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Austin Franklin Associates Inc.
HARDWARE/SOFTWARE/SYSTEMS CONSULTANTS

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20-SEPT-83

AUSTIN 80 (TM) COLUMN VIDEO PROCESSOR BOARD WITH
OPTIONAL RGBI COLOR BOARD FOR THE ATARI 800 (TM)

Custom next generation MOS/LSI video processor/controller used for word processing, terminal communications, programming, spread sheets, data bases, and the ATR8000.

FEATURES:

* 80 X 25 character screen
* 256 character EPROM - contains ATARI character set with Atari graphics symbols, also box and line characters.
* 7 X 9 character size in a 8 X 10 block.
* 4K on-board character and attribute memory.
* True descenders.
* Eight attributes: (can all be accessed by keyboard and program control.)
  - 4 RGBI color output bits
  - Blink
  - Reverse video
  - Half intensity
  - Underline
* Blinking cursor can be turned ON/OFF by keyboard control.
* Beep at end of line can be turned ON/OFF by keyboard control.
* Handles all Atari full screen editing functions such as: insert/delete line and character, clear screen, cursor controls, also, clear to end of screen, and clear to end of line.
* Software switches to 40 columns when graphics are used.

FACTS:

* Composite video output to monitor.
* Monitor must be of 10mhz bandwidth or better for quality picture.
* Proprietary phase locked loop synchronized access of character and attribute memory to insure no screen flicker.
* Runs text mode 0 through CIO.
* All features/attributes are available to user through program output statements. Such as:
  10 PRINT"<ESC><CTL-B>this line will blink<ESC><CTL-B>"
* System runs up to 30+% faster with this video board.
* Output to screen is at >20k baud.
* Resets to 80 columns from system reset.
* Easy plug-in installation - no modifications necessary.
* Installs in last slot with ribbon cable I/O cable through back cover.
* Automatically boots up 80 columns.
* Occupies no user ram - addresses are in the $D500 and $D600 pages.

WARRANTY: One year parts and labor.

PRICING: Austin 80 - $289.95
RGBI color board - $69.95
64k ATR8000 w/CP/M 2.2 including Austin 80 - $699.95
Smart Terminal Program - $39.95
Letter and Data Perfect available - inquire on price

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The Austin 80 (TM) video board for the Atari 800 (TM) comes with a monochrome composite video output for a monitor. The monitor must be of sufficient bandwidth (resolution) to support 80 columns. For RGBI color output the optional RGBI cable and adapter must be used.

COMPONENTS AND COMPONENT DESCRIPTION:

1. Austin 80 Column Console Software Cartridge -
   For 80 column auto-boot the cartridge is installed in the right cartridge slot. You may or may not choose to use an 8K cartridge in the left slot (such as BASIC). 16K cartridges will not work with the console software cartridge. For 40 columns remove the console software cartridge (this cartridge DOES NOT take up any ram).

2. I/O Cable:
   There are four connectors providing the following I/O:
   - 9 pin 'D' connector provides light pen input using pins 6 and 8. Light pens that are compatible with joy stick port 4 of the Atari will work with this.
   - 5 pin 'DIN' connector provides the 40 column video to the monitor when 80 columns is not selected. This plugs into the monitor output on the right side of the unit.
   - RCA (stereo hook-up type) connector provides the monochrome composite video output to the monitor.
   - 10 pin ribbon cable connector plugs into the Austin 80 and runs out through the rear of the unit under the cover.

3. Video Processor Board -
   DO NOT try to adjust anything on the board. You may render the board useless. If it is not installed in the unit it must be in its anti-static bag.

   The board fits in slot 3 (the last slot). It is recommended that you use a 48K Austin Board with loopback to get 48K.

   The character generator EPROM (24 pin chip with clear window) may be replaced with another character set.

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INSTALLATION OF THE AUSTIN 80 (TM)
INTO THE ATARI 800 (TM)

1) Power down the unit.

2) Remove all cables except the attached tv video cable.

3) Open the cartridge door.

4) If your unit has flaps to remove the top cover, turn them and remove the cover.

   If your unit has screws only, remove the two screws and remove the cover.

5) If there is a board in the last slot (slot 3), remove it.

6) Change or put in any new memory boards in slots 1 and 2. It is recommended that you use the Austin 48K and loopback for optimum memory.

   NOTE: Components face toward rear of unit.

7) Open the anti-static bag with a pair of scissors and remove the video board.

8) Attach the I/O cable to the video board as follows: Face components toward you with gold edge connector facing down. Locate the 10-pin connector on the right side of the board.

   NOTE: There is a 14-pin connector above it.

   On the cable assembly there is a red stripe designating pin 1. Install the 10-pin socket onto the connector on the video board with the red stripe toward the top of the board. Make sure the connector is properly aligned on all 10 pins. The cable should run across the board from right to left.

9) Install the video board in the last slot with THE COMPONENTS FACING TOWARD THE REAR OF THE UNIT, and the cable going out the right side of the chassis.

10) Fold the video cable over 90 degrees as it exits the card chassis in the channel. Run it in the channel and out the back of the unit.

11) Carefully replace the top cover taking care not to disturb or damage the I/O cable. Latch it with the screws or tabs.

12) Plug in the 5-pin 'DIN' connector into the computers monitor output on the right side of the unit.

13) Connect the compsite video monitor to the RCA jack via a male to male or other suitable cable.

NOTE: One end RCA male and other end to suit your monitor.

14) Connect the 9-pin 'D' connector to a light pen if needed.

15) Plug the software cartirdge into the right slot.

16) Reconnect the power cable only. Close the cartridge door.

17) Turn the computer and monitor on, 'Atari Computer Memo Pad' should appear on your monitor in 80 columns.

NOTE: The memo pad does not function in 80 column mode.

18) Adjust your monitor controls to get the entire 80 X 25 character screen on your monitor.

19) Reconnect the other cables as you deem necessary.

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PROGRAMMING WITH THE AUSTIN 80 (TM) VIDEO BOARD

IMMEDIATE MODE:
This is direct keyboard input to the screen.

CTL-A	Toggle underline
CTL-B	Toggle blink
CTL-C	Turn cursor ON/OFF
CTL-I	Toggle intensity
CTL-K	Clear to end of line
CTL-O	Enable/disable toggle for these CTL chars.
CTL-P	Toggle 78 column beep
CTL-R	Reset all toggles
CTL-S	Clear to end of screen
Atari key	Toggle inverse video

PROGRAM MODE:
This is used in any output statement to the screen. Use an ESC before CTL characters.

EXAMPLE OF PROGRAM MODE:

```
 1  PRINT"<ESC><CTL-R>"
 5  PRINT"<ESC><CTL-O>"
10  PRINT"<ESC><CTL-B>THIS LINE WILL BLINK<ESC><CTL-B>"
```

Any attributes may be combined in any output string to the screen.

The first output to the screen should be an <ESC><CTL-R> to clear any leftover attribute toggles. CTL-O must be toggled before any of the above control characters are operative (except CTL-K, CTL-O, CTL-R, and CTL-S).

NOTE:
All attributes and these control characters (except CTL-O and CTL-R) come up in the off state. The physical and logical line size is now 80 columns.

To return to 80 columns from a graphics mode, hit system reset.

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DEVICE HANDLERS

(It is assumed that you understand devices and the O/S, this is described in the Atari O/S manual and O/S source listing.)

Upon turning your system on, the 80 column cartridge in the right slot takes control of the system. It replaces the systems device handlers for the E: and S: devices (display and screen editor handlers). All subsequent calls through CIO to these devices are passed to the 80 column drivers. When a graphics mode other than 0 is issued in an open call, the 40 column drivers are installed in the system.

NOTE: This cartridge lives in the $D500 address space, and does not occupy any ram in the system, not even the 8K that the right cartridge normally occupies.

To return to 80 column mode, you will have to reopen the 80 column devices by closing the old handlers and calling the 80 column routines (as described below) as you would any handlers to init them.

NOTE: Basic does some funny stuff down in the page 0 device handler (duplicate of the one currently active) by writing the put byte routine address into it, so you will have to do the same to get back to 80 column mode.

Device table description:

Jump table for display handler:

```
$D524  DTAB:   DW     DOPEN-1      ;ADDRESS - 1 OF OPEN ROUTINE
               DW     RET1-1       ;CLOSE
               DW     DGTBYT-1;    ;GET BYTE
               DW     DPTBYT-1;    ;GET BYTE
               DW     RET1-1       ;GET STATUS
               DW     RETURN-1;    ;SPECIAL(N/A)
               JMP    DINIT        ;DISPLAY INIT
               DB     0            ;FILLER BYTE

$D534  ETAB:   DW     EOPEN-1      ;OPEN ROUTINE
               DW     RET1-1       ;CLOSE
               DW     EGTBYT-1;    ;GET BYTE
               DW     EPTBYT-1;    ;PUT BYTE
               DW     RET1-1       ;GET STATUS
               DW     RETURN-1     ;SPECIAL(N/A)
               JMP    EINIT        ;DISPLAY INIT
               DB     0            ;ROM FILLER BYTE
```

NOTE: The EGTBYT routine returns EOF, and BREAK status in Y. The system RESET vectors ($0A and $0B) are replaced so the system comes up in 80 columns when RESET is hit. What ever was there (if non-zero) is replaced to there and is also re-INITed.

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HARDWARE DESCRIPTION:
The video ram for characters and attributes are 16-128 byte banks. The bank number is 'anded' with the particular destination/source you want, and written to $D5F6. The CRTC uses bank 0 only. The base address for it to be read/written to/from is $D600 plus the offset into the 128 byte bank. (Sample drivers are available upon request.)

```
D0\
D1: Select video bank 0-F (as selected by D4-6)
D2:
D3/
D4  =0 select character ram \
D5  =0 select attribute ram : (select only one =0, others =1)
D6  =0 select CRTC          /
D7  =0 select 40 col, =1 select 80 col as video out
```

CRTC REGISTERS:
The CRT controller is an SMC CRT9007 (get the spec. sheets if you intend to program this). It is used in a double speed memory scheme with repetitive memory addressing. This means the CRTC and the 6502 have unlimited, unarbitrated access to the screen and attribute memory making this the fastest method. Repetitive memory addressing means the CRTC handles the screen as a block of continuous bytes. This is the simplest scheme for software to manage.

NOTE: The ATASCII character must be checked for inverse video and the appropriate bit set in the corresponding attribute ram. (See also location ATTRIB.)

HOW TO ACCESS THE CRT CONTROLLER LIGHT PEN FROM BASIC:

```
100  REM subroutine to check CRTC interrupt register for lpen interrupt
110  POKE 54774,176:REM select CRTC
120  X=PEEK(54842):REM put value of interrupt register in X
130  IF X>127 THEN X=X-128:IF X>63 THEN X=X-64:IF X>31 THEN GOSUB 200
140  RETURN
200  RPOS=PEEK(54843):REM row
210  CPOS=PEEK(54844):REM column
220  RETURN
```

NOTES ON LIGHT PENS:
Passive light pens (that use pins 6 and 8 only, no +5) that work in the Atari joy stick ports will work with the Austin 80 (TM). An active light pen (requiring +5v) video cable is available from AFA1. If you are using RGBI make your light pen 'targets' white. Always make them solid and not low intensity. The column data must be read last because when read, it resets the lpen interrupt and resets the registers.

Some light pens have a variance in the column data. The column is tougher to read (by approximately +/- 5 columns), so make sure 'targets' are well separated in the columns. Rows are 100% accurate.

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HOW TO ACCESS THE CRT CONTROLLER LIGHT PEN REGISTERS

From assembly:

```
;
;       SELECT CRTC
;
SELCRT:
        LDA     #$B0    ;B0 selects only CRTC (decimal 176).
        STA     $D5F6   ;Hardware address of video board control reg.
                        ;(decimal 54774).
;       Read light pen registers and put in wherever lpen... regs are
;
READPEN:
        LDA     $D63B   ;Lpen row register (decimal 54843).
        STA     LPENROW ;Any place or reg of your choice
;
        LDA     $D63C   ;Lpen column register (decimal 54844).
        STA     LPENCOL ;Any place ...
;
GOON:
                (go on with your code...)
```

How to poll for a light pen pseudo-interrupt:

```
;
;       check for light pen interrupt in CRTC
;
LPENINT:
        LDA     #$B0    ;Select CRTC (decimal 176).
        STA     $D5F6   ;And write to control register (decimal 54774).
;
        LDA     $D63A   ;Location in CRTC of status register
                        ;(decimal 54842).
;
;       A now contains the status register, interpreted as follows:
;
;       D5      =       A logic one indicates that a new coordinate
;                       has been strobed into the light pen regs.
;                       It is reset to a logic 0 when the column
;                       register is read.
;
        AND     #$20    ;Eliminate all but bit 5 (decimal 32).
        BNE     Get the coordinates..(see above routine READPEN)
;
;       light pen not strobed..continue
;
```

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AUSTIN 80 (TM) MEMORY LOCATIONS

HEX	DECIMAL	LOCATION	DESCRIPTION

$52 82 LMARGN Column of the left margin of text. Zero is the value for the left edge of the screen; LMARGN is initialized to zero. You can POKE the margin locations to set them to your specific program needs, such as POKE 82,10 to make the left margin start ten locations from the edge of the screen.

$53 83 RMARGN Right margin of the text screen, initialized to 79($4F) Maximum physical and logical line length. Both locations 82 and 83 are user-alterable.

Margins are reset to their default values by pressing RESET. Margins have no effect on scrolling or the printer.

A beep may be set to go off at column 78 by using CTL-P.

$54 84 ROWCRS Current text screen cursor row, value ranging from zero to 24. This location, together with location 85 below, defines the cursor location for the next character to be read/written to the screen. Rows run horizontally, left to right across the TV screen. Row zero is the top-most line; row 24 is the maximum value for the bottom-most line.

$55 85 COLCRS Current text mode cursor column; values range from zero to 79. The home position is 0,0 (upper left-hand corner). Columns run vertically from the top to the bottom down the screen, the left-most column being number zero, the right-most column the maximum value in that mode. The cursor has a complete top to bottom, left to right wraparound on the screen.

ROWCRS and COLCRS define the cursor location for the next character to be read from or written to in the main screen segment of the display.

BASIC's LOCATE statement not only examines the screen, but also moves the cursor one position to the right at the next PRINT or PUT statement. It does this by updating locations 84 and 85, above. You can override the cursor advance by saving the contents of the screen before the LOCATE command, then restoring them after the LOCATE. Try:

```
100   REM:  THE SCREEN MUST HAVE BEEN OPENED FOR READ OR READ/WRITE
            PREVIOUSLY
110   LOOK = PEEK(84): SEE = PEEK(85)
120   LOCATE X,Y, THIS
130   POKE 84, LOOK: POKE 85, SEE
```

Note that CHR$(253) is a non-printing character - the bell - and doesn't affect the cursor position.

$60 96 ATTRIB 80 column 8 bit attribute byte. (=1 ON, =0 OFF.) All subsequent writes to the screen will have these as attributes. Set to default (D0-3 and 6 all OFF; D4, 5 and 7 ON) by CTRL-R.

D0 Reverse video (Atari key)
D1 Blink (CTL-B)
D2 Underline (CTL-A)
D3 Low intensity composite video only (CTL-I)
D4 Red (1 = OFF, 0 = ON) (CTL-E)
D5 Green 1 = OFF, 0 = ON) (CTL-N)
D6 Blue (1 = OFF, 0 = ON) (CTL-L)
D7 Intensity - RGBI only (1 = OFF, 0 = ON) (CTL-I)

$73 115 CHFLG = 0 normal character sets, 0 - 127; = $80 (128) upper 128 bytes of character rom used. Normal is default.

$74 116 ROWLEN Used to specify the screen length. 24 is default (25 lines).

$76 118 BEPFLG = 0, no beep = 1. Beep at column 78. This warns user of the end of line. (CTL-P toggles this.)

$79 121 CCOLOR Cursor color (RGBI only). Different from ATTRIB and character color. (Same bits as ATTRIB for D4 - D7, D0 - D3 are not used.)

$2A3 675 TABMAP (10 bytes) Tab stop bitmap for 80 columns, set bit to '1' to indicate a tab stop. Column 0 is MSB of first byte etc.

$2B2 690 FRSTRW First displayed row of CRT (used to scroll screen).

$2B3 691 BRKROW Row at which sequential break of CTRC row addressing occurs.

$2B5 693 NSCROL = 0, scroll; = 1, don't scroll screen. Used to stop the screen from advancing (scrolling) when the cursor goes past column 80 or the end of line (ROWLEN).

$2B6 694 INVFLG Inverse character flag; zero is normal and the initialization value (i.e., normal ATASCII video codes have BIT7 equals zero). You POKE INVFLG with 128($80) to get inverse characters (BIT 7 equals one). This register is normally set by toggling the Atari go key; however, it can be user-altered. The display handler XOR's e ATASCII codes with the value in INVFLG at all times.

INVFLG works to change the input, not the output. For example, if you have A$ = "HELLO",POKE 694, 128 will not change A$ when you PRINT it to the screen. However, if you POKE 694,128 before an INPUT A$, the string will be entered as inverse.

$2F0 752 CRSINH Cursor inhibit flag. Zero turns the cursor on; any other number turns the cursor off. A visible cursor is an inverse blank (space) character. This register is set to zero (cursor restored) on powerup, RESET, BREAK, or an OPEN command to either the display handler (S:) or screen editor (E:). (CTL-C toggles this.)

$2FB 763 ATACHR Returns the last ATASCII character read or written. ATACHR is used in converting the ATASCII code to the internal character code passed to or from CIO.

Make sure the PEEK statement comes before the PRINT CHR$ statement, or you will not get the proper value returned. When the RETURN key is the last key pressed, ATACHR will show a value of 155.

$2FE 766 DSPFLG Display flag, used in displaying the control codes. If zero is returned or POKEd here, then the ATASCII codes 27-31, 123-127, 187-191 and 251-255 perform their normal display screen control functions (i.e., clear screen, cursor movement, delete/insert line, etc.). If any other number is returned, then a control character is displayed (as in pressing the ESC key with CTRL-CLEAR for a graphic representation of a screen clear). POKEing any positive number here will force the display instead of the control code action.

$2FF 767 SSFLAG Start/stop display screen flag, used to stop the scrolling of the screen during a LISTing or a PRINTing. When the value is zero, the screen output is not stopped. When the value is 255($FF; the one's complement), the output to the screen is stopped, and e machine waits for the value to become zero again before continuing ith the scrolling display. Normally SSFLAG is toggled by the user during these operations by pressing the CTRL-1 keys combination to both start and stop the scroll. Set to zero by RESET and powerup.

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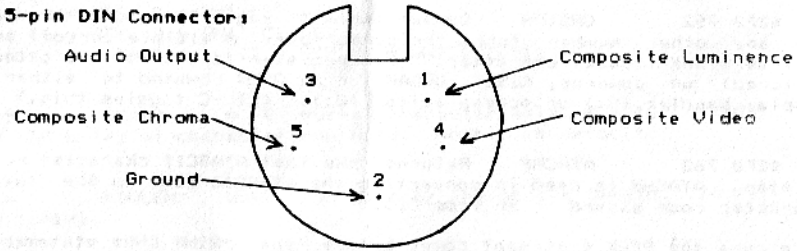
ALTERNATE 5-PIN DIN MONITOR JACK HOOKUPS

CONNECTOR DESCRIPTION:
The 5-pin DIN connector plugs into the monitor output plug located on the right hand side of your Atari 800 (TM).

5-pin DIN Connector:



(FROM BACK OF CONNECTOR)

AUDIO OUTPUT:
To hook up audio output to your monitor or another external speaker, use pins 2 and 3.

VIDEO ARRANGEMENTS:
The 5-pin DIN connector comes wired at pins 1 and 2. This provides the necessary output for most composite video monitors. To hook up alternate video arrangements consult your monitor for appropriate signals. The composite video output from the Atari side port (pin 4), does not have a strong enough signal to be routed through the Austin 80. That is why the composite luminence was used (pin 1).

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EPROM CHARACTER SETS

The Austin 80 (TM) uses an EPROM character generator. If you would like to change the character set you can do so by programming your own EPROM character set. The EPROM is the single voltage 350ns 2732A type. You will also need an EPROM burner.

PROGRAMMING THE EPROM:
Each character is programmed in an 8 X 16 cell matrix. The character size is actually 8 X 10 with the extra 6 rows unused. Normally it is best to leave space around the character by building it in a 7 X 9 or 5 X 7 sub-cell within the larger 8 X 10 master cell.

Row Address

	0	1	2	3	4	5	6	7	EPROM DATA BIT	EPROM ADDRESS
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										
A										
B										
C										
D										
E										
F										

Figure 1 (8 X 16) Master Cell

Using graph paper make a drawing of the master cell and duplicate it for as many characters as you intend to program.

Draw the character in the master cell by putting dots in the boxes where necessary to form the character. For example, the character 'F' in Figure 2 is formed with dots in a 7 X 9 sub-cell.

Row Address	0	1	2	3	4	5	6	7	EPROM DATA BIT	EPROM ADDRESS
0										
1			X	X	X	X	X		$7C	
2			X						$04	
3			X						$04	
4			X	X	X	X			$3C	
5			X						$04	
6			X						$04	
7			X						$04	
8			X						$04	
9										
A										
B										
C										
D										
E										
F										

Figure 2

The characters are addressed in the EPROM as follows:

EPROM ADDRESS BIT	INTERPRETATION
BIT 11	CHARACTER CODE BIT 7
BIT 10	CHARACTER CODE BIT 6
BIT 9	CHARACTER CODE BIT 5
BIT 8	CHARACTER CODE BIT 4
BIT 7	CHARACTER CODE BIT 3
BIT 6	CHARACTER CODE BIT 2
BIT 5	CHARACTER CODE BIT 1
BIT 4	CHARACTER CODE BIT 0
BIT 3	ROW ADDRESS BIT 3
BIT 2	ROW ADDRESS BIT 2
BIT 1	ROW ADDRESS BIT 1
BIT 0	ROW ADDRESS BIT 0

(BIT 0 IS THE LEAST SIGNIFICANT BIT)

Bits 0 through 3 of the EPROM address are the row address. It does not matter what data is programmed into row addresses $A through $F since it is not displayed. The remaining EPROM address is the 8 bit character.

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ADJUSTING THE VCO AND LOW INTENSITY

(...where in this document it says not to adjust anything - well, don't. (...less you feel it is absolutely necessary.)

VCO:
This is to only be adjusted if you have a twinkle effect in your characters, if you do not wish to attempt this and you have this problem, send the board to us and we will adjust it free of charge.

NOTE: This is not a normal adjustment, it is pre-set at the factory and should never need adjusting.

The VCO is adjusted by a white cylindrical capacitor on the top right side of the main video board. It is sealed with locking cement. Scrape the old locking cement off. Use a small slotted screwdriver to turn this. Only turn it a small amount as it should not be that much out of adjustment. Try it a few times in the unit and let it sit for a few hours with the sytem in 80 column mode. Seal the cap with locking cement when you are done tuning it (nail polish works fine).

NOTE: If your screen is wavy, move your monitor away from any transformer, magnets, or other electrical units (tv's, loudspeakers etc.). This should stabalize the screen.

LOW INTENSITY ADJUST:
This is done by the square potentiomenter to the left of the VCO cap. This is not a sensitive adjustment, just turn it with a small bladed screwdriver until you like the results.

Use this basic program to check it out:

```
10 POKE 766,1:REM ENABLE PRINTING OF SPECIAL CHARACTERS
20 FOR K=0 TO 15
30 FOR I=0 TO 127
40 ?CHR$(I);
50 NEXT I
60 ?"<ESC><CTL-I>";:REM TOGGLE INTENSITY
70 NEXT K
80 POKE 766,0
```