## FEATURES

- □ STD Bus Compatible
- □ 80 Character × 24 Line Display
- □ Optional 25th Status Line
- □ Control Code Compatible with VT52™, H-19 (Heath) and Most Other VT52 Emulators
- □ Parallel or Serial Keyboard Interface
- □ 128 Character Display Font
- □ Inverse Video by Character or Entire Field
- □ Auto-Repeat Keyboard Supported
- □ Line/Character Insert/Delete, Cursor Addressing, Forward and Reverse Scroll, Other Advanced Features
- □ Special Graphics Characters Supported
- □ Occupies Only 4 Host CPU I/O Ports, No Memory Space Required
- □ Flicker Free Display
- □ Single +5 Volt Supply
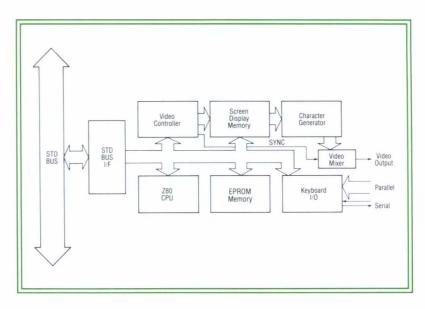- □ 4 MHz Operation
- □ Full 1 Year Warranty

## DESCRIPTION

The COLEX STD-CRT is a Z80 microprocessor based, high performance CRT controller and keyboard interface board for the STD Bus. It emulates the DEC VT52™ and interfaces to the STD Bus via emulation of the common UART. Because of the on-board Z80 CPU, the STD-CRT occupies no host memory space (as memory mapped cards do) and relieves the host of display management overhead. Control codes allow the STD-CRT to provide many features previously available only on expensive terminals: status line, line insert and delete, inverse video, high speed processing, and more.

The on-board Z80 CPU performs all the control and display generation functions of the card. The STD-CRT is accessed by means of the same I/O address scheme as an ordinary UART and no interrupts are required. Data is stored in the on-board dual ported Random Access Memory.

The character display is organized as 80 × 25; line 25 is the status line. Memory is continuous and scrolls automatically occur by moving the start address of the data. Each character cell is organized as 9 × 11 dots; the character generator PROM is 8 × 11 dots. The extra bit is derived by duplicating the last bit. This allows continuous lines and even Arabic characters.

Both standard ASCII serial and parallel keyboards are supported by the STD-CRT board. The serial interface allows a keyboard to be located remotely from the STD-Z80 Bus system and connected via a 4 wire line. An 8-bit parallel port is also available as a system interface. All eight memory bits are supported by the STD-CRT board in order to define special function keys in addition to the standard ASCII characters. The board can signal the user as the right margin is reached or

when the host CPU sends the BELL command. This signal is capable of driving a self-oscillating audible device.

The video output of the STD-CRT is RS-170 compatible and capable of driving a 75 ohm monitor directly or the input of an external RF modulator. Either 625 line, 50 Hz or 525 line, 60 Hz monitors are supported.

## SPECIFICATIONS

### ELECTRICAL

□ System Bus: STD Bus
□ Signal
  Loading:    Inputs:   One 74LS load maximum
          Outputs: $-3$mA min @ 2.4 volts
             24mA min @ 0.5 volts

□ Address
  Bus:   8 bits
□ Data Bus:   8 bits, bi-directional
□ Video
  Output:   625 line, 50 Hz
          or
          525 line, 60 Hz
          RS-170 composite video

□ Keyboard
  Input:   Parallel ASCII
          or
          Keytronic 2207 serial
□ Bell Output: 0 volts @ 100mA, dc
□ System Interrupt Units: 0 SIUs
□ Operating Temperature: 0° to 60° C
□ Power Requirements: @ 25° C

| Parameter | Condition | Min | Typ | Max | Units |
|-----------|-----------|-----|-----|-----|-------|
| $V_{cc}$ | — | 4.75 | 5.0 | 5.25 | volts |
| $I_{cc}$ | @ 5V | — | 800 | 1700 | mA |

NOTE: +12vdc may be required to support some serial keyboard assemblies.

## MECHANICAL

□ Card Dimensions:

| Form Factor | H | W | L | Units |
|-------------|-----|-----|-----|--------|
| STD Bus | 0.60 | 4.5 | 6.5 | inches |

□ PC Board Thickness: 0.062 inches
□ Connectors:
  STD Bus: 56-pin dual readout; 0.125 inch centers
  Keyboard: 26-pin dual readout; 0.100 inch grid
  Video Output: RCA female phono connector
              or
              4-pin dual row; 0.100 inch grid

## ORDERING INFORMATION

| Part Number | Description |
|-------------|-------------|
| STD-CRT-60 | VT52 Compatible Video Display Card for 60 Hz |
| STD-CRT-50 | VT52 Compatible Video Display Card for 50 Hz |
| STM-CRT | Technical Manual for STD-CRT |

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## FEATURES

☐ STD-BUS compatible CRT interface board

☐ 80 character x 24 line display

☐ Optional 25th status line

☐ Control codes compatible with VT52 (D.E.C.), H-19 (Heath) and most other VT52 emulators. Optional Mostek VDI compatible version.

☐ Parallel or serial keyboard interface

☐ 128 character display font (EPROM programmable)

☐ Inverse video by character or entire field

☐ Line/character insert/delete, cursor addressing, forward and reverse scroll plus many other advanced features

☐ Occupies only 4 host CPU I/O ports, no memory space.

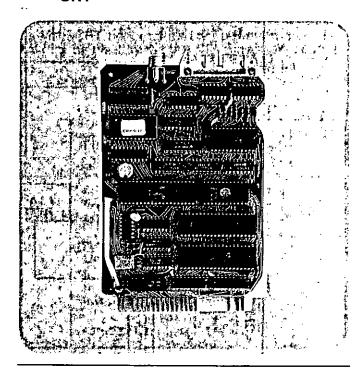☐ On board slave Z80 microprocessor

## MDX-CRT DESCRIPTION

The MDX-CRT is based on the microprocessor independent STD bus. The interface to the STD bus is identical to that of the UART on an MDX-EPROM/UART board. This allows the MDX-CRT to replace an MDX-EPROM/UART card in a system. Unlike other STD-BUS CRT interface cards, the MDX-CRT has an on board Z80 CPU, thus it occupies none of the host memory space. It relieves the host of display management. Data can be written to the MDX-CRT by the host at 65 $\mu$ s per byte.

The MDX-CRT interfaces to a video display via an RS170 compatible 75 ohm output. Normal 625 line, 50Hz monitors may be used.
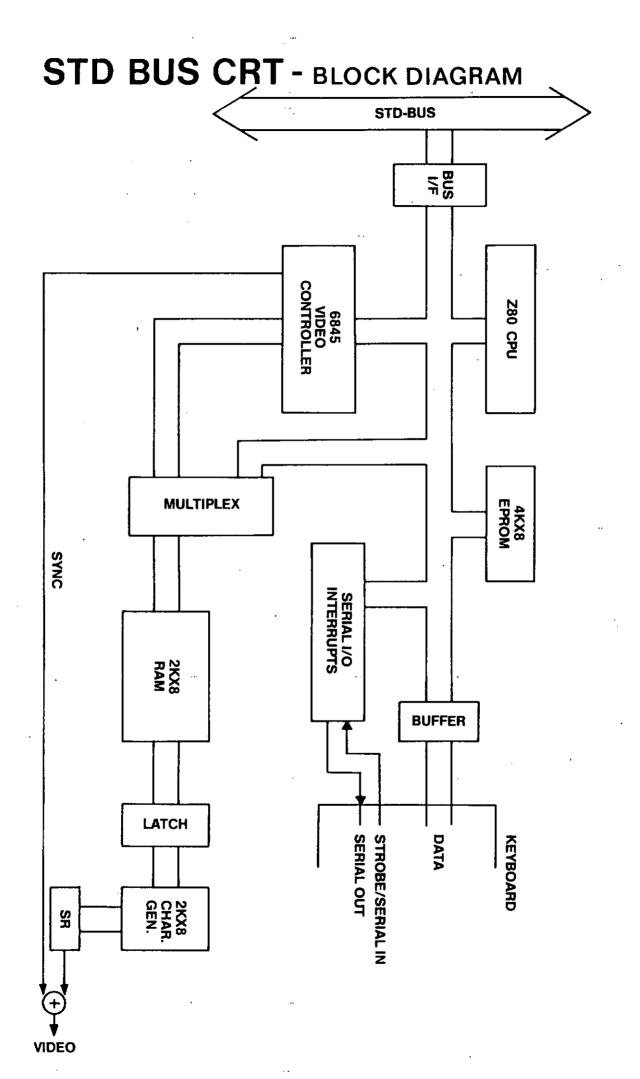
An ASCII encoded parallel or serial keyboard may be connected to the keyboard input of the MDX-CRT. The serial keyboard interface uses common ASCII serial data. For VT52 emulation extra control keys are required. For VDI emulation a minimal ASCII keyboard is sufficient.

## CRT



## ELECTRICAL SPECIFICATIONS

STD-BUS compatible
NO SYSTEM INTERRUPT UNITS ( 0 SIU)
SYSTEM CLOCK Operates to 6 MHz
OPERATING TEMPERATURE 0 to 60 degreesC.
POWER SUPPLY REQUIREMENTS
+5V at 1.7 Amp (excluding keybord)

# STD BUS CRT - BLOCK DIAGRAM

STD-BUS

BUS I/F

6845 VIDEO CONTROLLER

Z80 CPU

MULTIPLEX

4KX8 EPROM

SYNC

2KX8 RAM

SERIAL I/O INTERRUPTS

BUFFER

LATCH

SERIAL OUT

STROBE/SERIAL IN

DATA

KEYBOARD

2KX8 CHAR. GEN.

SR

VIDEO

## MECHANICAL SPECIFICATIONS

### CARD DIMENSIONS
4.50 in (11.43 cm) wide
6.50 in (16.51 cm) long
.67 in ( 1.71 cm) maximum profile thickness
.06 in ( .16 cm) printed circuit board thickness

### STD BUS EDGE CONNECTOR (J9)
56 pin dual readout, 0.125 in.centers

### KEYBOARD CONNECTOR (J7)
26 pin dual readout, 0.100 in.grid
Recommended keyboard: Keytronics L2207-51 (serial)

### VIDEO CONNECTOR (J8)
Cinch-Jones type 81 tip and ring connector

## CHANGING THE I/O ADDRESSING

The MDX-CRT I/O port addresses can be changed from
DC-DF (Hex) to BC-BF (Hex) by removing J3 and J4,
then strapping the jumpers as shown below.

| Addressing | DC-DF | BC-BF |
|---|---|---|
| | J3 .—. | J3 |
| | J4 .—. | J4 ! ! |

## INTERRUPTS

The MDX-CRT creates no interrupts to the bus CPU.
The interrupt daisy chain is wired directly through.

## SYSTEM RESET

The MDX-CRT performs it's own power-on reset. The
card may be reset by the bus CPU under SW control.

## I/O ADDRESSING

The 4 on-board ports are used as follows:

| Port address (HEX) | Type | Bit | Name | Function |
|---|---|---|---|---|
| DC | write | 0-6 | CRT DATA | ASCII data to display |
| | read | | CRT DATA | ASCII data from keyboard |
| DD | read | 6 | DA | Keyboard data ready |
| | read | 7 | TBE | Display ready to receive data |
| DE | write | any | | resets data ready |
| | read | 7 | IDA | inverted data ready (see note) |
| DF | | | | same as DE |

NOTE: Bit 7 of port DE is specially designed for compatibility with systems which use automatic baud rate measurement. These systems use port DE bit 7 for monitoring the serial data in directly to measure the width of the start bit of the first character received after reset. The software first writes to port DE to initialize the UART. This action is emulated on the MDX-CRT by sending the inverted data ready status on port DE bit 7.

## STD BUS CONNECTOR (J9)

| Description | Pin | Pin | Description |
|---|---|---|---|
| +5 V | 1 | 2 | +5 V |
| GROUND | 3 | 4 | GROUND |
| | 5 | 6 | |
| Data 3 | 7 | 8 | Data 7 |
| Data 2 | 9 | 10 | Data 6 |
| Data 1 | 11 | 12 | Data 5 |
| Data 0 | 13 | 14 | Data 4 |
| Address 7 | 15 | 16 | |
| Address 6 | 17 | 18 | |
| Address 5 | 19 | 20 | |
| Address 4 | 21 | 22 | |
| Address 3 | 23 | 24 | |
| Address 2 | 25 | 26 | |
| Address 1 | 27 | 28 | |
| Address 0 | 29 | 30 | |
| WR | 31 | 32 | RD |
| IORQ | 33 | 34 | |
| | 35 | 36 | |
| | 37 | 38 | |
| | 39 | 40 | |
| | 41 | 42 | |
| | 43 | 44 | |
| | 45 | 46 | |
| | 47 | 48 | PBRESET |
| | 49 | 50 | |
| *PCO | 51 | 52 | *PCI |
| GROUND | 53 | 54 | GROUND |
| | 55 | 56 | |

*PCO is connected on the card to PCI as no interrupts are used.*

## KEYBOARD CONNECTOR (J7)

| Description | Pin | Pin | Description |
|---|---|---|---|
| parallel keyboard data bit 0 | 1 | 14 | ground |
| parallel keyboard data bit 1 | 2 | 15 | ground |
| parallel keyboard data bit 2 | 3 | 16 | ground |
| parallel keyboard data bit 3 | 4 | 17 | ground |
| parallel keyboard data bit 4 | 5 | 18 | ground |
| parallel keyboard data bit 5 | 6 | 19* | +5 Volts |
| parallel keyboard data bit 6 | 7 | 20* | ground |
| (special function bit) 7 | 8 | 21 | ground |
| serial keyboard data out * | 9 | 22 | ground |
| parallel keyboard strobe | 10 | 23 | ground |
| STD bus 'Push Button RESET' | 11 | 24 | ground |
| bell output | 12 | 25 | ground |
| serial keyboard data in | 13 | 26 | |

* Required for serial keyboard operation.

## VIDEO OUTPUT

**The video output uses composite sync, with the following timing:**

| | | |
|---|---|---|
| Horizontal sweep | 15603 Hz | 4.73 µs sync width |
| | | 15.26 µs blank width |
| Vertical sweep | 50.01 Hz | 1.02 ms sync width |
| | | 2.37 ms blank width |

Non-interlace, 312 scan lines

The output of the MDX-CRT is capable of driving a 75 ohm monitor directly. It cannot drive the UHF or VHF sections of a normal TV set without an extra modulator.

## PARALLEL KEYBOARD INTERFACE

For lowest cost installation, an 8 bit ASCII parallel TTL connection is provided for interface to the system keyboard. Although in normal ASCII, 7 bits are usually enough to represent the entire ASCII character set, the interface to the MDX-CRT supports 8 bits in order to define special keys in addition to ASCII characters. If bit 7 (the MSB) is 0 then the lower seven of the 8 bits of data represent the normal ASCII characters between 0 and 7F hex. If bit 7 is high then special functions, available on some keyboards, are performed. For example function and cursor keys, these codes cause one or more codes of an escape sequence to be sent to the host CPU or control other terminal functions. See VT52 Emulation Keyboard Codes.
All ASCII codes are transmitted directly to the host CPU, unless the MDX-CRT is in local mode.

## PARALLEL MODE JUMPERS

**J6    J5**

**IMPORTANT NOTE:** Bit 7 must be grounded for ASCII characters.

## STROBE

The keyboard must deliver a strobe when data is valid. The strobe can have either a positive or negative active level, the MDX-CRT automatically determines the keyboard active level on power up (it is important that no key is pressed at the time of power on). If the strobe remains active longer than .5 seconds, then the data on the data lines will autorepeat at 30 characters per second. If the keyboard only provides a pulse on data valid, then no autorepeat will be done by the MDX-CRT. Minimum pulse width is 20 uS.

## LOUDSPEAKER

By connecting a self oscillating resonator between pin 12 and 5 Volts, the MDX-CRT can signal the user that the margin has been reached or that the host CPU has sent a bell command. The loudspeaker output supplies a dc signal for the duration of the bell interval.

Any keyboard input while the cursor is at positiion 72 will cause a 120ms bell tone output to loudspeaker. This margin bell will not signal on data sent from the host CPU while at column 72 unless a bell code is sent.

## SERIAL KEYBOARD INTERFACE

The MDX-CRT supports a serial interface to a keyboard. This allows a keyboard to be located remotely from the STD bus system via a 4 wire line. It utilizes the serial channel of the on-board Z80 CPU. This keyboard interface consists of a 300 baud serial connection.This allows both key data and bell/status information to be exchanged between the keyboard and the MDX-CRT board with 2 data lines. The interface is TTL level, and the protocoll is standard ASCII TTY style with 1 start and 1 stop bit.

The MDX-CRT uses the serial keyboard for bell and keyclick functions. Autorepeat is handled by the serial keyboard.
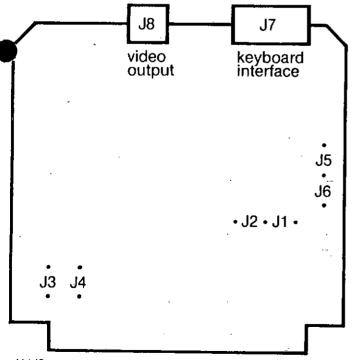
The serial keyboard interface supports 8 LEDs. Two indicate line/local status, a third displays keyboard FIFO full status. The remaining LED's may be programmed by the host CPU.

The Keytronics L2207-51 will work directly with the MDX-CRT.

## SERIAL MODE JUMPERS

J6    J5

·   ·   ·——· ·

## CONNECTOR AND JUMPER LOCATIONS



*J1/J2 are used in the factory and should not be changed.*

## CONTROL CODES

Two versions of the MDX-CRT exist. The MDX-CRT52 emulates the VT52 type of terminal with several key enhancements. The MDX-CRTO emulates the SD-VDI board for simple applications. For detailed information on the MDX-CRTO Control Codes see Appendix B.

## VT52 EMULATION

The control codes designed into the MDX-CRT52 are upward compatible to the VT52 and are also compatible with most of the other VT52/VT100 emulators. If the MDX-CRT52 is used with standard SW, choose Heath-/Zenith H19 command set as this is the enhancement set used in the MDX-CRT52.

The control codes allow the MDX-CRT52 to perform many features previously only available on expensive terminals. Features like status line, line insert and delete, inverse video, high speed processing, and more.

The MDX-CRT52 processes control codes either of one character, or multiple character ESCape sequences. The single character control codes processed by the MDX-CRT52 are listed below. Codes not listed are ignored.

| CODE-(hex) | Function |
|---|---|
| 07 | - Sound 120 ms bell tone |
| 08 | - Backspace cursor one position. Stop at left margin. |
| 09 | - Tab: move the cursor to the next tab position. In the MDX-CRT52, tabs are set at each 8th column. |
| 0A/0B/0C | - Line feed: move cursor down one line; if at bottom, scroll screen up one line. |
| 0D | - Return: set cursor to left margin. |
| 1B | - Start of ESCape sequence. |

Multiple character control sequences. These codes follow the DEC VT52 specification, with additions to handle inverse video, line insert/detelete and other features of VT52 emulators, specifically compatible with the Heath H-19. The ASCII representation of the character required after the ESC character (1BH) in the command is shown after the ESC below. A * left of the ESCape indicates the Heath/Zenith extensions, a + indicates SMS extensions.

| Command | Function |
|---|---|
| ESC A | - Move cursor up one line, stop at top. |
| ESC B | - Move cursor down one line, stop at bottom. |
| ESC C | - Move cursor right one position, stop at right margin. |
| ESC D | - Move cursor left one position, stop at left margin. |
| ESC E | - Move cursor to upper left corner, clear screen. |
| ESC F | - Select graphics character set in place of ASCII 60-7FH. |
| ESC G | - Select normal character set. |
| ESC H | - Move cursor to upper left corner (home). |

| | | |
|---|---|---|
| ESC I | - | Scroll screen contents down one line. |
| ESC J | - | Erase from cursor to end of screen. |
| ESC K | - | Erase from cursor to end of line. |
| ESC L | - | Insert blank line at cursor position. Scroll rest down. |
| ESC M | - | Delete line containing cursor. Scroll rest up. |
| * ESC N | - | Delete character at cursor position. |
| * ESC O | - | Exit insert character mode. |
| * ESC C | - | Enter insert character mode. |
| + ESC W P | - | Load leds 4-8 of serial keyboard from bits 0-4 of 'P'. |
| + ESC X | - | Load screen with 'E' characters to assist alignment. |
| ESC Y y x | - | Address cursor. 'y' is the vertical address, 'x' is the horizontal address. The ASCII character chosen to replace 'y' or 'x' indicates the row or column address. To avoid sending control codes within the addressing comand, 1FH is added to each address. Home is 20H 20H. The bottom right corner is 37H 6FH. The status line is addressed as 38H 'x', where x is the column number. |
| ESC Z | - | Send identification (ESC /K). |
| ESC = | - | Select keypad alternate codes. |
| ESC > | - | Select keypad numeric (normal) codes. |
| ESC [ | - | Enter hold screen mode. |
| * ESC \ | - | Exit hold screen mode. |
| * ESC ] | - | Read 25th 'status' line to host. |
| * ESC b | - | Erase from home to and including cursor. |
| * ESC j | - | Save cursor position. |
| * ESC k | - | Restore saved cursor position. |
| * ESC n | - | Report cursor address. Causes the sequence: ESC Y line≠ column≠ to be sent. The line/column addresses have 20H added. |
| * ESC l | - | Erase entire line. |
| * ESC o | - | Erase from beginning of line to and including cursor. |
| * ESC p | - | Write characters received with white background. |
| * ESC q | - | Write characters received with black background. |
| * ESC t | - | Set keypad as normally shifted. |
| * ESC u | - | Set keypad as normally numbers (unshifted). |
| * ESC v | - | Enable wraparound (auto return/line feed) at line end. |
| * ESC w | - | Disable wraparound. |
| * ESC x P | - | Set mode. The possible codes for 'P' are: |

1 = Enable 25th 'status' line.
2 = Turn off key click (serial keyboard only).
3 = Enter hold screen mode.
4 = Select Block cursor (reset = underline).
5 = Turn off cursor.
6 = Set keypad as normally 'snifted'.
7 = Select keypad alternate codes.
8 = Enable auto line feed on return.
9 = Enable auto return on line feed.

| | | |
|---|---|---|
| * ESC y | - | Reset mode. Codes match Set mode (see ESC x). |
| ESC z | - | Reset. |
| * ESC { | - | Disable keyboard. |
| * ESC } | - | Enable keyboard. |

## VT52 EMULATION KEYBOARD CODES

| Key-code | Name | Unshifted code | Alternate code | Shifted code |
|---|---|---|---|---|
| F 3 | left | ESC D | | |
| F 4 | right | ESC C | | |
| F 1 | up | ESC A | | |
| F 2 | down | ESC B | | |
| B1/B4 | kp 0 | 0 | ESC ?p | |
| C0/C4 | keypad 1 | 1 | ESC ?q | ESC L (insert line) |
| C1/C5 | keypad 2 | 2 | ESC ?r | ESC B (down arrow) |
| C2/C6 | keypad 3 | 3 | ESC ?s | ESC M (delete line) |
| D0/D4 | keypad 4 | 4 | ESC ?t | ESC D (left arrow) |
| D1/D5 | keypad 5 | 5 | ESC ?u | ESC H (home) |
| D2/D6 | keypad 6 | 6 | ESC ?v | ESC C (right arrow) |
| E1/E5 | keypad 7 | 7 | ESC ?w | ESC C (insert mode) ESC O (non insert mode) |
| E2/E6 | keypad 8 | 8 | ESC ?x | ESC A (up arrow) |
| E3/E7 | keypad 9 | 9 | ESC ?y | ESC N (delete character) |
| B2/B6 | keypad . | . | ESC ?n | |
| D3/D7 | keypad , | , | ESC ?l | |
| E4 | keypad — | — | ESC ?m | |
| C3/C7 | keypadENTER | RETURN | ESC ?M | |
| F6 | PF 1 | ESC P | | |
| F7 | PF 2 | ESC Q | | |
| F8 | PF 3 | ESC R | | |
| F9 | PF 4 | ESC S | | |
| FE | Setup | toggle line/local | | |
| B4/B0 | No Scroll | see HOLD SCREEN mode information | | |
| 89 | Space | Space | | |

⌐ ⌐— code if shift key pressed with key **
└— code if shift key not pressed

Other keys are ignored.
Invert bit 7 for parallel keyboard use.
kp indicates keypad keys.
** on the L2207-51 KB, these keys are not generated by the standard prom ESC t inverts normal and shifted keypad modes. ESCμ resets the inversion. (This allows shifted functions without a shiftable keyboard.)

# SPECIAL GRAPHICS CHARACTERS

Character codes (graphic glyphs shown):

Row 1: 7E  5F  60  61a  62b  63c  64d  65e  66f  67g  68h

Row 2: 69i  6Aj  6Bk  6C1  6Dm  6En  6Fo  70p  71q  72r

Row 3: 73s  74t  75u  76u  77w  78x  79y  7Az  7B {  7C |  7D }

---

## APPENDIX A

### MOSTEK SOFTWARE SUPPORT

### MOSTEK DDT-80 SOFTWARE INTERFACE

The MOSTEK DDT-80 firmware debug is used in many Z80 based STD bus applications. The MDX-CRT works best with a modification to the EPROM software. The modification avoids false baud rate measurements and bypasses an unused software switch. The standard MK6293 prom should be used as the base for these modifications.

#### A) Baud rate measurements

In some DDT-80 versions, the RESET/RETURN sequence may result in baud rate calculations which signal the system that delays are required after each character or return or both. There are two ways to fix this. The TK.SRC driver may be modified to load address FFEO with 0 when the TK unit is initialized. Otherwise, the baud rate calculation in prom may be changed to ignore the actual rate determined. To change the prom, look for the sequence '32 EO FF' and insert a 'AF' prior to it in place of a table lookup instruction. The most common versions of DDT-80 would be changed as follows:

| ADDR. | OLD CONTENTS | | NEW CONTENTS | |
|-------|------|------------|------|-------------|
| E040 | 1F | RRA | AF | XOR A |
| E041 | 32 | LD(ØFFEØH)A | 32 | LD (ØFFEØH),A |
| E042 | EØ | | EØ | |
| E043 | FF | | FF | |

#### B) Expanded debug switch

Bit 3 of port DE is not supported by the MDX-CRT, this may cause the DDT-80 to 'disappear' after a command is entered. To remove the call to nonexistant SW, the prom should be changed as shown:

| ADDR. | OLD CONTENTS | | NEW CONTENTS | |
|-------|------|-------------|------|------|
| E14A | C4 | CALL NZ,F004 | 00 | NOP |
| E14B | 04 | | 00 | NOP |
| E14C | F0 | | 00 | NOP |

In systems with no resister terminations, a pulldown resister on bit 3 of the data bus will also stop the CALL to location F004.

# APPENDIX B

## CONTROL CODES

Single character control codes processed by the STD-CRT. Codes not listed are ignored.

| CODE (hex) | Function |
|---|---|
| 07 | Sound 120 ms bell tone. |
| 08 | Backspace cursor one position. Stop at left margin. |
| 09 | Tab: move the cursor to the next tab position. |
| 0A | Line feed: move cursor down one line; if at bottom, scroll screen up one line. |
| 0B | Reverse line feed, move cursor up one line; if at top scroll screen down one line. |
| 0C | Move cursor one column to the right unless at margin. |
| 0D | Return: set cursor to left margin. |
| 0E | Delete tab marker at this position. |
| 0F | Set tab marker at this position. Downshift, next character is from graphics set. |
| 17 | Set inverse video mode. |
| 18 | Set inverse video mode. |
| 19 | Reset inverse video mode. |
| 1B | Start of ESCape sequence. |
| 1C | Set remote mode, send 06 as acknowledgement. |
| 1D | Clear to end of screen. |
| 1E | Go to home position. |
| 1F | Clear te end of line. |

Multiple character control sequences. These consist of two or more characters, the first of which is always an ESC charater (1HB). Codes marked with a * are additions to the MOSTEK VDI control set.

| Command | Function |
|---|---|
| ESC = yx | Address cursor. 'y' is the vertical address, 'x' is the horizontal address. The ASCII character chosen to replace 'y' or 'x' indicates the row or column address. Home is 1B 3D 17 0 (hex bytes) The bottom right corner is 1B 3D 0 4F (hex) If the status line is enabled it may be accessed for writing via 1B 3D 18 x (hex) where x is the horizontal address. |
| ESC + yx | Position cursor relatively using y and x as 7 bit positive numbers converted to addresses via module 24/80 arithmetic. |
| ESC ? | Report cursor position, send 02 y+30 x+30 (hex bytes). |
| ESC ] | Set local mode. |
| ESC ) | Read character at cursor position. |
| ESC < | Read cursor line. Send 02 data 0D 0A 03 (hex bytes). |
| ESC > | Read page. Sends 02 line1 0D 0A line2... 0D 0A 03 (hex). |

| | | |
|---|---|---|
| * | ESC A | Align screen, fill screen with 'E's. |
| * | ESC L | Insert blank line at cursor position. Scroll rest down. |
| * | ESC M | Delete line containing cursor. Scroll rest of screen up. |
| * | ESC W | Load user LEDs with the 5 LSB of the following character (requires serial keyboard). |
| * | ESC x | Enable status line. |
| * | ESC y | Disable status line. |
| * | ESC z | Reset the card. |

These control codes allow the STD-CRT to perform many features previously only available on expensive terminals. Features like status line, line insert and delete, inverse video, high speed processing, and more.

## STATUS LINE

The status line is intended to allow the programmer to indicate the host CPU status, or the mode of the system. For example the function keys 'function' can be written dynamically on the screen the allow different functions under different conditions.

## SCROLL KEY USE

If the 'SCROLL' key is pressed, then processing of data is stopped until the 'SCROLL' key is pressed again.

## NON-ASCII SERIAL KEYBOARD CODES

| Key code | Name | Code sent |
|---|---|---|
| F3 | left | 08H |
| F4 | right | 0CH |
| F1 | up | 0BH |
| F2 | down | 0AH |
| B1 | keypad 0 | '0' |
| CO | keypad 1 | '1' |
| C1 | keypad 2 | '2' |
| C2 | keypad 3 | '3' |
| D0 | keypad 4 | '4' |
| D1 | keypad 5 | '5' |
| D2 | keypad 6 | '6' |
| E1 | keypad 7 | '7' |
| E1 | keypad 8 | '8' |
| E3 | keypad 9 | '9' |
| B2 | keypad . | '.' |
| D3 | keypad , | ',' |
| E4 | keypad - | '-' |
| C3 | keypad enter | 0DH |
| F6 | PF1 | 1CH |
| F7 | PF2 | 1DH |
| F8 | PF3 | 1EH |
| F9 | PF4 | 1FH |
| FE | setup | toggles between line/local |
| B0 | no scroll | stop/starts processing of received data |
| 89 | space | ' ' |

Other keys are ignored.