C O M P A C T O R   I V
Preliminary User's Manual

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I. INTRODUCTION

The COMPACTOR IV is a full-feature video processor and serial interface for the TRS-80 Model III microcomputer. The LSI, microprocessor-based board is easily installed in any TRS-80 cabinet. COMPACTOR IV will operate under TRS-DOS application software or the industry tested CP/M operating system made available on the TRS-80 Model III with Hurricane Laboratories' COMPACTOR I hardware. Many powerful easy-to-use features are offered by the COMPACTOR IV:

DISPLAY FORMAT:

* 80 characters per line
* 24 lines per display
    Total of 1920 characters displayable at once.

CHARACTER FORMAT:

* 6 by 7 dot matrix character contained within a 8 by 10 dot matrix.
* True character descenders
* Blinking or non-blinking block cursor
* Multi-character Attributes (invisible field attributes)
    Inverse Video, Underline, and Blinking
    (16 attributes per line max)

SPECIAL CHARACTERS RECOGNIZED:

* Control Codes
* Line Feed (LF)
* Carriage Return (CR)
* Backspace (BS)
* Home cursor
* Clear screen

TERMINAL EMULATORS:

* ADM3A emulator (standard)
* SOROC-120 emulator (standard)

ESCAPE SEQUENCES RECOGNIZED:

        * Absolute cursor addressing
        * Relative cursor addressing
                Cursor Up
                Cursor Down
                Cursor Right
                Cursor Left
                Home Cursor
        * Erase to the End of Line
        * Erase the Current Line
        * Erase to the End of Screen
        * Master COMPACTOR reset
        * Character Attribute select
        * RS-232 Asynchorous Serial Interface
            Serial Port Set-up (Parity, Word length, Stop bits)
        Full or Half Duplex
        Line/Local Mode
        Baud Rate Select

CHARACTER'S TRANSMITTED:

        * Uppercase and Lowercase 96 ASCII alphanumeric characters
        * ASCII Control characters

PROGRAM MEMORY:

        * 4K bytes of 2732 EPROM (this is the FIRMWARE)

BUFFER/DISPLAY/STACK MEMORY:

        * 4K bytes of 8116 Static RAM

RS-232 SERIAL INTERFACE:
        * Programmable Data Rate (in BAUD)
            110   300   600   1200
            2400   4800   9600   19200
        * EIA standard modem control lines

VIDEO SWITCH:
        * Programmable Switch

CRT MONITOR REQUIRED:
        * 13 Mhz bandwidth monitor

COMPUTER INPUT:
        * ASCII Data

SCREEN REFRESH RATE:
        * 60 Hz

II. GENERAL OVERVIEW

The COMPACTOR IV fits into the TRS-80's serial interface board's slot and provides features of TRS-80's serial interface plus fully independent video processing superior to TRS-80's. These two sections of the COMPACTOR IV can operate separately, as a serial port or video processor, or together to emulate terminal functions. There are five modes of data path configurations, and all are selectable under program control.

In addition to mode control commands, the COMPACTOR IV also implements sets of commands to control the serial port parameters and the video display. The baud rate, screen and line clearing, character attributes, and many other features can be controlled in this way.

The versatility of the COMPACTOR's video processor, which contains RAM, character generator ROM, and video signal circuitry, is extended with a software controlled video switch. The switch selects which video signal is sent to the TRS-80 monitor, either the TRS-80's or the COMPACTOR's. This provides increased video information storage and allows one to be updated while the other is displayed.

The block diagram of the COMPACTOR IV is shown is Figure 1. The diagram illustrates the basic functional sections of the COMPACTOR IV and the interfaces to the TRS-80 Model III.
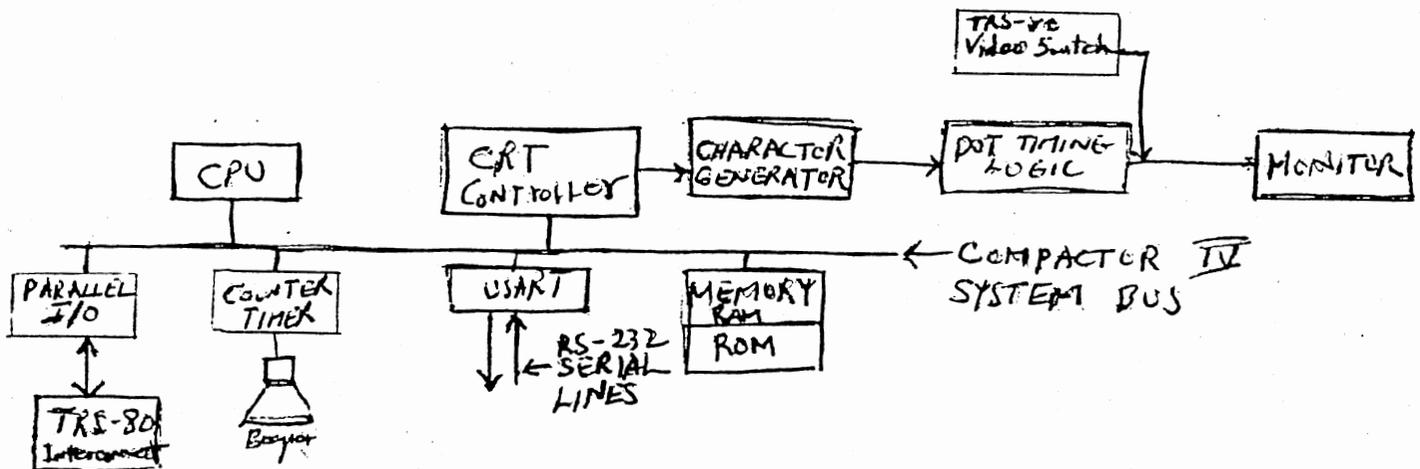
FIG 1. COMPACTOR IV BLOCK DIAGRAM

Figure 1.

III. FUNCTION DESCRIPTION

A. I/O Interface to TRS-80

The COMPACTOR IV uses a standard 8-bit parallel I/O port to convey byte data to and from the TRS-80. There are three port addresses (a fourth is reserved; see Table 1) a write Control, a read Status, and a read/write Data. If a character is sent to the COMPACTOR IV it latches it and lowers the Input Buffer Full bit in the Status byte until processing is finished and another character can be accepted. If data came in on the serial interface and the COMPACTOR is in a SERIAL mode, the Output Buffer Full bit in the Status byte is raised to signal the TRS-80. The TRS-80 must then lower the Input Acknowledge bit in the control byte, read the data port to obtain the character, and then raise the Acknowledge bit. If the COMPACTOR is in the no wait serial mode, (default on power up) and a new character is input by the RS-232 port before the TRS-80 has read the old one, the old character will be overwritten. If the COMPACTOR is in the wait mode then the COMPACTOR will place DTR busy for serial handshaking and wait until the TRS-80 has read the character before processing any new characters (either from the RS-232 port or from the TRS-80).

TABLE 1   I/O Interface Between TRS-80 and COMPACTOR IV

Port Addresses:

PORT (hex)	INPUT	OUTPUT
E8	(reserved)	Control
E9	(reserved)	(reserved)
EA	Status	(reserved)
EB	Data	Data

Control Byte Definition:

BIT	FUNCTION
DB7	(reserved)
DB6	(reserved)
DB5	(reserved)
DB4	(reserved)
DB3	(reserved)
DB2	Video Switch (0=TRS-80, 1=COMPACTOR IV)
DB1	Reset to Local (0=reset)
DB0	Input Acknowledge (0=acknowledge)

123 = 00

Status Byte Definition:

```
     BIT    FUNCTION
     ---    ------------------------------------
     DB7    Output Buffer Full (1=character ready)    CHARACTER IN FROM RS232
     DB6    Input Buffer Full (1=busy, 0=not busy)      "    OUT TO RS232.
     DB5    TRS-80 vertical sync
     DB4    COMPACTOR IV vertical sync
     DB3    (reserved)
     DB2    (reserved)
     DB1    (reserved)              |
     DB0    (reserved)
```

B. Modes

A particular data path configuration (one byte wide) within the
COMPACTOR IV between the serial port, the video processor, and
the parallel data port to the TRS-80 is called a "mode". The five
modes are defined below and illustrated in Figure 2.

SERIAL   The TRS-80 communicates directly with the
                    serial port as if the COMPACTOR were a TRS-
                    80 serial board. No wait (default) or wait mode.

LOCAL   Data from the TRS-80 is sent only to the
                    COMPACTOR's video processor. The serial port
                    is inactive.

FULL DUP. LINE   Data received by the serial port is sent to
                    the COMPACTOR's video processor and data
                    from the TRS-80 goes to the serial port.

HALF DUP. LINE   Data in on the serial port is sent to video
                    and data from the TRS-80 goes to both the
                    video processor and serial port.

SERIAL WITH   This is the same as SERIAL with the data
MONITOR   coming in on the serial port being sent to
                    the video processor as well as the TRS-80.

In SERIAL mode the COMPACTOR IV acts as a serial interface and
the video processor is inactive. SERIAL WITH MONITOR allows the
user to see what comes in on the serial port with the monitor. If
only the video capabilities of the COMPACTOR are needed, LOCAL
mode is the one to select. This provides all the features of TRS-
80's video section plus many more and an expanded display. The
LINE modes combine the two sections of the COMPACTOR into
terminal emulating configurations.

Local Mode

Serial Mode

Slave Processor → 80X24 Video

RS-232 Serial

T RS-80

Slave Processor → * → 80X24 Video

RS-232 Serial
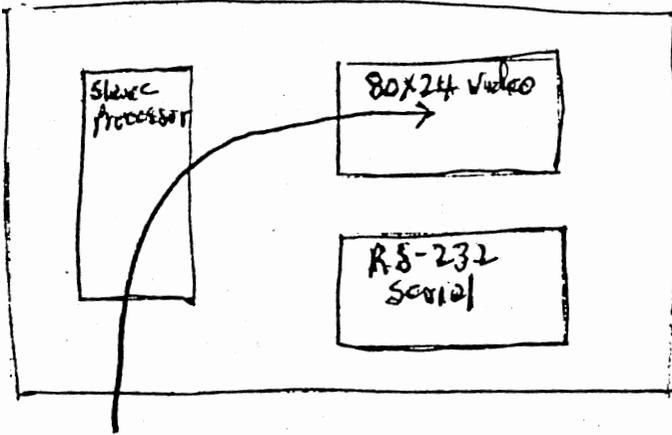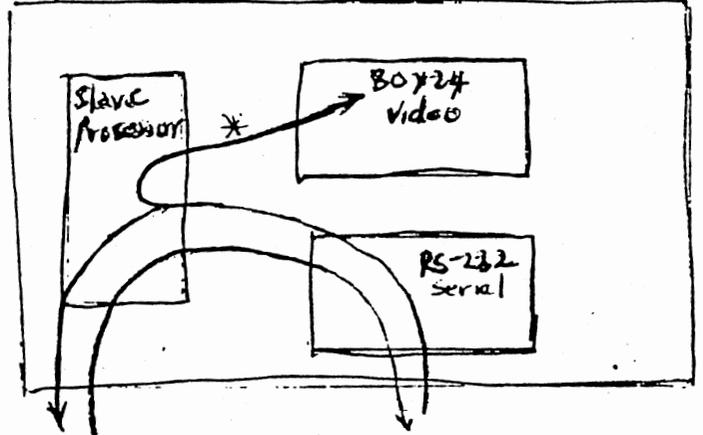
TRS-80   Modem/Printer

*Monitor Mode with video enabled

Terminal Mode (Half Duplex)
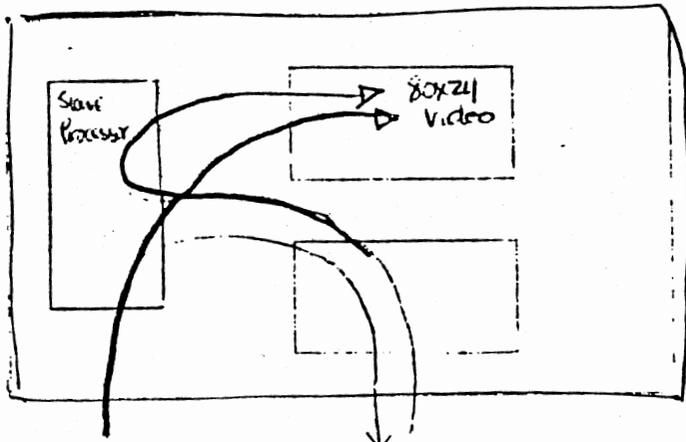
Terminal Mode (Full Duplex)

Slave Processor → 80X24 Video

TRS-80   Modem/Printer

Slave Processor → 80X24 Video

RS-232 Serial
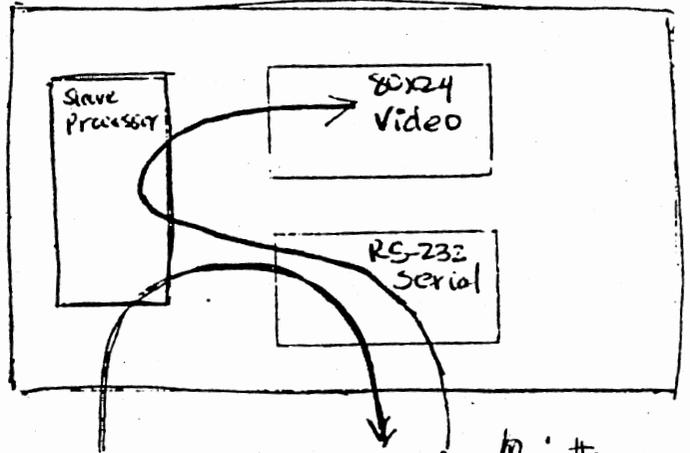
TRS-80   Modem/Printer

Figure 2.

C. Mode Selection

The mode may be changed in two ways (at power-on the mode is initialized to switch settings, TABLE 5). The first is with the Reset to LOCAL bit in the control byte (Table 1). By setting this bit low for at least .001 second (when the COMPACTOR is ready to accept data) the COMPACTOR can be placed in LOCAL mode from any other mode. (Note that this is the only way out of SERIAL mode and the only direct TRS-80 control of FULL DUP. LINE and SERIAL WITH MONITOR modes.)

The second method is by sending a mode changing command over the data path to the COMPACTOR IV. Commands are in the form of escape sequences (Table 2) and are monitored on the path to the video processor (Fig. 2). The normal method for selecting a mode is from LOCAL mode since this mode may be forced by a reset action from any other mode. But, other mode sequences can be executed by the TRS-80 if attention is given to where the data is coming from on the path to the video processor through the block labeled "CONTROL" in Figure 2. For example, if the device connected to the serial port is echoing back the data sent to it in FULL DUP. LINE mode, the TRS-80 may select a different mode by sending out the escape sequence as normal. When escape sequence commands are recognized they are taken from the data path before being executed. Note that to select SERIAL WITH MONITOR mode two escape sequences are needed, one to toggle the MONITOR flag and the other to execute the change to SERIAL configuration.

TABLE 2   Mode Selection Commands

The following escape sequences when recognized by the CONTROL block will affect mode changes (Note: ESC 'V' only toggles the MONITOR flag).

ESC 'X' 59H SERIAL (No wait mode is default on power up)
ESC 'L' 4CH LOCAL
ESC 'N' 4EH FULL DUPLEX LINE
ESC 'F' 46H HALF DUPLEX LINE
ESC 'V' 56H Switch MONITOR flag (requires subsequent ESC
         'X' to change to SERIAL WITH MONITOR)
ESC 'y' 79H No wait mode. When serial mode is activated by ESC 'X',
         the Compactor will not wait for the TRS-80 to read the
         serial data. The unread character is replaced by the
         new character that just came from the RS-232 port.
         This is the default mode on power up.
ESC 'z' 7AH Wait mode. When serial mode is activated by ESC 'X'
         this wait mode will cause the Compactor to wait until
         the TRS-80 has read the serial data before any more
         characters (either from RS-232 or TRS-80) are
         processed.

D. The Video Processor

The COMPACTOR IV's video processor provides an 80 characters per
line by 24 lines per screen display (1920 characters total).
Display control and character manipulation is accomplished
through escape sequences and control codes (Table 3). The base
set is compatible with and provides all the features of the
popular Lear-Siegler ADM-3A and SOROC-120 CRT terminals. This
allows operation of the COMPACTOR IV with a number of common
software packages and eliminates terminal configuration problems.
In addition, there is a Set Attribute escape sequence which
enables control of underline, reverse video, highlight, blinking,
and charater set choice, for greatly enhanced character display
(Table 4). Using this feature the user can change the display
characteristics of individual characters, lines of text, or the
entire screen.

TABLE 3   Video Processing Commands

The following escape sequences and control codes are
commands to the video processor to control the display.
These are effective only if sent on the data path to the
video processor (see Fig. 2). Note that some commands
require additional bytes x, or y.

ESC '=',x,y	Position cursor (x=row# + 20hex, y= col# + 20H, see Table 3)
ESC 'T'	Erase to end of line
ESC 'Y'	Erase to end of screen
ESC 'K'	Clear line
ESC 'H'	Home cursor
ESC '%'	Non-Blinking Cursor
ESC '@'	Blinking Cursor
ESC ')'	Reverse video on
ESC '('	All Character Attributes off
ESC 'S',x	Set Character Attribute (x=Attribute encode, Table 4)
ESC '+'	Special fast mode which may be used if no inverse video or highlight codes are used (ADM-3A mode)
ESC '-'	Normal mode (default) which will do proper processing of the invisible attribute codes (SOROC-120 mode)
^Z (1A)	Clear screen and home cursor
^^ (1E)	Home cursor
^J (0A)	Line feed
^K (0B)	Cursor up
^L (0C)	Cursor right
^M (0D)	Carriage return
^H (08)	Backspace
^G (07)	Sound beeper

Cursor Positioning:

The Cursor can be the programmed to any one of the 1920 character positions on the screen by sending the COMPACTOR IV an ESC '=' followed by the row number (0-23) + 32 and the column number (0-79) + 32. For example If you want to position the cursor to row 15 colum 30, the data would look this 27,61,47,62 in decminal or 1B,3D,2F,3E in Hex.

Beeper Option:

The COMPACTOR IV has an optional programmable beeper. The beeper pitch and duration are set by sendng the COMPACTOR IV the following escape code:

    ESC G pitch1,pitch2,duration1,duration2

Note: The pitch and duration are made up of two bytes each, pitch1 & duration1 are the upper bytes and pitch2 & duration2 are the lower bytes.

Multi-Character Attributes Codes:

There are six basic character attributes: Blink, Highlight (TRS-80 Model I only), Reverse Video, Underline, and General Purpose / Alternate character sets. These character attributes are defined as follows:

1. Blink - Characters following the code (ESC S B) cause the blink circuitry to be activated.

2. Highlight - Characters following the code (ESC S A) cause the highlight circuitry to be activated (TRS-80 Model I only).

3. Reverse Video - Characters following the code (ESC S P) cause the reverse video circuitry to be activated.

4. Underline - Characters following the code (ESC S p) cause the underline circuitry to be activated.

5. General Purpose / Alternate Character Sets - Characters following the codes (ESC S 00H, ESC S 04H) cause character set 1, and character set 2 circuitry to be activated respectfully.

TABLE 4 Set Character Attribute Encode:

ESC S follow by this control byte:

```
7   6   5   4   3   2   1   0
1   0   U   R   G   G   B   H
|   |   |   |   |   |   |   |
|   |   |   |   |   |   |   ----> Highlight (HL) Model I only
|   |   |   |   |   |   --------> Blink (BL)
|   |   |   |   |   ------------> GP0 (GP0)
|   |   |   |   ----------------> GP1 (GP1)
|   |   |   --------------------> Reverse (RV)
|   |   ------------------------> Underline (UL)
|   ----------------------------> Not Used
--------------------------------> Not Used
```
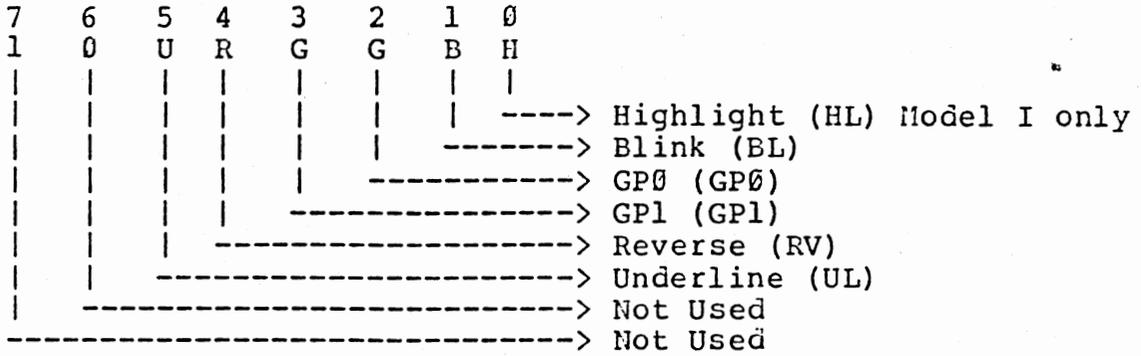
Note: Bits 6 & 7 of the attribute byte are stripped off by the Compactor IV
      so the attribute byte can be defined as an ASCII character.

(UL)	(RV)	(GP1)	(GP0)	(BL)	(HL)	(CHAR)	(HEX)
X						p	60
	X					P	50
		optional				H	48
			optional			D	44
				X		B	42
					X	A	41
X	X					0	30
X				X		b	62
X					X	a	61
X	X			X		2	32
X	X			X	X	3	33
	X			X		R	52
	X				X	Q	51
	X			X	X	S	53
				X	X	B	43
		optional	optional			L	4C

This is repeated for optional character sets 2, 3, and 4.
All combinations of character attributes can display a unique character.

E. Serial Port

The serial port on the COMPACTOR IV uses the asynchronous RS-232 standard. The UART parameters are set at power-on time (and for a Master Reset command) from switches on the PC board (see Set-Up). All the parameters can be changed under program control via the Set UART and Set Baud Rate commands (Table 5). These commands should be given in LOCAL mode before switching to a SERIAL mode (these commands are recognized only under the same conditions as the mode selection comands).

TABLE 5 Serial Port Commands

These escape sequence commands are recognized when the CONTROL block is monitoring the data path to the video processor. They affect the controls to the UART in the serial port and should be sent before switching to a SERIAL mode.

```
ESC 'Z',x  Set UART (x=UART control encode, Table 6)
ESC '0'   Set baud rate to   110   ESC '1'   Set baud rate to    300
ESC '2'   Set baud rate to   600   ESC '3'   Set baud rate to   1200
ESC '4'   Set baud rate to  2400   ESC '5'   Set baud rate to   4800
ESC '6'   Set baud rate to  9600   ESC '7'   Set baud rate to  19200
```

Set-up:
The COMPACTOR IV serial Default Parameter Switch is defined as follows:

O	O	O	19.2K
O	O	C	9.6K
O	C	O	4800
O	C	C	2400
C	O	O	1200
C	O	C	600
C	C	O	300
C	C	C	110

O=OPEN   C=CLOSE

O=1 Stop Bit / C=2 Stop Bits; Cø=Disable Parity / Oø=Enable Parity; O=8 Data Bits / C=7 Data Bits; O=Local C=Line; O=Even Parity C=Odd Parity; BAUD RATE
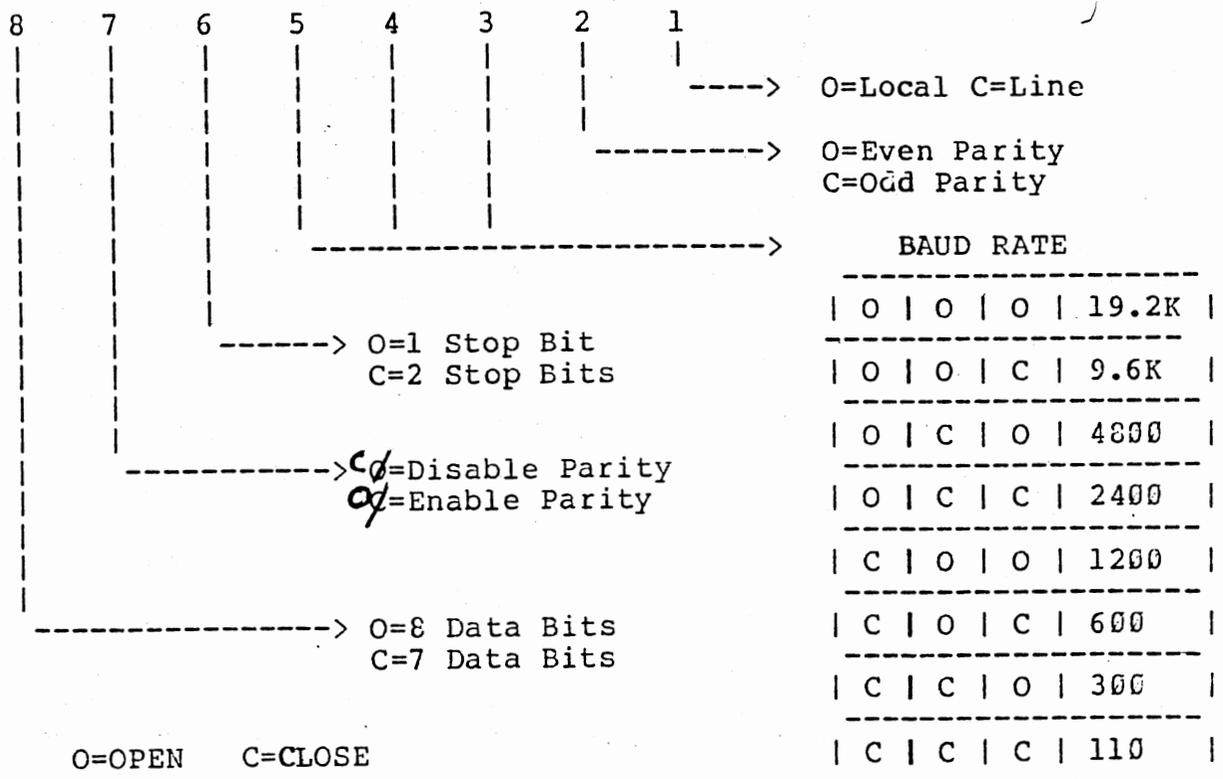
TABLE 6 Set UART Command Encode:

ESC Z follow by this control byte:

```
      D7    D6    D5    D4    D3    D2    D1    D0
    ------------------------------------------------
    | S2 | S1 | EP | Pen | L2 | L1 | B2 | B1 |
    ------------------------------------------------
      |     |     |     |     |     |     |     |
      |     |     |     |     |     |     |     ----> Always 1
      |     |     |     |     |     |     --------> Always 0 for 16X Baud Rate
      |     |     |     |     |     |
      |     |     |     |     |     |              Character Length
      |     |     |     |     |     |              -------------------
      |     |     |     |     |     ----------->  | 0 | 1 | 0 | 1 |
      |     |     |     |     |                    -------------------
      |     |     |     |     -----------------> | 0 | 0 | 1 | 1 |
      |     |     |     |                          -------------------
      |     |     |     |                         | 5 | 6 | 7!| 8 |
      |     |     |     |                         |bits|bits|bits|bits|
      |     |     |     |                          -------------------
      |     |     |     |
      |     |     |     |                          Parity  Enable
      |     |     |     ----------------------->  1=Enable 0=Disable
      |     |     |
      |     |     |                                Parity Generation / Check
      |     |     ---------------------------->  1= Even Parity 0=Odd Parity
      |     |
      |     |                                     Number of Stop Bits
      |     |                                     ---------------------
      |     ------------------------------------> | 0 | 1 | 0 | 1 |
      |                                            ---------------------
      ------------------------------------------> | 0 | 0 | 1 | 1 |
                                                   ---------------------
                                                  | NA | 1 |1-1/2| 2 |
                                                  |    |.bit| bits|bits|
                                                   ---------------------
```
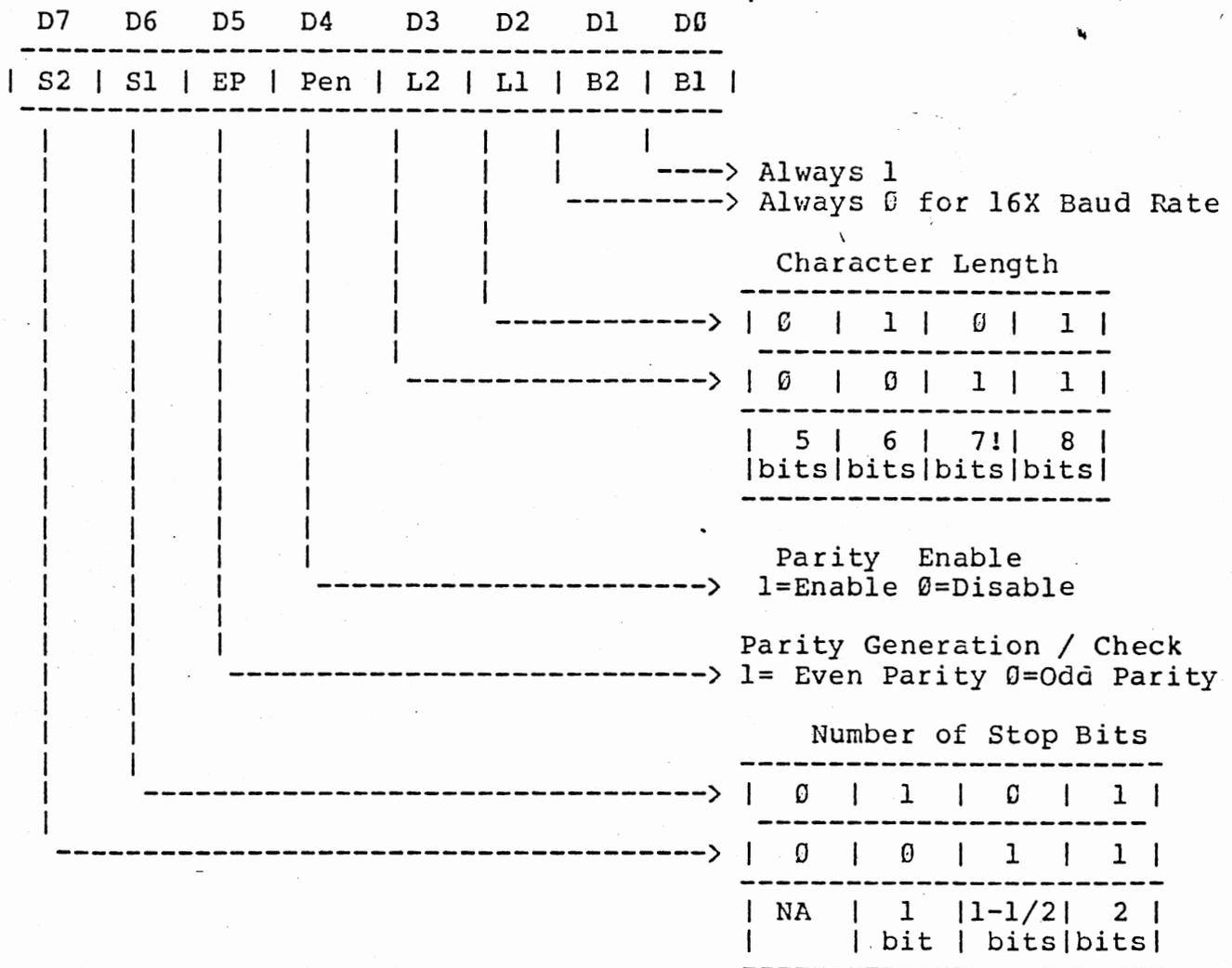
Data is transfered to and from the RS-232 line with a handshaking procedure. COMPACTOR IV does not provide interrupt capability. A character is written to the COMPACTOR IV (port EB hex) and the Input Buffer Full bit in the Status byte (port EA hex, DB6) is lowered until the character is sent out. After a character has been received over the RS-232 line the COMPACTOR raises the Output Buffer Full bit (port EA hex, DB7) to signal the TRS-80 and also sets the Data Terminal Ready (DTR) line low to halt transmission until the TRS-80 reads the character (in wait mode only, in no wait mode old character will be overwritten by new character). The read is done by first setting the Input Acknowledge bit in the Control port (port E8 hex, DB0) low then reading the data port. Data integrity is ensured with this full handshaking procedure.

In SERIAL mode the serial port can be used to drive a printer or modem device, and SERIAL WITH MONITOR will enable the incoming data to be displayed for debugging or application purposes. Communication with a mainframe when the microcomputer must act like a terminal is made easy with one of the LINE modes. In FULL DUPLEX LINE mode, the TRS-80 gives the COMPACTOR "keyboard data" to be sent out on the serial interface and data coming in is sent to the video processor. HALF DUPLEX LINE mode is like FULL with the out going as well as the incoming data sent to the video processor.

F. Video Switch

The COMPACTOR IV has complete video processing circuitry: RAM, character generator ROM, and video signal generator. By interrupting the TRS-80's video signal to the monitor and providing a circuit to select between the TRS-80's and the COMP-ACTOR's signal the power of video processing available to the software is increased enormously. The Video Switch bit in the Control byte (Table 1) controls selection. This feature more than doubles video information storage capacity, provides buffering capabilities, simplifies program environment separation, and eases software development.

G. Power-On and Reset

At power-on the COMPACTOR IV initializes its video processor, serial interface, and parallel port to TRS-80, then sets itself in LOCAL mode with the TRS-80 video signal going to the monitor. The initial parameters for the serial interface's UART are configurable through switches on the COMPACTOR PC board (see Set-Up). This initialization sequence can be invoked to reset the COMPACTOR IV under control of the software by the Master Reset command, ESC 'M' (it is best to do a Reset to LOCAL first to ensure that the COMPACTOR is in a mode to accept the escape sequence for this command).

INSTALLATION PROCEDURE

Note: Please read the entire installation procedure before attempting to install or operate the COMPACTOR IV.

You will need the following tools and elements to perform this installation produre:

* Phillip's Screwdriver
* Standard Screwdriver or IC puller
* Needle Nose Pliers
* COMPACTOR IV Installation Manual
* COMPACTOR IV Video Display & RS-232 Module
* Soft working surface

Photo 1-1, 1-2 & 1-3 follows

Step-by-Step Disassembly Procedure

Step 1
Clear a soft working surface and position the TRS-80 on its rear panel to provide easy access to the case bottom.

Photo 2-1

Step 2
Remove the 10 screws from the bottom assembly. Note the different types, lengths, and their positions. Set them aside in groups. There is a screw hidden under the warranty tag (refer to Photos).

Photo 3-1

Step 3
Place the computer upright in its normal operating position. Remove the screw from back panel (Note: earlier models do not have this screw).

CAUTION
Failure to perform step 4 correctly could damage the Picture Tube/ CRT and disrupt the interconnection between the Monitor and Keyboard base assembly.

Photo 4-1, 4-2, 4-3

Step 4
The Monitor Assembly now can be removed from the Keyboard Base assembly. Stand in front of the TRS-80 and lift the rear of the Monitor assembly appoximately two inches. Then lift it straight up over the Keyboard Base assembly and set the Monitor assembly on its left side (refer to Photos)

Step 5
Remove all cables connected to the main CPU board: power supply, video, keyboard, and cassette (if the RS-232 or Floppy Disc Controller is present remove those interconnecting cables as well).

Step 6
Remove the PC guard bracket screws and take off the bracket (this bracket does not exist in all units).

Step 7
Remove the five screws holding the main CPU board to the chassis (refer to photo). Double check that all screws and cables have been removed from the CPU board (if plastic spacers are holding the board in place take a small pair of needle-nose pliers and press the release tab on each spacer to free it). Gently take out the CPU board.

Step 8 If RS-232 board is present. (Compactor IV replaces it)
Disconnect the flat interconnect cable from the RS-232 board. Disconnect both ends of the power cable. Remove the four screws holding the board in place and take out the board.

Step 9
Put the COMPACTOR IV in the position of the RS-232 board and secure with the four screws (refer to photo).

Step 10
Take the power cable supplied with the COMPACTOR IV and connect the middle connector to the COMPACTOR IV. Disconnect both ends of the power cable to the Floppy Disc Controller (FDC). (If this cable is held in place by tie wraps use diagonal cutters to clip the wraps so that the cable can be removed.) Connect the short end of the power cable now on the COMPACTOR IV to the FDC. Take the long end of the cable and connect it to the floppy disc power supply.

Step 11
Cut the tie wraps securing the video monitor cable. If a ground strip is present on the shielded cable (exposed metal wire), fold it back and insulate it with the heat-shrink tubing supplied or electrical tape (refer to photo). Take the cable from the monitor and connect it to the COMPACTOR IV's video output connector P3.6

CAUTION
This next step involves turning on the main power to the TRS-80 while the cabinet is open.
E L E C T R I C A L   S H O C K
could occur if care is not taken when working around the exposed circuitry.

Step 12
Plug in the power line to the AC outlet and turn the TRS-80 power on. Look for the cursor on the monitor, it should be in the upper lefthand corner. If it is in the same position relative to the sides of the monitor as shown in the photo then turn power off, disconnect plug and go to step 13. To adjust cursor position turn R12 (on left) for the vertical and R13 for the horizontal adjustments (refer to photo). If the cursor does not appear try adjusting the contrast and brightness controls on the left side of the TRS-80. If after vertical and horizontal adjustment it still cannot be brought onscreen check cable connections. (If the cursor is still missing call Hurricane Laboratories, Inc. (408) 25 STORM.) Be sure that the cursor occupies only one character position. Turn off power and disconnect cord.

Step 13
Take the supplied video cable and plug the end labeled "COMP IV VIDEO IN" into the COMPACTOR IV connector P2 labeled "VIDEO IN". Take the supplied flat ribbon cable and plug it into the COMPACTOR IV connector J3 making sure that the exposed contacts of both the plug and the jack are mated.

STEP BY STEP REASSEMBLY PROCEDURE

Step 14
Put the CPU board back in place and secure it with the five screws.

Step 15
Connect the COMPACTOR IV video cable to the CPU video jack J5. Connect the COMPACTOR's flat ribbon cable into the CPU connector 8. Reconnect the power, keyboard and cassette cables. Bundle and secure all cables with the tie wraps supplied.

Step 16
Replace the RF shield and reinstall the screws. Make sure the Video GROUND strap is secured. Double check to ensure that the interconnecting wires are in place.

Step 17
Caution: Failure to perform this step could damage the connectors. Carefully replace the top assembly over the base assembly without bumping the CRT.

Step 18
Replace the rear panel screw.

Step 19
Position the TRS-80 on its rear panel and replace the screws in the bottom, as numbered on the Screw Chart.

CHECK-OUT PROCEDURE

Step 20

Plug the system into the AC outlet and turn on the power. Press
BREAK key to get into TRS-BASIC so that the following test
program can be entered and executed.

```
10 OUT 232,255          ;Switch Video to 80x24
20 FOR I= 1 TO 50       ;Set count of 50
30 FOR A= 32 TO 126     ;Let A=all ASCII
40 OUT 235,A            ;Out Data to COMPACTOR IV
50 NEXT A               ;OUT all displayable characters
60 NEXT I               ;Loop until count is zero
70 OUT 232,251          ;Switch Video to TRS-80 64x16
80 END
```

VII. APPENDIX

A. COMPACTOR IV Commands

Mode Selection Commands:

```
ESC 'X'    SERIAL
ESC 'L'    LOCAL
ESC 'N'    FULL DUPLEX LINE
ESC 'F'    HALF DUPLEX LINE
ESC 'V'    switch MONITOR flag (requires subsequent ESC
           'X' to change to SERIAL WITH MONITOR)
ESC 'y'    No wait mode select (lower case 'y'), (default mode)
ESC 'z'    Wait mode select. (lower case 'z')
```

Video Processing Commands:

```
ESC '=',x,y    Position cursor (x=row# + 20hex, y= col# + 20H)
ESC 'G',pitch1,pitch2,duration1,duration2  Beeper programming
ESC 'Y'        Erase to end of screen
ESC 'T'        Erase to end of line
ESC 'K'        Clear line
ESC 'H'        Home cursor
ESC '%'        Non-Blinking Cursor
ESC '@'        Blinking Cursor
ESC ')'        Reverse video on
ESC '('        Reverse video off
ESC 'S',x      Set character attribute (x=attribute encode, see Table 4)
ESC '+'        Special fast mode when not using attributes (ADM-3A mode)
ESC '-'        Default mode (SOROC 120) when using attribute codes
^Z (1A)        Clear screen and home cursor
^^ (1E)        Cursor home
^J (0A)        Line feed
^K (0B)        Cursor up
^L (0C)        Cursor right
^M (0D)        Carriage return
^H (08)        Backspace
^G (07)        Sound beeper
```

Serial Port Commands:

```
ESC 'Z',x    Set UART (x=UART control encode, Table 6)
ESC '0'      Set baud rate to    110
ESC '1'      Set baud rate to    300
ESC '2'      Set baud rate to    600
ESC '3'      Set baud rate to   1200
ESC '4'      Set baud rate to   2400
ESC '5'      Set baud rate to   4800
ESC '6'      Set baud rate to   9600
ESC '7'      Set baud rate to  19200
```