THE 40-COLUMN ROM

There are some important words used throughout this leaflet that must be well understood in order to make the most of the 40column ROM. These are the SCREEN, the DISPLAY WINDOW, the EDITOR routine, the INTERRUPT routine and the INPUT routine. A few other hardware terms also need to be known such as MEMORY, PROCESSOR and the VIC chip. A complete page, devoted to these terms, is at the end of this text. Practically, you only have to know how to activate the ROM and by trial and error, make your own choice of DISPLAY and SCREEN.
Underneath the SRC 16 or SRC 32 Ram cartridge, there is a switch block. To activate the 40-column ROM, sw1 must be on and sw4 must be off. (Sw1 controls the chip select of the ROM and sw4 the RAM between $A000-BFFF). Power on the VIC and enter:

```
SYS40960:WABCD
```

Press return after the command.
The display will shrink and show:

```
**** CBM BASIC
26879 BYTES FRE
READY
```

The memory size is reduced from 28159 to 26879
If you move the cursor to the right, the following things will come out from the right hand side of the screen:

```
   V2 ****
   E
```

You could call this lateral scrolling. The proper term is in fact automatic tracking of the cursor.
You can control the window movement in 3 different ways:
1) With the cursor. The window has to follow the cursor anywhere the latter goes.
2) With the joystick. The joystick replaces the cursor keys, and the fire button replaces the delete key.
3) With the (control) cursor keys. Press Control key at the same time when depressing the cursor keys (shifted and unshifted with only the left hand side shift key)

SYS40960 will cause the VIC to jump to the 40-column ROM. The parameters which follow will tell the ROM how the screen will be configured.
'W'param. is the window mode prefix setting the window flag ($02FC).
'A'param. is the DIS-COL (number of letter that you see) size. Its value is defined in the table below. A is worth 15, .B=16, C=17 etc...
Next to the letter 'A' which defined the DIS-COL, you have the DIS-ROW value, 'B', which is worth 16. This means that there will be 16 lines on the display.
Next to the DIS-ROW value is the MAXCOL value. 'C' gives to the MAXCOL the value of2 x 17, there will be 34 characters per screen

line, 19 more than the DIS-COL value. This is put in evidence with the scrolling movement. The letters 'V2' in the example above are seen when the display is moved to the right.
The exception of the MAXCOL value is needed by the 80 column card. It is possible to specify 80 column by the letter Z, normally worth 40.
The last one is the MAXLINE value. 'D' gives the value of 18 to the number of screen lines, 2 more than the DIS-ROW in the above example.

Now enter:

SYS40960:

The VIC will print some status information about the display:

```
MAXLINE:018
MAXCOL :034
DISPLAY:017
COLOUR :020
DIS-ROW:016
DIS-COL:015
LEFT-MG:018
TOP-MRG:040
BASIC  :023
RAMTOP :128
```

You can now try different values for the display and screen format. The general formula is as follows:

The display mode:

SYS40960: DIS-COL (space) DIS-ROW

Example of display mode: SYS40960: P R (30 x 32)

The window mode:

SYS40960 (to access the ROM) : W (window prefix) (separator) DIS-COL (space) DIS-ROW (space) MAXCOL (space) MAXLINE (then return)

Other examples of the window mode: SYS40960: W M P Z Z
display window: 27 x 30, screen: 80 x 40

A=15	B=16	C=17	D=18	E=19	F=20	G=21	H=22	I=23	J=24
K=25	L=26	M=27	N=28	O=29	P=30	Q=31	R=32	S=33	T=34
U=35	V=36	W=37	X=38	Y=39	Z=40				

Usually, to get the normal television picture with 22 colunm screen and 23 lines, the formula would be:
SYS40960:HI
Space can be omitted.
Any bigger window can be specified. You will have to adjust your

television to get more than 32 columns wide and 30 lines high. A video monitor will accomodate much more.

In either mode, specifying too big a sreen or display size may cause the ROM to install a default format and this could cause quite a few problems.
If you have specified a small format once the program has started and subsequently decide to change to a larger format, the program typed in may be lost. This is because the Basic area hasd to be raised in order to accommodate the larger size.

POSSIBLE APPLICATIONS

Many applications involving games and picture drawing can be considered. Due to great pressure of work on the 40 column ROM we cannot supply yet any concrete example of typical applications. Updating information can be sent to you later upon request.
The major use in our view is to make it possible to offer a low cost word processor based on this ROM, destined to be used in conjunction with our (colour) 80 column video card.
A different command mode that is not explained above is reserved for its use: SYS40960:,,25,80,1,25,80,112,120
This sort of VDU command will tell the ROM that the display card is available, the sreen is at $7000 and colour map at $7800. The full screen is visible on the video and the window is still available to the normal VIC television output.
The 80 column card will cost arount £40 and will be available shortly.

FURTHER TECHNICAL EXPLANATIONS:

Inside the VIC computer you will find the central processor unit (CPU for short, which is a Commodore product, MOS-6502A), 2 ROM chips- one holds the character set (2332) and the other (23128) holds the operating system and the basic interpreter, the video interface chip-MOS 6551-VIC for short, lots of random access memory chips-2114's and 2 x 6522's versatile interface adapter chips.
The VIC chip is responsible for the display and the sound generator. The CPU treats all devices the same way. They are simply memory locations regardless of their real function.
When a program is loaded (or typed) into the VIC20, it is stored in the RAM. The CPU simply treats the program as a memory area, the operating system as another area ,the VIC chip another memory location etc..
Physically, action produced by the VIC chip does not interfere much with activity of the processor due to a designer's trick. The VIC chip works alternately with the processor chip (known as transparent access). The VIC chip will treat a portion of memory as the display memory; it translates numbers stored in this area into video signal for your television set.
What emerges from this explanation is that the basic interpreter which is responsible for running your program does not know what the VIC chip is doing. It only knows that the screen is a portion of memory, whether identical or not to the display memory.
When the display memory (known to the VIC chip) is not identical

to the screen memory (known to the basic interpreter), some sort of automatic translation of a portion of the screen memory to the display memory will take place. This is precisely the work of the 40-column ROM.
The basic interpreter (or other machine code programs) controls the screen with a portion of code, known as the screen editor. This code is actually written in a rigid way for the VIC20 and offers what you know as the normal screen: 23 x 22. Fortunately the VIC also allows you to intercept commands going to this screen editor by modifying its vector (base address) at location ($0316-$0317). When you type in SYS40960, the 40-column ROM will perform this modification and take over the job of the screen editor.
The keyboard uses the screen as extra input. The 40 column ROM will also have to handle the input routine at the same time.
There is a need to move the window quickly, even when the cursor is not visible. This is achieved with the control cursor keys. The routine responsible for keyboard scanning is the interrupt routine which is called 60 times a second. The 40-column ROM also redirects this routine to itself.
Under control of the 40-column ROM, the display memory and the screen memory can be distinguished and likewise for the screen colour and the display colour. In the display mode, the screen memory and display memory coincide. This saves the expense of extra memory and this solution is implemented on the VIC20. In the window mode, the amount of memory used by the screen and display will show up in the reduction of the number of bytes free.
For practical purposes, a standard screen width of 80 column is needed to match most printers. By defining a screen of 80 columns you will see exactly what will be printed on paper. Most word processors use a text line width of 64 columns. You can also define a screen large enough for you to see what your text will look like once printed. Such things can be easily produced with the 40-column ROM.
To summarize, the 40-column ROM interfers with programs run on the VIC through these 3 routines.Pressing the Run-stop Restore key will return the VIC to normal Display Mode, 22 x 23.

We wish you much successful use and interesting programming with the 40 column Rom. We regret that we cannot give advice on very specific applications, using sepcific printers or formats, for example. We also regret that we cannot give detailed technical advice by telephone. If you experience what you may consider to be a hardware-based problem, please write to our technical department, which will be happy to deal with it appropriately.

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