

NEW 4032/4016 PET CONVERSION TO 80 COLUMNS

by Dieter Demmer

The new models coming from Commodore (identified by the 12 inch C.R.T.) called 4016/4032 can be 'easily' converted to an 80 column machine. Here is how you can do it.

First the jumper configuration must be changed using either new jumpers to convert the PET permanently or using toggle-switches in case you want to keep both, a 40 column and an 80 column alternately. Jumper 1 goes to 2, and 3 goes to 4 (located at front right of board). This changes the dot-clock rate and the video shift-register load frequencies. Secondly the two jumpers marked 40 and 80 go to the 80 position (located front center of board). These jumpers change the addressing of the odd/even screen memory to incorporate the second 1000 words of screen-ram. Now five I.C.s have to be installed in the locations that are free on the printed circuit board:

Qty 2 - 2114 (1024 X 4 Ram) in UC6 and UC7

Qty 2 - SN74LS244 (Driver) in UB6 and UB7

Qty 1 - SN74LS373 (Buffer) in UB8

If both, 40 and 80 versions are desired, pin 1 of UB8 must be switched via another jumper or toggle-switch. In 40 column position this pin is simply pulled up to VCC via a 2 K resistor and in 80 column position it is connected to the artwork of the board.

To complete the hardware modification, all BAx jumpers located in the centre of the board must be moved one position up. The easiest way to accomplish this is to install single-row male header strips (20 pins) and using a shorting plug with every other pin shorted across, move the plug one position up for 80 columns and one down for 40. This jumpering accomplishes the screen-ram addressing scheme which is word oriented rather than byte. I.e. BA0 is not used, BA1 goes to SA2 etc.

Now that the hardware resembles an 8032, some firmware changes are in order to make the operating system aware of this. All changes take place in the E000-E7FF Rom of the system. It must be re-programmed using a 2716 or 2516 E-Prom. Use a friends programmer if you don't have one yourself. Here are the necessary changes:

1 - Screen line wrap table must be changed to reflect 80 columns.

2 - CRTC registers must be set for different line spacing and line length.

3 - PET must come on in lower case characters.

4 - Screen clear function must now clear 2000 locations.

The following minimum changes were done to the authors system and all standard 8032 software runs as normal.

LOCATION FROM TO LOCATION FROM TO

E045 C0 80 E047 83 87
E04C 28 50 E05C 9D 20
E05D 00 9E E05E 80 E5
E07F 27 4F E091 28 50
E095 28 50 E1DF 27 4F
E28E 28 50 E32B 28 50
E32F 28 50 E34E 28 50
E3FA 27 4F E407 27 4F
E70C 27 4F E734 27 4F
E67F 8E 20 E680 4B BA
E681 E8 E5

Create two new routines at the presently unused area after E59E and insert the following code:

Routine one (clear screen)

E59E STA 8000.X
ESA1 STA 8100.X
ESA4 STA 8200.X
ESA7 STA 8300.X
ESAA STA 8400.X
ESAD STA 8500.X
ESB0 STA 8600.X
ESB3 STA 8700.X
ESB6 INX
ESB7 BNE E59E
ESB9 RTS

Routine two (reprogram CRTC and lower case)

E5BA LDA (No.sign)\$09
E5BC STA \$E880
E5BF STA \$E881
ESC2 LDA (No.sign)\$0E
ESC4 STA \$E84C
ESC7 LDX (No.sign)\$00
ESC9 STX \$E84B
E5CC RTS

Change the table in addresses E799 thru E7B0 to the following:

(least significant byte of screen wrap-table)

50 A0 F0 40 90 E0 30 80 D0 20 70 C0
10 60 B0 00 50 A0 F0 40 90 E0 30 80

For persons not equipped to implement these changes, a fixed up version may be made available on disk or tape. Since the software is proprietary to Commodore Business Machines Inc., the author prefers to have interested people do the changes themselves.

To have 40 and 80 column capabilities at the flick of a few switches, it is recommended to keep both roms, the old (901499-01) and the fixed up version in the system. To change between them a rom switch board could be installed in the 'E' socket. It may be necessary for a proper graphics character ratio, to adjust the vertical size slightly. This can be done from the underside of the PET without dismantling the entire cabinet. (Use small insulated screwdriver or filter adjustment tool).

Due to the high frequency that is switched in some cases (16 Mhz), it is required to keep the leads to the switches as short as possible. Care must also be taken to install the miniature toggle-switches laying down on the board since the height underneath the keyboard does not allow standing them up. Even sub-miniature P.C. mount are too long.

The thus modified PET in my possession can be altered for any configuration within 10 seconds. Make sure power is turned off when switching systems or funny things happen on the screen and the PET may crash (software-wise, that is).

For real hardware experts, there is a method of implementing all changes with the addition of a single Flip-Flop (SN74LS109) and only one 4 pole double-throw switch which will have the added advantage of two complete screens full in 40 column mode. This additional chip has to be installed in the main 16 Mhz clock line between UE5 and UD3/UD2 to divide all frequencies at the counter output by two. In this case the feedback to the clock-phase shift register A input has to be moved to output Qc of UD3 instead of Qd to retain correct memory timing.

It seems that J.Strasma (see July TORPET) has expressed wishes for a dual function PET of this kind. For software development people it is obviously a must, if only one machine is to be kept in the house.