-	Empty colour list	PA	Pan
+	Add colour to list	PT	Point trail
-	Subtract colour from list	RB	Rubber banding
0	black	SB	Save both (screen and textures)
1	blue	SC	Swap cursor
2	green	SD	Screen dump
3	purple	SH	Swap help line
4	green	SMA	Switch magnification
5	cyan	SN	Swap noise
6	yellow	SS	Save screen
7	white	ST	Save texture
CM	Colour merge	TD	Texture define
CS	Colour swap	TE	Text
DE	Delete file	TI	Texture indicate
DI	Directory	TP	Texture plant
EL	Ellipse	TR	Texture repeat
FA	Find area	TS	Texture swap
FC	Fill colour	TT	Texture trail
FL	Flash	TU	Texture use
FO	Format	WB*	Wipe both (screen and textures)
FT	Fill texture	WS*	Wipe screen
FI	Swap info	WT*	Wipe texture
ID	Info down	X	XOR mode
IU	Info up	ZA	Zap (erase) line