PYRAMIDE

GRAPHIC TOOLKIT

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INTRODUCTION

This toolkit provides a range of functions and procedures aimed at exploiting the screen and graphic capabilities of the QL. The extensions (occupying around 11 K of code) are accompanied by several applications and example routines. Most of these are described in detail in this manual. An alphabetical index for the extensions can be found at the back.

Before using GRAPHIC TOOLKIT, you should make a backup as follows:

Place GRAPHIC TOOLKIT in mdv2_
Place a BLANK cartridge in mdv1_
Type: **LRUN mdv2_backup**

To install the extensions ...

either : Reset the QL, insert GRAPHIC TOOLKIT in mdv1_ and press F1 or F2

or : Reserve memory for the extensions - addr=RESPR (11000) : CALL addr

or : Type - LRUN mdv1_boot

Syntax of command descriptions etc.

In this manual, the syntax for descriptions conforms to these rules :

UPPER CASE words ...	should be typed as written (in upper or lower case)
lower case words ...	are descriptive
[ ]	indicates an optional parameter

Apart from the boot and backup programs, the filenames on the toolkit cartridge have the following descriptive suffixes :

"_bin"	indicates a binary file
"_bas"	is a BASIC program
"_scr"	is a 32 K screen file
"_set"	is a character set (font)
"_x"	is an 'EXEC'able file

POINTER x, y (Procedure)
XPOINT (Function)
YPOINT (Function)
POINTKEY (Function)

Places a pointer at position x,y which can be moved around the screen using the four cursor keys, joystick or mouse. The pointer will remain on screen until either SPACE, ENTER or ESCape (or the corresponding mouse or joystick button) is pressed .

On return from the procedure POINTER, three variables are set -
XPOINT returns the last x co-ordinate of the pointer.
YPOINT returns the last y co-ordinate of the pointer.
POINTKEY returns a value of 0 if the key pressed was 'ESC'
1 if the key pressed was 'SPACE'
2 if the key pressed was 'ENTER'

Note: Examine the routine "pointer_demo_bas" for an example of usage.

POINTBUF (Function)

The pointer is defined on a matrix of 7 lines of 8 pixels (together with a mask of the same dimensions). It may be redefined by POKEing new values into the pointer buffer (the relevant address is returned by the function POINTBUF). The pointer is intended principally for use in mode 4 - since in mode 8 the matrix becomes effectively 7x4 pixels - however it is possible to define pointers for use in mode 8 (attention must be paid to avoid setting flash bits).

The data for the default arrow is as follows:

Arrow (binary)	hex	Mask (binary)	hex
11111110 00000000	FE00	00000001 11111111	01FF
10000010 00000000	8200	00000001 11111111	01FF
10001110 00000000	8E00	00000001 11111111	01FF
10100110 00000000	A600	00000001 11111111	01FF
10110011 00000000	B300	00000000 11111111	00FF
11111001 00000000	F900	00000000 11111111	00FF
00001111 00000000	0F00	11110000 11111111	F0FF

Note: Each line is defined by the high byte of a word (all the bits in the low byte are reset in the case of the shape and set in the case of the mask).

Example (mode 8 pointer):

```
100 RESTORE 120
110 FOR x=0 to 13 : READ num$ : POKE_W POINTBUF + (2*x), DEC(num$)
120 DATA "AA00", "8000", "8000", "8200", "8000", "8800", "0200" : REMark arrow
130 DATA "00FF", "00FF", "00FF", "00FF", "00FF", "00FF", "FCFF" : REMark mask
```

POINTSPD value (Procedure)

POINTSPD sets the pointer speed. Ten speeds are available, from 1 (slowest speed) to 10. On installation POINTSPD is set at 5. The pointer speed will remain unchanged until a new value is set by POINTSPD.

FRAME w, h, x, y, scr_x, scr_y, virtual_screen_addr (Procedure)

FRAME sets up a "window" (w pixels by h lines) at co-ordinates x,y and displays "behind" that window, a section of a virtual 512x256 screen whose origin is located at virtual_screen_addr. The virtual screen may consist of a 512x256 image that has been stored in memory, or it may take its origin at any memory address - even within the current screen display (131072 to 163840).

The third and fourth co-ordinates indicate the point (measured relative to the virtual screen's origin) that will coincide with the display window's origin.

All horizontal co-ordinates are rounded down to coincide with long word addresses. This is in order to increase speed of execution in shifting large sections of screen memory. The virtual screen start address may be anywhere in RAM, however, it is important that the window defined by w,h,x,y falls within the normal 512x256 screen display or the QL will probably crash.

```
Example:  100  SETWIN 4 : LIST#0 : LIST#1 : LIST
          110  RECT#2, 128+SMODE/2, 82, 45, 22, 0
          120  w=128 : h=80 : x=48 : y=24 : scrx=48 : scry=24 : addr=131072
          130  REPeat loop
          140  IF KEYROW(1)&&2 : scrx=scrx-16
          150  IF KEYROW(1)&&16 : scrx=scrx+16
          160  IF KEYROW(1)&&4 : scry=scry-8
          170  IF KEYROW(1)&&128 : scry=scry+8
          180  FRAME w, h, x, y, scrx, scry, addr
          190  END REPeat loop
```

Note: The FRAME routine is used by the program "transfer_x" to pan/scroll the second screen within a window.

PAINT x, y, colour, [source_colour] (Procedure)

PAINT will paint an area of uniform colour (where x,y is a point inside that area), using another colour (0 to 255). The two co-ordinates, x and y, should be given as absolute (based on a screen of 512x256) for both mode 4 and mode 8. If the paint colour specified is the same as the original colour found at x,y then the paint will not take place.

A fourth parameter may be specified (source_colour) - in which case the paint will only execute if the colour found at x,y has the same value as that parameter.

PAINT contd.

To fill more complex shapes, more than one PAINT will be required. However, no memory is used by the routine for storing co-ordinates etc., and execution is reasonably rapid. The procedure POINTER is an ideal means of positioning x and y when using mode 4.

```
Example:  100  INPUT#0,"Colour ? "; colour : NOKEY : POINTER 250, 120
          110  PAINT XPOINT, YPOINT, colour
          120  POINTER XPOINT, YPOINT : IF POINTKEY=2 : GOTO 100
          130  GOTO 110
```

ALCHP (nbytes) (Function)
RECHP address (Procedure)

ALCHP is used to allocate memory space (in the Common Heap) for use by machine code programs, storage of screens etc. Its use is similar to that of the function RESPR (which reserves space in the Resident Procedure area), the main difference being that the memory may be later released to the Common Heap when no longer required.

Example: addr = ALCHP (32768) . . . will reserve 32768 bytes

Since 32768 bytes is the screen memory size, you could for instance load a screen directly from microdrive into memory using **LBYTES mdv1_name_scr,addr** and then place the image on the screen using FRAME or PLACE.

RECHP is used to release memory allocated by the above. It is important to save the base address (addr - returned by the function ALCHP) if you wish to use the procedure. Type RECHP (followed by the address) to release the memory to the Common Heap.

Important note: The Common Heap may become fragmented by multiple allocations . . .eg:

```
PRINT FREE
q = ALCHP (40000) : PRINT FREE
a = ALCHP (512) : PRINT FREE
RECHP q
PRINT FREE
```

The RECHP appears not to have worked - this is because the small space (which is reserved by "a") is separating two sides of the Heap area. If you now type - **RECHP a**, although you are only releasing 512 bytes, typing FREE will reveal that the heap has been restored to one area. Using a directory device (eg: mdv2_) for the first time, will set up a "definition block" in the Common Heap in the same way as the example above.

It is advisable to previously access all the directory devices likely to be used during large allocations of the Common Heap.

FREE (Function)

This function will return the approximate number of bytes free for use by Superbasic (the largest single free space), and is essential as a means of keeping check on memory usage.

```
Example:  100  DEFine PROCedure pr
          110  v = v+1
          120  AT 0,0 : PRINT FREE;" Bytes left   " : pr
          130  END DEFine
          140  CLEAR : v=1 : pr
```

After a while the "Out of memory" message will appear. It is often difficult to locate a cause of memory wastage in large programs. Using FREE (within a main loop) as follows could help to do so . . . IF KEYROW(3) = 16 : AT#0,0,0 : PRINT#0, FREE

BVAR (Function)

Unlike the QDOS System Variables (located above the screen at $28000), the position in memory of the Basic Variables is not fixed. The BVAR function returns the base address of this area, thus giving access to the variables which are at fixed offsets from that address.

QDOS$ (Function)

This is the QDOS equivalent of the basic function VER$ and will return the QDOS version number for you QL (ie: 1.03).

STAMP mdv, n1, n2 (Procedure)
CHECK mdv, n1, n2 (Procedure)

These are used for anti-copy protection. To invisibly mark a **previously formatted but blank cartridge** type STAMP - followed by 3 parameters - microdrive number (1 or 2), then two numbers (each between 2 and 200). You must then save a program on the cartridge before removing it from the drive.

To test for the two numbers, type - CHECK - followed by the microdrive number and the two 'pass' numbers. After reading the cartridge, if the numbers are correct, nothing will happen - otherwise the error "Bad or changed medium" will occur.

This routine is very effective if incorporated within a Supercharge compiled program to check for a 'master' or 'original' cartridge in one of the drives.

```
Example:  100  CHECK 2, 48, 58 : REMark the program will stop if 48 & 49 are not
               found to be STAMPED on the cartridge in mdv2_
```

LOCK (Procedure)
UNLOCK (Procedure)
LOCKED (Function)

LOCK will dis-enable 'Break' caused by CTRL/SPACE as well as 'pause' normally caused by CTRL/F5. It is important **NOT** to **LOCK TWICE** otherwise the computer will crash (use the function LOCKED to check).

UNLOCK has the reverse effect, ie: it will re-enable CTRL/SPACE & CTRL/F5.
The function LOCKED returns a value of 1 if locked or 0 if not locked.

Example: 100 IF NOT LOCKED THEN LOCK : ELSE PRINT "Already locked !"

DEVSTAT ("device") (Function)

This function tests and will return the status of any directory device connected to the QL. It is a useful means of avoiding program crashes during directory or access from non-existant cartridges or disks etc. (the device name must be enclosed by inverted commas). The status number returned in the event of an error is the QDOS error code (a small negative value) - otherwise a zero is returned.

```
Example:  100 IF DEVSTAT ("mdv2_") < 0 : BEEP 3000,50 : Print "Place a cartridge
              in mdv2_ & press a key" : PAUSE : CLS : GOTO 100
          110 PRINT "..... OK"
```

REPORT [#n], error_number (Procedure)

REPORT will print the equivalent QDOS error message to the given channel (the default is #0). Error codes are between -1 and -21.

Example: REPORT#2,DEVSTAT("flp1_")
. . . will print "Not found" in window #2 if a disk drive is not connected or there is no disk in the drive.

RESET (Procedure)

This is a software equivalent of pressing the reset button on the side of the QL.

WAIT value (Procedure)

Suspends a program for a period depending on the value given. Unlike the PAUSE command, WAIT is unaffected by use of the keyboard. In addition, the length of wait is unaffected by compilation using Supercharge - (a value of 200 gives around 1 second, 1000 around 5 seconds, 2000 around 10 seconds etc.).

SCADDR (x, y) (Function)

Returns the address in the screen memory indicated by co-ordinates x and y. The co-ordinates must be given as absolute (512x256 pixels). This procedure is useful for locating start and end addresses when saving just a section of screen.

```
Example:  100  REMark to save screen from 0,22 to 512,200
          110  start = SCADDR (0,22)
          120  finish = SCADDR (512,200)
          130  length = finish - start
          140  SBYTES mdv1_screen_section, start, length
```

POKE_S x, y, value (Procedure)
PEEK_S (x, y) (Function)

POKE_S pokes a word length value to the screen at the given co-ordinates while PEEK_S reads the screen at x,y. An example of application is to stock values using the screen as memory (either to save on RAM elsewhere or in order to read values from "data boxes" on screen for menu selection using a pointer).

DISP n (Procedure)

Switches the QL screen display according to the value given (between 0 and 4). The corresponding effects are as follows:

- 0 - switches off the display
- 1 - sets the 4 colour display
- 2 - sets the 8 colour display
- 3 - sets the 2nd screen 4 colour display
- 4 - sets the 2nd screen 8 colour display

Changing between the displays does not affect the screen RAM - only the way in which it is interpreted. Switching is instantaneous.

```
Example:  100  DISP 0
          110  LBYTES mdv1_screen_scr, 131072
          120  DISP 1
```

SMODE (Function)

SMODE returns a value of either 4 or 8, depending on the QL's current mode. It is useful for setting variables that require different values for mode 4 or mode 8, or checking that the correct mode is set without re-calling the MODE command.
ie: IF SMODE < > 4 THEN MODE 4

SETWIN n (Procedure)

This command selec' one of six screen layouts for the three windows opened at switch-on. The first two are identical to those that appear on pressing respectively F1 or F2 after a reset (the screen mode is not changed by SETWIN). The third layout is similar to the second, but expanded to meet the edges of the screen. The fourth is the same as that produced by pressing F1, but #1 is narrower and #2 wider (which is more practical for displaying program listings). Display n°5 stacks the three windows from top to bottom and n°6 sets a full screen (512x256a0x0) for #1.

To select one of the above window layouts, type SETWIN followed by a number between 1 and 6. The INK/PAPER/STRIP colours and BORDERS are also set, and all windows cleared by this procedure.

FONT [#n], addr1, addr2 (Procedure)

The procedure FONT sets the 2 character fonts for any screen or console channel. If no channel is specified, the default is #1. The two parameters that follow are the base addresses for font 1 (characters 31 to 127) and font 2 (characters 127 to 191). Either one or both can be set - giving a 0 as one of these two parameters (in place of an address) will set that font to the QL ROM set. A character font normally requires 875 bytes (reserved using RESPR or ALCHP).
The format for a character font is as follows:

1st byte	the lowest valid character value
2nd byte	the number of valid characters -1

. . . followed by 9 bytes of definition for each of the characters (see "definer_bas").

FONT1BASE [(#n)] (Function)
FONT2BASE [(#n)] (Function)

These functions return the base addresses for respectively the first and second fonts set for that given channel. If no new fonts have been installed then the ROM font addresses are returned. (The ROM character set addresses vary depending on the QL version).

CURSZ [#n], h, v (Procedure)

CURSZ sets the character spacing in horizontal and vertical increments for a given window (default #1). In mode 4 for instance, the default increments for CSIZE 0,0 are 6 and 10. (By using CURSZ 6,9 in mode 4, it is possible to increase the maximum number of character lines displayable by 10%).

Note: The commands NEW, MODE and CSIZE will cancel increments that have been set by CURSZ.

XPIXS (#n) (Function)
YPIXS (#n) (Function)
XCHRS (#n) (Function)
YCHRS (#n) (Function)

Typing - PRINT XPIXS(#n), YPIXS(#n) - where n is a screen or console channel, will print the window size in pixels (honzontally and vertically) of #n. This information can be used to set sizes/limits etc. for objects placed within a window area.
XCHRS and YCHRS are similar except that they return the window size in terms of characters, which will of course vary according to the character size set by CSIZE.

XPIXP (#n) (Function)
YPIXP (#n) (Function)
XCHRP (#n) (Function)
YCHRP (#n) (Function)

These functions return the current cursor position within the specified channel. XPIXP and YPIXP will return the x,y co-ordinates in pixels, and XCHRP and YCHRP will return x and y in character co-ordinates.

CHANID (#n) (Function)

Returns the QDOS channel identification for the given Basic channel ID. When converted to a hex string - eg: PRINT HEX$ (8, CHANID(#2)) - the QDOS channel ID consists of - in the low word (RHS) a reference to the location in the channel table, and in the high word, a "tag" that increments each time that channel is opened.

Example: (After switch-on) #2 would have a QDOS ID of $00020002

CURSEN #n (Procedure)
CURDIS #n (Procedure)

The procedure CURSEN (followed by a screen channel) will enable the cursor in that window. CURDIS has the reverse effect - the cursor is "unprinted" and dis-enabled for the given channel.

The function INKEY$ takes data from the keyboard without enabling the cursor. Using CURSEN it is possible to enable the cursor in a window so that when INKEY$ is called the keyboard queue will be switched to that window and the cursor will flash.

```
Example:  100  CURSEN#2
          110  PRINT#2, "You have 10 seconds to press a key > > >"
          120  key$ = INKEY$(#2,500)
          130  CURDIS#2 : CLS#2,3
```

MOVXY (Procedure)
XP (Function)
YP (Function)
SPA (Function)

The procedure MOVXY has the effect of reading the four cursor keys (and SPACE), and incrementing/decrementing x and y values (which are returned as XP and YP respectively). MOVXY is subject to previously set limits (LIMXY) and increments (XYSTEP). It is capable of replacing lengthy cursor moving loops with just a few instructions.

```
Example:  100  SETWIN 6
          110  REPeat loop : MOVXY : BLOCK 2, 1, XP, YP, 2 : END REPeat loop
```

SETXY x, y (Procedure)

SETXY followed by two co-ordinates sets respectively XP and YP for use with the procedure MOVXY.

LIMXY left, up, right, down (Procedure)

It is usually necessary to set a limit to the possible values of XP and YP. LIMXY is used for this purpose. The parameters are (in order) - lowest possible values for XP and YP, followed by the highest possible values for XP and YP. (When the extensions are first installed, LIMXY is set at 0, 0, 504, 250). It is important to make sure that the co-ordinates set in SETXY fall within the limits set by LIMXY.

XYSTEP xstep, ystep (Procedure)

XYSTEP sets the increments in x and y for the procedure MOVXY. When one of the cursor keys is pressed, XP or YP will increase/decrease by the amount set in XYSTEP. (On installation of the extensions, both steps are set at 1).

```
Example:  100  IF SMODE < > 8 : THEN MODE 8
          110  SETWIN 6 : CLS
          120  LIMXY 0, 0, 240, 100 : XYSTEP 8, 4 : SETXY 0, 0
          130  REPeat loop
          140  MOVXY
          150  IF SPA : colour=0 : ELSE : colour=RND(7) : END IF
          160  BLOCK 16, 8, 252-XP, 128-YP, colour
          170  BLOCK 16, 8, 252+XP, 128+YP, colour
          180  BLOCK 16, 8, 252+XP, 128-YP, colour
          190  BLOCK 16, 8, 252-XP, 128+YP, colour
          200  END REPeat loop
```

CROSS [#n], x, y, colour (Procedure)

CROSS prints a cross-wire cursor in a channel (default #1) at window position x,y using INK colour. It is subject to the value of OVER set for that window - (so if using OVER -1, printing the cursor a second time at the same position will have the effect of unprinting it).

RECT [#n], width, height, x, y, colour (Procedure)

Prints a rectangle in a window (default #1) in the specified colour, where x and y are the pixel co-ordinates of the rectangle's top left corner. (RECT may be 'XOR'ed by setting OVER [#n], -1).

GRID [#n], [size] (Procedure)

GRID will print a grid over the whole or part of the screen which **will remain displayed until SPACE is pressed.** It is intended for use in measuring proportions for planning screen layouts (opening windows, placing cursors, setting limits etc.) and is printed in XOR mode in order to preserve the screen image when it is unprinted.

GRID may be used without any parameters - in which case it will cover the whole screen area with gridlines every 32 pixels/lines. If however one parameter is given, that parameter is interpreted as the grid size (minimum 8). When two parameters (window and gridsize) are specified, the grid will displayed only within that window (the second parameter is needed when specifying a window for the grid).

HEX$ (no_of_hex_digits, value) (Function)
DEC ("hex$") (Function)

HEX$ returns the hexadecimal equivalent of a positive denary integer. The number of hex digits required must be stated (between 1 and 8).
Example: PRINT HEX$ (8, 179) . . . gives 000000B3

DEC returns the denary (decimal) equivalent of a hexadecimal string. The hex must be enclosed by inverted commas;
Example: PRINT DEC ("20000") . . . gives 131072

DUMP (Procedure)

This is an extremely slow screen dump for use with Epson compatibles. DUMP will operate in mode 4 or 8 and will dump the whole screen to a printer connected to **ser1_** (serial port).

Note: The process may be interrupted during the course of operation by holding down the ESCape key.

CNUM (colourA, colourB, stipple) (Function)

CNUM followed by two colour values (0 to 7) and a stipple pattern (0 to 3) will return the equivalent colour/stipple combination as a single value (between 0 and 255).

GETBRUSH x, y (Procedure)
PUTBRUSH x, y (Procedure)

These two procedures are for "reading from" and "writing to" the screen according to a definable brush. The preset brush shape is circular with centre at co-ordinates x,y. Brushes may be redefined by directly POKEing new values (see later).

GETBRUSH reads the screen pixel by pixel along a set course covering the area beneath the brush. The pixel colours are read into a buffer to be used by PUTBRUSH. PUTBRUSH places the pixels (read by GETBRUSH) onto the screen at specified co-ordinates x and y. This process is used by the program "transfer_x" to copy free hand from one position to another on the screen.

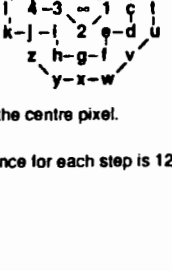
Example:
```
100 LIMXY 8, 8, 504, 228 : SETXY 240, 120 : XYSTEP 4, 4
110 WINDOW 512, 256, 0, 0 : OVER -1
120 REPeat loop
130 MOVXY
140 IF SPA : GETBRUSH XP, YP : PUTBRUSH XP+100, YP+20
150 FOR c = 1 TO 2 : CROSS XP, YP, 7 : END FOR c
160 END REPeat loop
```

BRUSHBUF (Function)

BRUSHBUF gives the start address of the buffer used to define the path between each constituent point of the brush. The format of the buffer is as follows :

```
        Word  - number of steps to take within the brush
then ... Byte  - parameter for first x (horizontal) step
         Byte  - parameter for first y (vertical) step  . . .and so on for each step . . .
```

A negative movement in x or y (ie: left or up) must be indicated by setting in addition the 8th bit of that byte (this is done by adding 128 to the number to move). In the default brush the path starts at the centre and spirals outward, the first point read being the pixel just above the centre, and the last being that of the centre. The buffer starts with a word value 37, then bytes 0, 129 (right 0, up 1) for step 1. Then 1, 1 (right 1, down 1), and so on. The last step will be 2, 130 (right 2 pixels, up 2) to go from the outside (z) to read the centre pixel.



(The max. number of steps definable is 70, and the max. distance for each step is 127).

BCOLBUF (Function)

BCOLBUF returns the address of the buffer used for storing the colours read by GETBRUSH.
Each pixel colour is stored as a word in sequence following the path taken by the brush (see BRUSHBUF).

SVAR n, value (Procedure)
VAR (n) (Function)

SVAR and VAR provide a means of stocking a 32 bit value in memory which will not be erased by the commands CLEAR or NEW, or by loading another Basic program. They may be used for transfer of variables between programs or into compiled programs, storing ALCHP addresses or any other variable function. 16 variables are available.

To set the value of one of these variables, type SVAR - followed by the identifying number (from 1 to 16) and then the value you wish to store.

Example: Type - SVAR 5, 131072 ... then type NEW
Type - PRINT VAR(5) ... which will give a value 131072

FLEN (#n) (Function)

Providing a channel is opened to a directory device file, FLEN will return the length in bytes of that file. It is a useful check before loading code into memory so that the exact amount of space can be reserved.

The procedure is as follows:

Open the channel - eg: OPEN#3, mdv1_program
Call the function - length = FLEN (#3)
Close the channel - CLOSE#3

WAITMD (Procedure)

The command WAITMD will suspend a program while any of the microdrives are turning. This can be used to avoid situations where screen messages appear before intended because the microdrive motors are still running.

```
Example:  100  SAVE mdv2_program
          110  PRINT "Wait for the motor to stop . . ."
          120  WAITMD : PRINT "Now the motor has definitely stopped"\
               "You can remove the cartridge from mdv2_"
```

NOKEY (Procedure)

NOKEY will suspend any action while any of the keys are pressed. It can be used to prevent multiple exits from nested loops etc. when polling the keyboard using the function KEYROW.

```
Example:  100  REPeat loop
          110  AT#0, 0, 0 : PRINT "Press 'SPACE' "
          120  IF KEYROW(1) : AT 0, 0 : PRINT "-------OK-------" : NOKEY
          130  END REPeat loop
```

STORE w, h, x, y, address (Procedure)
PLACE w, h, x, y, address, [n] (Procedure)
STORSIZ (Function)

These routines are intended for storing part or all of the screen into memory, and placing from memory to a position on the screen. The co-ordinates for the rectangle (width, height, x, y) defining the image area, assume a 512x256 pixel display. STORE can be used before opening a window on screen, to store any images that lie beneath that window. When the window is no longer required, PLACE may be used to restore the image to the screen (see "pointer_demo_bas" which uses this principle).

Another use for STORE/PLACE is to save a section only of screen to disk or microdrive (eg: a block 152x100 requires only 3800 bytes - after having used STORE or PLACE, STORSIZ will return the size in bytes of the screen block).

```
Example:  100  addr = RESPR (5000)
          110  STORE 152, 100, 40, 25, addr
          120  SBYTES mdv2_screen_section, addr, STORSIZ
```

The section may later be loaded from microdrive into memory and positioned on screen as desired using PLACE. It is however necessary to keep note of the proportions of the saved section, as severe distortion will occur if these are changed.

Horizontal co-ordinate parameters are rounded down to the nearest word interval for speed in moving screen memory. It is imperative that the parameters defining PLACE fall within the screen display area otherwise the QL will crash.

An optional fifth parameter [n] may be used with PLACE. It must comprise a value of 0, 1 or -1. If this parameter is zero, the section is moved to the screen normally regardless of the underlying image. If the parameter is 1 the two images will be 'OR'ed. If it is -1, the two images will be 'XOR'ed . . . which has a similar effect to printing with "OVER -1".

(Using a value of -1 can produce interesting results in mixing two or more images).

Another useful application is in panning or scrolling with "wrap-around" of opposite edges.

```
Example:  100  addr = ALCHP(80) : SETWIN 6 : CLS
          110  OPEN#3,scr_164x100a62x50 : BORDER#3,1,2 : INK#3,2 : LIST#3
          120  OPEN#4,scr_164x100a254x50 : BORDER#4,1,2 : INK#4,4 : LIST#4
          130  REPeat loop
          140  STORE 160,1,64,51,addr : STORE 160,1,256,148,addr+40
          150  SCROLL#3, -1 : SCROLL#4, 1
          160  PLACE 160,1,64,148,addr+40 : PLACE 160,1,256,51,addr
          170  END REPeat loop
```

COMP [address] (Procedure)
DCOMP address (Procedure)
COMPSIZ (Function)

COMP is a screen compress routine designed to economise on the normal 32K required for storage. The savings on memory can be considerable, depending on the complexity of the image. However, very complex screens could require more than 32K. By using COMP without any parameters, the image will be processed but not stored.

The function COMPSIZ returns the number of bytes required to store the compressed screen. If this is satisfactory, COMP - followed by the address of a reserved area in memory, will store the compressed screen to that address.
The image can then be saved to microdrive if required by using (say) -

```
SBYTES mdv1_image_cmp,address,COMPSIZ
```

The procedure DCOMP together with a valid address will have the reverse effect, - the image is decompressed from memory to the screen. COMPSIZ will return the size of compressed image after either COMP or DCOMP.

```
Example:  100  REMark addr = ALCHP(20000)
          110  COMP
          120  IF COMPSIZ < 20000 : COMP addr : ELSE : PRINT "Screen too
               complex ...    ";COMPSIZ;" bytes required"
```

PCOL (x, y) (Function)

PCOL returns the colour of the pixel located at co-ordinates x,y. The co-ordinates must be relative to the whole screen area (ie: 512x256 pixels). In mode 8 the x parameter will be rounded down to an even value.
(Note - in mode 4, the colour returned will be 0, 2, 4 or 6).

For drawing routines, this function is extremely useful for pen colour changes etc. as colour can be indicated directly on screen by sample rather than by palette or menu selection.

MAG [#n], source_x, source_y, dest_x, dest_y (Procedure)

Magnifies a section of screen by a factor of 4 in x and in y (the area is magnified 16 times). The area that is to be magnified measures 28x20 pixels - and is magnified to 112x80 pixels. The magnification is displayed within a window {#n} - if no window is specified the default is #1. The parameters source_x, source_y are the co-ordinates of the top left corner of the area to be magnified (relative to the whole 512x256 screen). The next two parameters locate the top left corner of the destination block (relative to the display window's origin - ie: 0,0 is the top left of the window #n). No error will take place if the destination co-ordinates are wholly or partially outside the window's limits.

```
Example:  100 REMark     To magnify from the top right hand corner of the screen
          110 REMark                  and display the magnification in window #0
          120 MAG#0, 484,0,0,0
```

Note: See the routine "zoom_bas" for an application example.

ROTATE address, nbytes (Procedure)

ROTATE will swap end rotate the bytes of the the first and last words of a sequence of bytes (starting at the given address and ending at that address + nbytes), . . . then the second and the second to last words of the sequence, then the third and third from last and so on.

The principal use is in rotating a string of words of screen memory.
For instance: ROTATE 131072,32768 . . . will result in the entire screen being effectively turned through 180°. ROTATE 133248,128 will rotate just one line starting at address 133248 - which is the same as mirroring that line horizontally.

```
Example:  100 FOR y = 0 TO 255
          110 ROTATE 131072 + (128 * y), 128
          120 END FOR y
```

The effect of this will be to mirror the whole screen left to right. Using combinations of individual line, and whole/part screen rotations, images can be turned or mirrored very simply. It is important that nbytes (the length of sequence to rotate) is divisable by 4, that is to say - an even number of screen words and that the start address is an even number.

SFLASH n (Procedure)

The parameter n is either 0 or 1 and has the effect of setting or resetting (zero-ing) all the flash bits in the screen memory. In mode 8 - SFLASH 0 will cause any flashing to cease. The main use of SFLASH is for reworking in mode 8, screen images created in mode 4, to suppress flashing characteristic of the incompatible colour interpretation.

SHRINK address (Procedure)

SHRINK will store a reduced image of the entire screen at the specified address. The reduced "screen" will require 1/4 of the normal 32 K (ie: 8192 bytes) for storage (reserved by ALCHP or RESPR). This image can then be positioned on screen using the procedure PLACE. The new screen image will measure 256x128 pixels.

The procedure is not really suitable for use in mode 8 as flashing will probably occur. (However - this may be removed using SFLASH).

Example:
```
100  REMark     **** first load an image onto the screen ****
110  addr = ALCHP(8192)
120  FOR c = 1 TO 5
130  SHRINK addr : DISP 0
140  FOR x = 0,256
150  FOR y = 0,128 : PLACE 256,128, x, y, addr
160  END FOR x
170  DISP SMODE/4 : PAUSE 100
180  END FOR c
```

THE PROGRAMS

Transfer_x

This program is used for transfer and treatment of images between two screens. One unique feature is the ability to copy freehand from one image to the other, using a variety of brushes.

To run the program - type **EXEC_W mdv1_transfer_x** (Note: as for all the programs on this cartridge, the toolkit extensions must be installed previously)

Transfer_x will not affect the current screen image - so it may be used from within a Basic program (memory permitting). Transfer_x reserves for itself around 42000 bytes to hold the second screen and for windowing etc.

Note: This will be released after exit from the program, providing no new directory devices are accessed during the program (due to common heap fragmentation - see ALCHP on page 4). This problem can be avoided by previously accessing all the devices likely to be used for SAVE-ing or LOAD-ing screens.

Transfer_x has two modes. When the program starts, you are in INLAY mode. The "help" window (which can be called during this mode only by pressing F1) is displayed. INLAY mode concerns functions such as loading and saving, positioning, panning, scrolling etc. of the two screens - ie: the main display, and the second screen (displayed behind a window inlayed in the main display).

Press a key to remove the help window.

Loading an image

Press F2 to load an image from disk or cartridge (either to the inlay or main screen). After indicating the device from which to load, a directory of files is shown. Enter the file name exactly as it appears in the directory (or just press ENTER if you do not wish to load a file). You will then be asked whether to load to screen or inlay.

Note: If you load a "mode 4" screen while using the program in mode 8 . . . severe flashing will occur. This may be removed by pressing the key "4".

Saving an image

After processing, the main screen may be saved to disk or microdrive. Press F3 and input the name of the device to save to. A directory of files already saved is displayed and you are asked for a name for the image to save. If there is not enough room to save the screen (64 sectors) or you have changed you mind - just press ENTER. Otherwise, type a name for the screen and press ENTER.

Note: SAVE-ing will overwrite any previously saved file of the same name.

Once both images have been loaded, the inlay window can be manipulated as follows:

←→↑↓ ..... to pan/scroll the inlay screen
←→↑↓ + SHIFT ..... to adjust the size/shape of the window
←→↑↓ + ALT ..... to move the inlay window around the main screen
F5 ..... will print the image in the window to the screen beneath

Note: The inlay window may be removed from the screen by reducing its height to 0 using SHIFT and ↑, after which ←→↑↓ may be used to pan/scroll the main screen display.

COPY mode

This mode is concerned with freehand copying, drawing, transfer and stretching of screen images/textures. Press F4 to enter COPY mode.

You are presented with two superimposed cross-wire cursors which may be moved around the display in parallel (using the CURSOR keys). One of these represents the "reading" brush, and the other the "writing" brush. To set the relative positions of the cursors, the function keys F1 to F5 are used as follows:

F1 - writing brush right
F2 - writing brush left
F3 - writing brush down
F4 - writing brush up
F5 - the writing brush assumes the same location as the reading brush

While the cursors are separated, pressing SPACE will transfer from one cursor to the other, similar to a pantograph.

However - when the cursors are superimposed, the ALT key will cause the brush to read the texture/colours into the buffer. Consequently, pressing the SPACE bar will write those colours back to the screen. It is then possible to draw with the stored texture.

Using this technique (and a skillful manipulation of ALT and SPACE), textures can be stretched from (say) the side of a face to distort its shape/contours. Each time ALT is pressed - a new set of colours is read by the brush into the buffer.

Step

For all cursor movement, the step rate may be altered by pressing SHIFT. Between 1 and 8 pixels per step are possible. While holding down SHIFT, the current step is indicated at the top left of the screen.

Brushes
A selection of brushes is available - to change brush press CTRL. While the CTRL key is pressed the brush shape/icon is displayed at the top of the screen. Eight brushes and two airbrushes are provided - which, when used in conjunction with varying step sizes, gives an enormous range of possible textures for drawing, transfer etc.

Note: when using the airbrushes, a step of 2 or 3 is recommended.

To EXIT from COPY mode - press ESCape
To QUIT the program (from INLAY mode), and return to Basic - press CTRL + ESCape

---

Zoom_bas

Zoom_bas is a routine written in Basic to illustrate the procedure MAG, used to examine a 28x20 pixel block magnified to 16 times. The routine (which can be incorporated within a larger program) is used as follows:

A block appears on screen, which will move in response to the cursor keys. This should be positioned over the area to be examined.
Press SPACE - the block will be magnified in a window to one or other side of the screen.

Inside this window a flashing "pixel" indicates the current cursor position. It is possible to draw within the window using the CURSOR keys and SPACE (the default ink colour is black but may be changed by pressing "C"). Any drawing will be echoed normal size on the screen. Moving the cursor to an edge of the window will cause the area that is magnified in the window to be scrolled or panned in that direction. (Pressing F5 indicates the screen location of the block).

To exit from the routine press ESCape.

Definer_bas

This is a very simple character definer which (unusually) allows you to work with the complete 9x8 character matrix (although only mode 4's CSIZE 1,0 and 1,1 are capable of using the full matrix).

Each screen channel has two character fonts. Normally the first contains characters 31 (the graphic square) to 127 (©) while the second contains characters 127 to 191 (© to ↓). Font 1 requires 875 bytes and font 2 requires 587 (see FONT on page 8). When the program is loaded you are asked to select font 1 or 2 (which is then transfered from ROM into an area pointed to by VAR(3)). On loading a font from microdrive for redefining, this selection is made automatically.

Definer_bas contd.

The main display consists of four windows. In the top window the new set of characters is displayed beneath their ROM set equivalents. These may be scrolled left or right using F1 or F2. The current character is also displayed in the next window down in a selection of sizes together with its character code. To the left is an enlarged display of the character's pixels. On releasing F1 or F2, after a short pause - the current character will be read into the large display. (To prevent this - press TAB immediately after releasing F1 or F2).

You can draw within this display to modify the character, using the CURSOR keys and SPACE bar (F5 clears the matrix). You can write the modifications to the character definition by pressing ALT.

The fourth window contains "help" information, and is used for prompts when loading (F3) or saving (F4) character sets.

Note: Saving will overwrite a previously saved file of the same name.

Once a font has been edited or created and saved to disk or microdrive, it can be installed using the command FONT. The process is as follows:

```
Reserve enough space  - ie:      addr = RESPR(875)
Load the font                    LBYTES mdv1_symbol_set, addr
Install the font for (say) #2    FONT#2, addr, 0
```

Note: If either font address parameter is zero, that font will default to the ROM character set.

EXTENSIONS

(F or P indicate either function or procedure)

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F	ALCHP	4
F	BCOLBUF	13
F	BRUSHBUF	12
F	BVAR	5
F	CHANID	9
P	CHECK	5
F	CNUM	12
P	COMP	15
F	COMPSIZ	15
P	CROSS	11
P	CURDIS	9
P	CURSEN	9
P	CURSZ	8
P	DCOMP	15
F	DEC	11
F	DEVSTAT	6
P	DISP	7
P	DUMP	11
F	FLEN	13
P	FONT	8
F	FONT1BASE	8
F	FONT2BASE	8
P	FRAME	3
F	FREE	5
P	GETBRUSH	12
P	GRID	11
F	HEX$	11
P	LIMXY	10
P	LOCK	6
F	LOCKED	6
P	MAG	16
P	MOVXY	10
P	NOKEY	14
P	PAINT	3
F	PCOL	15
F	PEEK_S	7
P	PLACE	14
F	POINTBUF	2
P	POINTER	2
F	POINTKEY	2
P	POINTSPD	3
P	POKE_S	7
P	PUTBRUSH	12
F	QDOS$	5
P	RECHP	4
P	RECT	11
P	REPORT	6
P	RESET	6
P	ROTATE	16
F	SCADDR	7
P	SETWIN	8
P	SETXY	10
P	SFLASH	16
P	SHRINK	17
F	SMODE	7
F	SPA	10
P	STAMP	5
P	STORE	14
F	STORSIZ	14
P	SVAR	13
P	UNLOCK	6
F	VAR	13
P	WAIT	6
P	WAITMD	13
F	XCHRP	9
F	XCHRS	9
F	XP	10
F	XPIXP	9
F	XPIXS	9
F	XPOINT	2
P	XYSTEP	10
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F	YP	10
F	YPIXP	9
F	YPIXS	9
F	YPOINT	2

Programs

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Also on the GRAPHIC TOOLKIT microdrive ...

Pointer_demo_bas
RPRINT_bas
Symbol_set
Puzzle_bas
Relief_set
Screen_scr

FOR ALL USERS

The program Transfer_x contains a 'PAINT' function (accessed during COPY mode)

PAINT (<) When the key '<' is pressed followed by a colour between 0 and 7, a 'PAINT' will be executed at the cursor's co-ordinates. If the '<' key is held pressed, then the fill will execute using the colour selected for the previous PAINT.

FOR USERS WITH EXTRA MEMORY

The program Transfer_x contains the following new features:

UNDO (U) When the program is first executed, a copy of the screen is read into the 'undo' memory area. Any changes made to the main screen display can be 'undone' by pressing the key 'U' (during INLAY mode).

UPDATE (X) The 'undo' area is updated only when the key 'X' is pressed (in either INLAY or COPY mode). After the 'X' key has been pressed it is not possible to UNDO any changes that have taken place. It is recommended that you update the 'undo' area each time you are satisfied with your image.

ERASE (?) The ERASE feature is another unique feature of the program TRANSFER_x. It does not reveal a background colour as it erases ... IT REVEALS THE BACKGROUND PICTURE. In other words this is a 'freehand UNDO'. Some other graphics programs offer what they call a 'freehand UNDO' however what they mean is that they undo all the freehand drawing that was done since the last function change or 'undo update'. The eraser used in TRANSFER_x is a true FREEHAND ERASER.
The erase function is switched on and off (during COPY mode) by pressing the '?' key. When ERASE is enabled, a medium pitched tone will be heard - when disabled, a low pitched tone will be heard.
The current brush is used for the ERASER and any of the available brushes may be used, including the airbrushes.

A useful application is the transfer of a block of image from one screen to the other, after which the edges of the block can be cut away / shaped etc. using the eraser and the various brushes, to blend the transfer into the surroundings.

Z = PeeK (655 36)

4BYTES mehr 4..K F.Z

Call Z.