# VT1XX-AC
## USER GUIDE

| DEC | DECnet | IAS |
|---|---|---|
| DECUS | DECsystem-10 | MASSBUS |
| Digital logo | DECSYSTEM 20 | PDT |
| PDP | DECwriter | RSTS |
| Unibus | DIBOL | RSX |
| VAX | EduSystem | VMS |
| | | VT |

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## 6  COMMUNICATION

## 7  INSTALLATION

## 8  OPTION CHECKOUT

# FIGURES

**TABLES**

# PREFACE

The VT1XX-AC option is a serial printer interface for VT100 and VT132 video terminals. The option connects the terminals to a local serial printer.

The *VT100 User Guide* (EK-VT100-UG) and *VT132 User Guide* (EK-VT132-UG) are used with this document.

This guide contains the following chapters.

Chapter 1    A general introduction to the VT1XX-AC. Describes the purpose of the option, contents of the option kit, related documentation, and general hardware and software considerations.

Chapter 2    Describes the VT1XX-AC controls and indicators used during operation.

Chapter 3    Describes print operations performed by the VT1XX-AC and how they are controlled from the video terminal keyboard.

Chapter 4    Describes how the video terminal SET-UP mode changes when the VT1XX-AC is installed. Includes a description and selection procedure for each of the new or altered SET-UP features.

Chapter 5    Describes the VT1XX-AC print operations, the control functions used to perform the operations, and the use of all new or altered video terminal control functions.

# 1 INTRODUCTION

## GENERAL

This chapter is a general introduction to the VT1XX-AC serial printer interface option. The chapter describes the purpose of the option, the contents of the option kit, related documentation, and general hardware and software considerations.

## DESCRIPTION

The VT1XX-AC is used with VT100 and VT132 video terminals. It provides an Electronic Industry Standard (EIA) RS-232-C compatible printer interface that connects the terminals to a local serial printer as shown in Figure 1-1.

The VT1XX-AC is field installable by either a DIGITAL Field Service representative or a technically qualified customer.
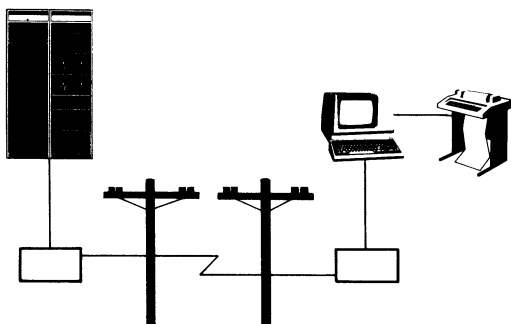


MA-5765

Figure 1-1    VT1XX-AC General Configuration

**CAUTION**
**A DIGITAL Field Service representative should**
**install this option. When the customer installs**
**the VT1XX-AC, any damage to either the ter-**
**minal or the option is the customer's responsi-**
**bility.**

The VT1XX-AC is a standard terminal port (STP) printer interface printed circuit (PC) board. The board plugs into the internal STP connector of the video terminal. Installing the board requires configuring PC boards with plug-in read only memory (ROM) integrated circuit (IC) chips and may include installing jumpers. Soldering skills are required if jumpers are needed.

The VT1XX-AC connects the video terminal to one of the DEC serial printers in Table 1-1. The table also lists serial printer options recommended for use with the VT1XX-AC. Printer options are ordered through your local DIGITAL sales office or through DIGITAL Accessories and Supplies Group. (When ordering from DIGITAL Accessories and Supplies Group, refer to the ordering information section of this chapter.)

**Table 1-1    Applicable DEC Serial Printers**

| Printer | Option Recommended | Description |
|---------|--------------------|-------------|
| LA34 | LAX34-LL or LAX34-PL | Paper low detection Paper out detection |
| LA35 | LAXX-KG LAXX-LZ* | EIA interface Paper fault detection |
| LA36 | LAXX-KG LAXX-LZ* | EIA interface Paper fault detection |
| LA38 | (No options required) | |
| LA120 | (No options required) | |

\* Paper fault detection is standard on LA35-CE, LA35-CJ, LA36-CEand LA36-CJ models. All other LA35 and LA36 models should order this option.

## HARDWARE REQUIRED

The hardware in Table 1-2 is required to install the VT1XX-AC. However, this hardware is not contained in the VT1XX-AC option kit. Table 1-3 lists the contents of the VT1XX-AC option kit. These cables and options are ordered through your local DIGITAL sales office or through DIGITAL Accessories and Supplies Group. (When ordering from DIGITAL Accessories and Supplies Group, refer to the ordering information section of this chapter.)

**Table 1-2   Required Hardware**

| Description | Part Number |
| --- | --- |
| Advanced video option (AVO) | VT1XX-AB |
| Null modem cable for: | |
| LA34, LA38, LA120 | BC22A-10, BC22A-25 or BC03M |
| LA35, LA36 | LAXX-LG or LAXX-KG used with BC22A-10, BC22A-25 or BC03M |

**Table 1-3   VT1XX-AC Option Parts List**

| | | | Used On | |
| Description | Part No. | Qty | VT100 | VT132 |
| --- | --- | --- | --- | --- |
| STP Board (printer option board) | 5414260 | 1 | X | X |
| VT100 terminal controller ROM ICs* | 23-095E2 | 1 | X | |
| | 23-096E2 | 1 | X | |
| | 23-139E2 | 1 | X | |
| | 23-140E2 | 1 | X | |
| VT100 advanced video ROM ICs | 23-184E2 or 23-186E2 | 1 | X | |
| | 23-185E2 or 23-187E2 | 1 | X | |

* The VT132 requires a ROM set not provided with VT1XX-AC. Contact a Terminal Product Group customer or a DIGITAL Field Service office for information on ROM ICs.

**Table 1-3   VT1XX-AC Option Parts List (Cont)**

| Description | Part No. | Qty | Used On VT100 | VT132 |
|---|---|---|---|---|
| Access cover | 7017383-00 | 1 | X | X |
| (PRINT)/ENTER keycap | 1214333-UO | 1 | X† | |
| Fiber spacer (7/16 in) | 9009306-00 | 1 | X | X |
| Phillips head screws (4-40) | 9008301-01 | 2 | X | X |
| Jumpers | 9009185-00 | 4‡ | X | |
| VT1XX-AC User Guide | EK-VT1AC-UG | 1 | X | X |
| SET-UP label | 3617254-00 | 1 | X | |
| VT1XX-AC label | 3617253-02 | 1 | X | X |
| VT1XX-AB label | 3617253-01 | 1 | X | |

† Not used on WPS terminal applications.

‡ Only one jumper is required during the installation procedure.

**NOTE**
**The advanced video option and a null modem cable are required to install the VT1XX-AC. However, these items are not contained in the VT1XX-AC installation kit and must be ordered separately.**

## COMMUNICATING WITH THE HOST COMPUTER
The VT1XX-AC is used where computer software is created specifically to support the option. When using host computer controlled print operations, the host computer must be able to send and receive escape and control sequences. However, several print operations are controlled from the video terminal keyboard and require no special computer software support.

The host computer must support the XON/XOFF (DC1/DC3) control characters. These characters prevent losing data due to overflows in the terminal's input character buffer. The host cannot use fill characters to prevent input character buffer overflows. Overflows occur when:

- The terminal receives characters faster than it can process them

- The printer "not ready" condition occurs during a print operation (refer to the Printer Ready Check section in Chapter 3)

- The terminal receives characters during a print operation.

(Refer to the Input Character Buffer Overflow Prevention section in Chapter 5 for information on the input character buffer.)

The video terminal with the VT1XX-AC installed reliably transfers data up to a maximum speed of 9600 baud (bits per second). Therefore, all communication with the host computer should be limited to a maximum speed of 9600 baud. (Refer to SET-UP mode in Chapter 4 for host communication features.)

## COMMUNICATING WITH THE SERIAL PRINTER

The VT1XX-AC is used with LA34, LA35, LA36, LA38, and LA120 or equivalent serial printers. The serial printer must operate in "data leads only mode" (no EIA modem controls).

The serial printer should indicate a full input character buffer to the video terminal. The two most common ways are: 1) using XON and XOFF control characters; and 2) turning the Data Terminal Ready interface signal of the serial printer on and off. LA35 and LA36 printers do not support XON/XOFF control characters, but they operate at a maximum speed of 300 baud and can print characters as fast as they are received.

Feature settings of the VT1XX-AC serial printer interface are selected in the terminal's SET-UP mode. Printer interface SET-UP feature settings must match those of the serial printer. VT1XX-AC SET-UP features are:

- Send and receive speeds (baud rates)

- Number of data bits per character

- Parity selection.

Horizontal margins on the printer must be set as wide or wider than the number of characters per line setting of the terminal's SET-UP A presentation. Therefore, the screen display prints as shown on the terminal.

**RELATED DOCUMENTS**

Table 1-4 lists the related DIGITAL documents refer-
enced within this guide. Video terminal related docu-
ments are purchased from the DIGITAL Accessories
and Supplies Group. (When ordering from the
DIGITAL Accessories and Supplies Group, refer to the
ordering information section of this chapter.)

Table 1-5 lists the Electronic Industry Association
(EIA) documents referenced in this document. These
documents are purchased from the EIA Engineering De-
partment. (When ordering from the EIA Engineering
Department, refer to the ordering information section of
this chapter.)

**Table 1-4    Related DIGITAL Documents**

| Title | Order No. | Description |
|-------|-----------|-------------|
| VT100 User Guide | EK-VT100-UG | VT100 installation, operation, and programming information |
| VT100 Video Terminal Illustrated Parts Breakdown | EK-VT100-IP | Detailed breakdown of VT100 and options |
| VT100 Field Maintenance Print Set (contains VT1XX-AC) | MP-00631 | VT100 schematic, assembly drawings, and parts lists |
| VT132 User Guide | EK-VT132-UG | VT132 installation, operation, and programming information |
| VT132 Video Terminal Illustrated Parts Breakdown | EK-VT132-IP | Detailed breakdown of VT132 and options |

**Table 1-4    Related DIGITAL Documents (Cont)**

| Title | Order No. | Description |
|-------|-----------|-------------|
| VT132 Field Maintenance Print Set (contains VT1XX-AC) | MP-00748 | VT132 schematic, assembly drawings, and parts lists |
| VT1XX-AC Field Maintenance Print Set | MP-00901 | VT1XX-AC schematic and parts lists |

**Table 1-5    Related EIA Documents**

| Title | Order No. | Description |
|-------|-----------|-------------|
| Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange | EIA RS-232-C | Specifications of electrical signals, mechanical connections, circuit descriptions, and standard communication systems |

## DIGITAL ORDERING INFORMATION

All orders for DIGITAL cables, options, and documents are ordered as follows:

### Telephone Ordering

- Minimum order of $35.00 unless charged to Master Charge, Visa, or American Express

- Maximum order of $5000.00

- Orders are accepted at current list price only.

- Phone orders are accepted per DIGITAL standard terms and conditions only

- Phone orders should be placed using the following numbers:

  Continental United States only: dial 800-258-1710.

  In New Hampshire, Hawaii, and Alaska: dial 603-884-6660.

  Hours: 8:30 a.m. – 5:00 p.m. Eastern Time.

### Direct Mail Ordering

- Minimum order of $35.00 unless items are paid by check, money order, or credit card (Master Charge, Visa or American Express).
- No maximum order value
- Purchase orders may be mailed directly to the following addresses:

### U.S. Customers
Digital Equipment Corporation
Att: A&SG
P.O. Box CS2008
Nashua, NH 03061

### International Customers
Digital Equipment Corporation
A&SG Business Manager
c.o. Digital's local subsidiary

### Local DIGITAL Sales Offices

- Purchase orders may be submitted to your local DIGITAL Sales Office.

### EIA ORDERING INFORMATION
All orders for Electronic Industry Association publications should be forwarded to:

EIA Engineering Department
2001 Eye Street, N.W.
Washington, D.C. 20006.

# 2 CONTROLS AND THE INDICATOR

## GENERAL
This chapter briefly describes the controls and the indicator used during print operations. The controls and the indicator are located, labeled, and operate the same on VT100 and VT132 terminals.

## CONTROLS
The VT1XX-AC serial printer interface can be controlled from the terminal keyboard. Figure 2-1 identifies the keyboard keys that control print operations. The following paragraphs briefly describe the video terminal keys used for print operations.

### The (PRINT) ENTER Key
(PRINT)/ENTER controls printing operations. While pressing **CTRL**, press **(PRINT)/ENTER** to select and terminate Auto Print (line-at-a-time) operation.

While pressing **SHIFT**, press **(PRINT)/ENTER** to start a Print Screen operation. (Refer to Chapter 3 for more information on the Auto Print and Print Screen operations.)

### The SET-UP Key
**SET-UP** is used to enter and exit SET-UP mode. Entering and exiting SET-UP mode stops all print operations in progress. If Auto Print is selected only the line containing the cursor does not print. However, Auto Print is maintained.

Printer Controller operation is not affected by the **SET-UP** key. (Refer to Chapter 3 for more information on Auto Print and Printer Controller operations.)
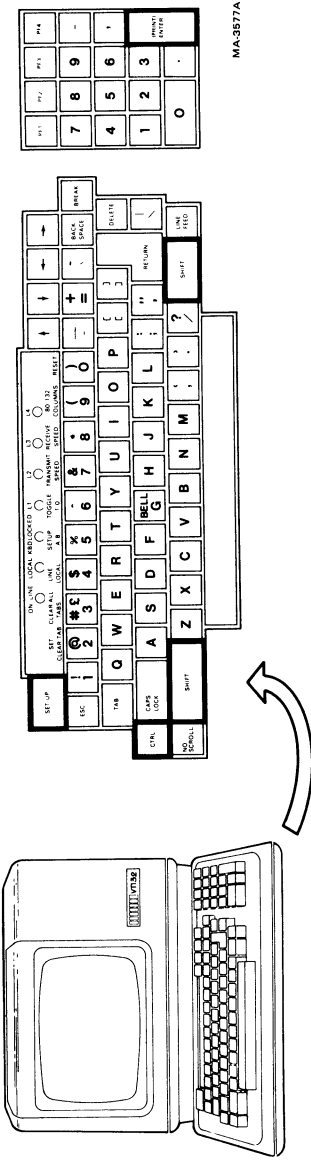
Figure 2-1    Terminal Print Control Keys
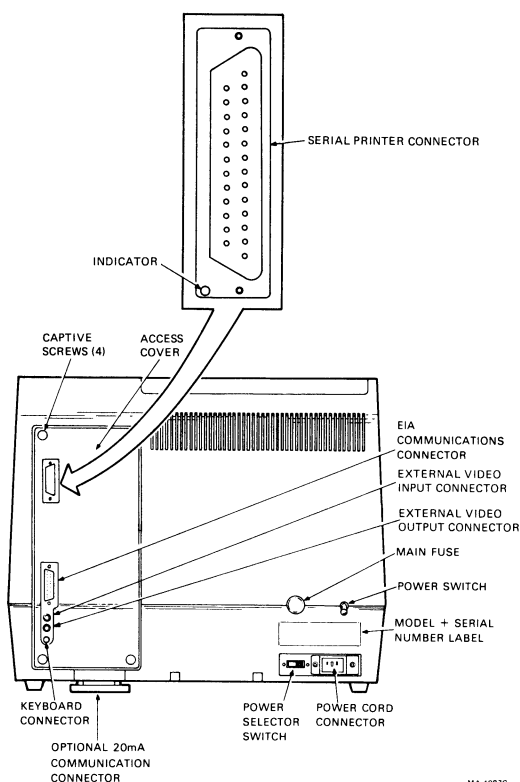
Figure 2-2    VT1XX-AC Indicator (terminal rear view)

**The Indicator**

The VT1XX-AC indicator is visible from the rear of the terminal. It is located below the serial printer interface connector as shown in Figure 2-2.

The indicator turns on, off, and on during the internal self-test. (Refer to the Error Codes section in Chapter 8 for further information on self-test.)

The indicator blinks when print operations are attempted and the serial printer is not ready to print. (Refer to the Printer Ready Check section in Chapter 3 for further information on the printer "not ready" condition.)

# 3 PRINTING OPERATIONS

## GENERAL

This chapter describes the printing operations performed by the VT1XX-AC option. The procedures that control these operations from the terminal keyboard are explained in detail. The printing operations and controls are the same in both the VT100 and VT132 terminals.

### Printer Ready Check

VT100 and VT132 terminals with the VT1XX-AC installed perform print operations only when the serial printer is on-line. The on-line condition is checked by the VT1XX-AC to ensure a printer is connected to the printer interface. If the serial printer has not been on-line since the terminal was turned on or reset, all attempts to print are ignored.

If the serial printer is connected and is on-line, the VT1XX-AC assumes the printer is ready to print. If the printer is not ready to print and printing is attempted, the terminal suspends all operations until printing is completed. When the terminal suspends operation the VT1XX-AC indicator flashes (refer to Figure 2-2 to locate the indicator) and the terminal does not respond to keyboard entries. When the printer is ready to print again, the print operation is completed and the terminal functions again.

> **NOTE**
> The print operation request may be cleared by performing a Reset in SET-UP mode.

The serial printer may not be ready to print for one or more of the following reasons:

● Printer power is turned off

● Printer is placed in local

- Printer is out of paper
- Printer cover is open
- Printhead is jammed
- Operator sent XOFF **(CTRL S)** from printer keyboard.

The VT1XX-AC is ready to print when the following action is taken:

- Printer power is turned on
- Printer is placed on-line
- Printer paper is reinstalled
- Printer cover is closed
- Printhead jam is cleared and the printer cover is closed
- Operator sends XON **(CTRL Q)** from the printer keyboard.

> **NOTE**
> **The NO SCROLL, CTRL S, and CTRL Q keys on the terminal request the host computer to stop sending characters to the screen. The LINE/LOCAL, CTRL S, and CTRL Q keys on the serial printer request the video terminal to stop sending characters to the printer.**

## PRINTING
The VT1XX-AC option prints using four print operations:

> Auto Print (line-at-a-time printing)
> Print Screen
> Print Cursor Line
> Printer Controller.

All print operations can be selected by the host computer. Only Auto Print and Print Screen can be selected from the terminal keyboard. The **(PRINT)/ENTER** key on the auxiliary keypad is used with the **SHIFT** or **CTRL** keys on the main keyboard to control print operations.

### Auto Print
Auto Print (line-at-a-time) can be selected from the terminal keyboard or by the host computer. When Auto Print is selected, the screen display is printed one line at a time. A line on the screen is printed when the cursor

moves off the line. The cursor moves off the line when a line feed, form feed, or vertical tab character is received. Subsequent line feeds, form feeds, or vertical tabs move the cursor one line on the screen and the line is printed. When the cursor moves off the line, the line on the screen cannot be changed before it is printed.

While a line is printing, terminal keyboard entries are not sent to the host computer. After the line prints, the keyboard entries are sent.

> **NOTE**
> **When the VT132 is in edit mode, Auto Print is suspended. When the VT132 exits edit mode, Auto Print continues. All other print operations are not affected by the VT132 edit mode.**

If a line contains double height characters, the characters print as two identical lines with standard width characters. Double width characters print as standard width characters on a single line.

Select Auto Print from the terminal keyboard by performing the following procedure:

1. Place the serial printer on-line.
2. To select Auto Print, hold down the **CTRL** key, press the **(PRINT)/ENTER** key; then release both keys.

   Entering and exiting SET-UP mode stops the current line from printing; however, Auto Print is maintained.

   > **NOTE**
   > **If printing stops by entering and exiting SET-UP mode the printhead on the printer must be moved to the left margin.**

3. To terminate Auto Print, hold down the **CTRL** key, press the **(PRINT)/ENTER** key; then release both keys.

**Print Screen**

Print Screen can be selected from the terminal keyboard or by the host computer. Print Screen sends a complete copy of the screen display to the serial printer. Depending on the SET-UP C Print Extent feature selection (Field D, bit 4), either the complete screen or just the scrolling region is sent to the printer. The scrolling region is selected by the host computer.

After Print Screen is selected, the contents of the screen cannot be changed before it is printed. While the display is being printed, terminal keyboard entries are not sent to the host computer. After the screen contents is printed, the keyboard entries are sent.

If the screen contains double height characters, the characters print as two identical lines with standard width characters. Double height characters print as standard width characters on a single line.

Select Print Screen from the terminal keyboard by performing the following procedure:

1. Place the serial printer on-line.

2. To select Print Screen, hold down the **SHIFT** key, press the **(PRINT)/ENTER** key; then release both keys.

   Entering and exiting SET-UP mode stops Print Screen.

   **NOTE**
   **If printing stops by entering and exiting SET-UP mode, the printhead on the printer must be moved to the left margin.**

3. After the screen display prints, Print Screen stops automatically.

**Print Cursor Line**

Print Cursor Line can only be selected by the host computer. The function prints the screen line containing the cursor. The cursor position is not changed by this function. After Print Cursor Line is selected, the screen line containing the cursor cannot be changed before it prints.

While a screen line is being printed, terminal keyboard entries are not sent to the host computer. After the line is printed, the keyboard entries are sent.

Entering and exiting SET-UP mode stops the current line from printing.

   **NOTE**
   **If printing stops by entering and exiting SET-UP mode, the printhead on the printer must be moved to the left margin.**

If a line contains double height characters, the characters print as two identical lines with standard width characters. Double width characters print as standard width characters on a single line.

**Printer Controller**

Printer Controller can only be selected by the host computer. All data received from the host computer is printed by the serial printer. The data is not displayed on the terminal screen.

When Printer Controller is selected, data from the terminal keyboard can be sent to the host computer. This allows communication with the host computer while Printer Controller is selected.

If other print operations are selected while Printer Controller is selected, the print operation starts when Printer Controller is terminated.

If the terminal receives a Printer Controller request and no serial printer is installed, all data received by the terminal is displayed on the screen.

# 4 SET-UP MODE

## GENERAL

This chapter describes how SET-UP mode changes when the VT1XX-AC option is installed. The added or changed features are explained and the selection procedure for each feature is presented. The chapter is divided into two major sections: VT100 and VT132.

## VT100 SET-UP MODE

VT100 SET-UP mode operates as described in the *VT100 User Guide* (EK-VT100-UG). However, with the VT1XX-AC option a SET-UP C presentation and several new SET-UP B features are added.

SET-UP mode contains three brief summaries of the current status of feature settings. SET-UP A displays a visual ruler numbering each character position on the line. Tab stop settings are shown above the ruler. SET-UP B displays the status of features that control VT100 operation characteristics. SET-UP C displays the status of printer interface features. When the desired features are selected, the SET-UP feature settings can be stored using the Save operation (refer to the *VT100 User Guide*).

## SET-UP A

SET-UP A operates as described in the *VT100 User Guide.* (Refer to the user guide for detailed information on these features.)

Characters printed by the serial printer are automatically spaced to match the VT100 screen display without regard to tab stop settings. Tab stops on the VT100 and the serial printer are ignored when printing in Auto Print, Print Screen, or Print Cursor Line.

Horizontal margins on the printer must be set as wide or wider than the number of characters per line setting of SET-UP A. Therefore, the screen display prints as shown on the screen. A line on the screen display consists of 80 character positions (80-column mode) or 132 character positions (132-column mode).

## SET-UP B

The printer interface option adds operational features to the VT100. Therefore, the SET-UP B presentation is changed to show the status of the new SET-UP B features. In SET-UP B, the Auto XON/XOFF, Transmit Speed, Receive Speed, Parity, and Data Bits per Character features have been changed. The features of field 4 are changed and a field 5 is added. All other SET-UP B features are selected and operate as described in the *VT100 User Guide.* The SET-UP B presentation looks similar to Figure 4-1. Figure 4-2 summarizes the meaning of the SET-UP B presentation. The areas shown as reserved have no meaning at this time but are for future use.

The following paragraphs define the changed features of SET-UP B in alphabetic order.



```
SET-UP B
TO EXIT PRESS "SET-UP"




1 ▓▓▓ 2 ▓▓▓ 3 ▓▓▓ 4 ▓▓▓ 5 ▓▓▓    P=7S  T= 9600  R= 9600
```
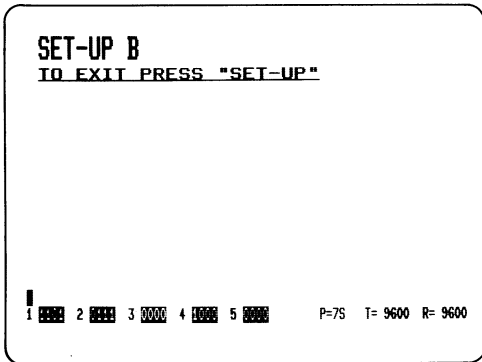
MA 5676

Figure 4-1       VT100 SET-UP B Presentation
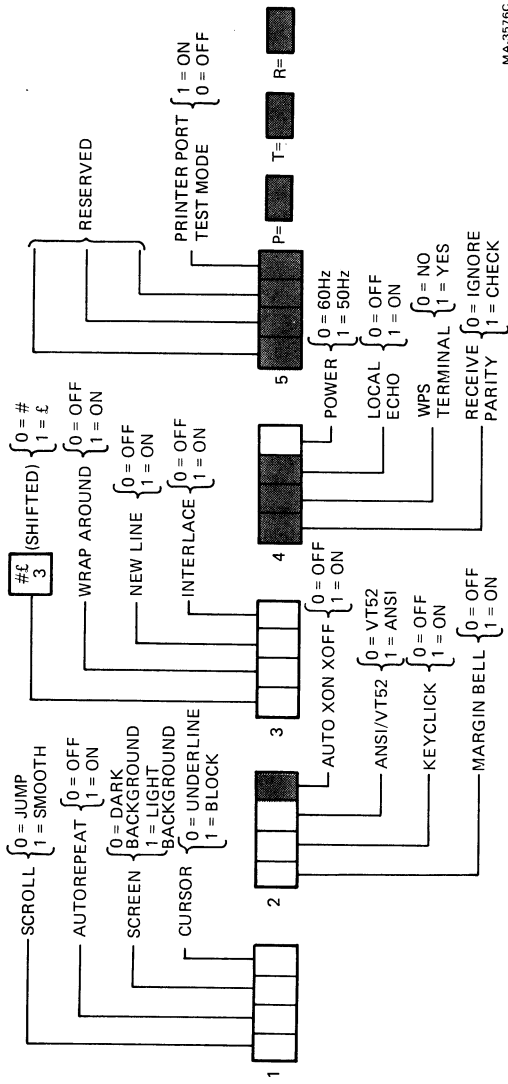
Figure 4-2    VT100 SET-UP B Summary

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**Auto XON/XOFF**

This feature allows the VT100 to automatically generate the XON (DC1) and XOFF (DC3) control characters. XOFF is a request to the host to stop sending characters; XON is a request to the host to resume sending characters. The host must support XON/XOFF to ensure against the loss of characters. Therefore this bit is forced to the selected on (1) condition in SET-UP B.

> **NOTE**
> **When the VT1XX-AC is installed the Auto XON/XOFF feature is always selected on (1).**

The VT100 also recognizes received XOFF and XON. Receipt of XOFF stops the VT100 from sending any characters except XOFF and XON. A few keystrokes are stored in a keyboard buffer. If the keyboard buffer overflows, keyclicks stop and the KBD LOCKED indicator lights. Sending characters resumes upon receipt of XON.

If XON is not received from the host (due to communication system failure), the KBD LOCKED indicator can only be cleared by performing a Reset in SET-UP mode. Performing a Reset destroys the contents of the VT100's input character buffer. However, if the host computer has intentionally left the VT100 in the XOFF condition, keyboard entries typed after clearing the KBD LOCKED indicator by a Reset may be lost.

**Local Echo**

When this feature is set to (1), every character sent to the host is also displayed on the screen. The host or data set is not required to send the character back to the VT100 for display. Each character is displayed twice if the Local Echo feature is selected and the host or data set is echoing characters.

When this feature is set to off (0), only characters sent to the VT100 from the host or data set are displayed.

**Parity**

This feature defines two separate but interrelated items: data bits per character; and parity used with the host computer. Data bits per character defines the number of data bits of the characters sent and received, 7 or 8 bits. In 8-bit operation, the 8th bit is set to space (or 0) for characters sent. The 8th bit of all characters received is ignored.

Parity defines the type of parity bit the VT100 generates for characters sent and checks on received charac-

ters; if the Receive Parity feature is set to (1) check. If no parity is selected, the parity bit is removed from the character.

The VT100 operates using one of the data bits per character/parity selections in Table 4-1.   Set the parity and data bits per character selection used with the host, by performing the following steps:

1. Place the VT100 in SET-UP B.

2. Hold down the **SHIFT** key, press the **P** key; then release both keys. Each time this key combination is pressed, the terminal selects another data bits per character/parity selection.

**Table 4-1    Communication Interface Data Bits per Character/ Parity Selections**

| PS= | Description |
|-----|-------------|
| 7M  | 7/mark parity |
| 7S  | 7/space parity |
| 7O  | 7/odd parity |
| 7E  | 7/even parity |
| 7N  | 7/no parity bit |
| 8O  | 8/odd parity |
| 8E  | 8/even parity |
| 8N  | 8/no parity bit |

**Printer Port Test Mode**

When set to on (1), this feature selects a test mode used in external data loopback testing of the printer interface. Characters received from the host computer are ignored and all keyboard entries are sent through the printer interface. When the printer interface is not being tested, this feature is set to off (0).

> **NOTE**
> The Printer Port Test mode feature must always be Saved as off (0).

**Receive Speed**

Selection and operation of this feature is described in the *VT100 User Guide.* However, when the VT1XX-AC is installed the maximum reliable receive speed is 9600 baud.

> **NOTE**
> **When the Receive Speed SET-UP feature is set for 50, 75, or 110 baud (bits per second), two stop bits are used. All other selections use one stop bit.**

**Receive Parity**

This feature checks or ignores the parity bit of all characters received. If the feature is set to check (1) and the Parity feature is set to odd or even, the parity bit of the received characters is checked according to the Parity feature setting. If a receive parity error is detected, the substitution character (■) is displayed on the VT100 screen instead of the character in error. When the feature is set to ignore (0), any parity bit received is ignored.

**Transmit Speed**

Selection and operation of this feature is described in the *VT100 User Guide.* However, when the VT1XX-AC is installed the maximum reliable transmit speed is 9600 baud.

> **NOTE**
> **When the Transmit Speed SET-UP feature is set for 50, 75, or 110 baud (bits per second), two stop bits are used. All other selections use one stop bit.**

**WPS Terminal**

This feature is set to yes (1) when the VT100 is used in a word processing system. When set to yes (1) the position of the **LINE FEED** and \ keys on the keyboard are interchanged. In all other VT100 applications this feature is set to no (0).

**SET-UP C**

The serial printer interface is configured using SET-UP C features. Enter SET-UP C from SET-UP B by pressing the **5 (SET-UP A/B)** key on the main keyboard. SET-UP C features are selected and operate in the same fashion as SET-UP B features. The SET-UP C display is shown in Figure 4-3. Figure 4-4 summarizes the SET-UP

```
SET-UP C
TO EXIT PRESS "SET-UP"




A ███  B ███  C ▤▤▤  D ▓▓▜     PRINTER PORT: P=80  T/R=  300
```

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Figure 4-3     VT100 SET-UP C Presentation

C presentation. Those areas in the presentation shown as reserved have no meaning at this time but are for future use.

Exit SET-UP C by pressing the **SET-UP** key which removes the VT100 from SET-UP mode, or press the **5 (SET-UP A/B)** key on the main keyboard to enter SET-UP A.

The following paragraphs define the features of SET-UP C in alphabetic order.

**Print Extent**

This feature determines what characters on the VT100 screen are printed by the serial printer during a Print Screen operation. When set to full screen (1), all characters on the screen are printed. When set to scrolling region (0), only the characters located in the scrolling region are printed. The scrolling region is defined as the screen area between the left, right, top, and bottom margins. The top and bottom margins are specified by the host computer.

**Print Termination Character**

This feature selects a print termination character after a Print Screen. When the print termination character is set to form feed (1), a form feed character is sent to the
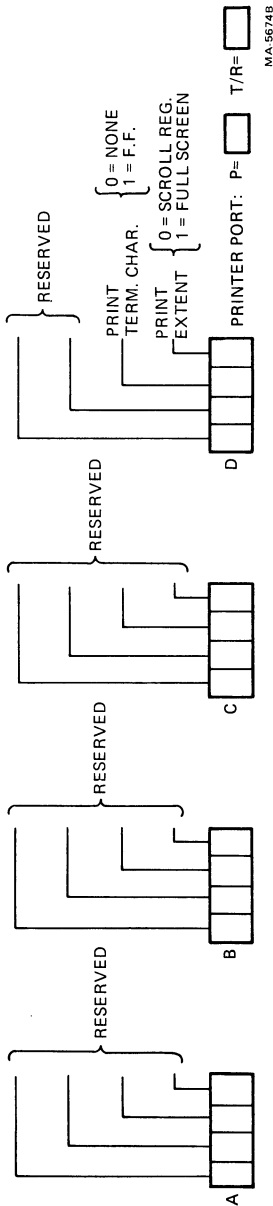
**Figure 4-4    VT100 SET-UP C Summary**

RESERVED

PRINT TERM. CHAR. { 0 = NONE, 1 = F.F. }

PRINT EXTENT { 0 = SCROLL REG., 1 = FULL SCREEN }

PRINTER PORT:   P=     T/R=

MA-5674B

printer after the screen is printed. When set to none (0), no print termination character is used.

> **NOTE**
> **Carriage return and line feed characters are always sent to the printer when the Auto Print, Print Screen, and Print Cursor Line printing is completed.**

**Parity**

This feature defines two separate but interrelated items: data bits per character and parity used with the serial printer. Data bits per character defines the number of data bits (7 or 8) of the characters sent and received. In 8-bit operation, the 8th bit is set to a space (or 0) for characters sent. The 8th bit of all characters received is ignored.

Parity defines the type of parity bit the VT100 generates for characters sent and checks on received characters. If no parity is selected, the parity bit is removed from the character.

The VT100 can operate using the data bits per character/parity selections in Table 4-2. Set the parity and data bits per character used with the serial printer, by performing the following steps:

1. Place the VT100 in SET-UP C.

2. Hold down the **SHIFT** key, press the **P** key; then release both keys. Each time this key combination is pressed, the terminal selects another data bits per character/parity selection.

**Table 4-2    Printer Interface Data Bits per Character/Parity Selections**

| PS= | Description |
|-----|-------------|
| 7M  | 7/mark parity |
| 7S  | 7/space parity |
| 7O  | 7/odd parity |
| 7E  | 7/even parity |
| 7N  | 7/no parity bit |
| 8O  | 8/odd parity |
| 8E  | 8/even parity |
| 8N  | 8/no parity bit |

**Receive and Transmit Speed**

Receive and transmit speeds used with the serial print-
er are always the same. Split baud rates (different send
and receive speeds) are not allowed. Transmit and re-
ceive speeds are selected by pressing either the **7
(TRANSMIT SPEED)** or **8 (RECEIVE SPEED)** key on
the main keyboard while in SET-UP C. Each time the
key is pressed, the speed (baud rate) changes. The serial
printer interface operates reliably at a maximum of 9600
baud (bits per second).

Table 4-3 lists the available send and receive speeds.
Select the speeds used with the serial printer by per-
forming the following steps:

1. Place the VT100 in SET-UP C.

2. Press either the **7 (TRANSMIT SPEED)** or **8 (RE-
CEIVE SPEED)** key on the main keyboard. Each
time the key is pressed, the feature setting changes.
Either key may be used to set the baud rate because
split baud rates (different send and receive speeds)
are not allowed.

   **NOTE**
   **When the send and receive speed SET-UP fea-
   ture is set for 50, 75, or 110 baud (bits per sec-
   ond), two stop-bits are used. All other selec-
   tions use one stop bit.**

**Table 4-3    Printer Interface Receive/Transmit Speed (Baud
Rate) Selections**

| Speed | No. of Stop Bits | Speed | No. of Stop Bits |
|---|---|---|---|
| 50 | 2 | 600 | 1 |
| 75 | 2 | 1200 | 1 |
| 110 | 2 | 1800 | 1 |
| 134.5 | 1 | 2000 | 1 |
| 150 | 1 | 2400 | 1 |
| 200 | 1 | 3600 | 1 |
| 300 | 1 | 9600 | 1 |
|  |  | 19200 | 1 |

**SET-UP Default Conditions**

The VT100 contains a default condition for all non-volatile (NVR) memory SET-UP features. These conditions are contained in read only memory (ROM) and are not changeable. When default conditions are invoked, all feature settings change to the default conditions. The contents of NVR memory is not changed when the default condition is invoked.

There are two default conditions: a general default and a tab default. The conditions are invoked in two ways; either automatically by the VT100 when it has difficulty reading the contents of NVR memory; or manually from the keyboard.

**General Default** – The general default condition resets all VT100 feature settings. SET-UP A features are set for 80 columns per line with tab stops every eight columns. SET-UP B and SET-UP C features are shown in Figures 4-5 and 4-6, respectively. The VT100 is placed in LOCAL and the answerback message is not used.

To invoke the general default condition from the keyboard use the following procedure:

1.  Place the VT100 in SET-UP mode.

2.  Hold down the **SHIFT** key, press the **D** key; then release both keys. The screen clears and after a brief time the VT100 returns to SET-UP A.

**Tab Default** – The tab default condition resets all VT100 tab stops and sets a new tab stop at every eighth column. To invoke the tab default condition use the following procedure:

1.  Place the VT100 in SET-UP A.

2.  Hold down the **SHIFT** key, press the **T** key; then release both keys. The tab settings clear and a tab stop is set every eighth column.

**VT132 SET-UP MODE**

VT132 SET-UP mode operates as described in the *VT132 User Guide* (EK-VT132-UG). However, with the VT1XX-AC option several new SET-UP B and SET-UP C features are added.

SET-UP mode contains three brief summaries of the current status of feature settings. SET-UP A displays a visual ruler numbering each character position on the line. Tab stop settings are shown above the ruler. SET-UP B displays the status of features that control terminal
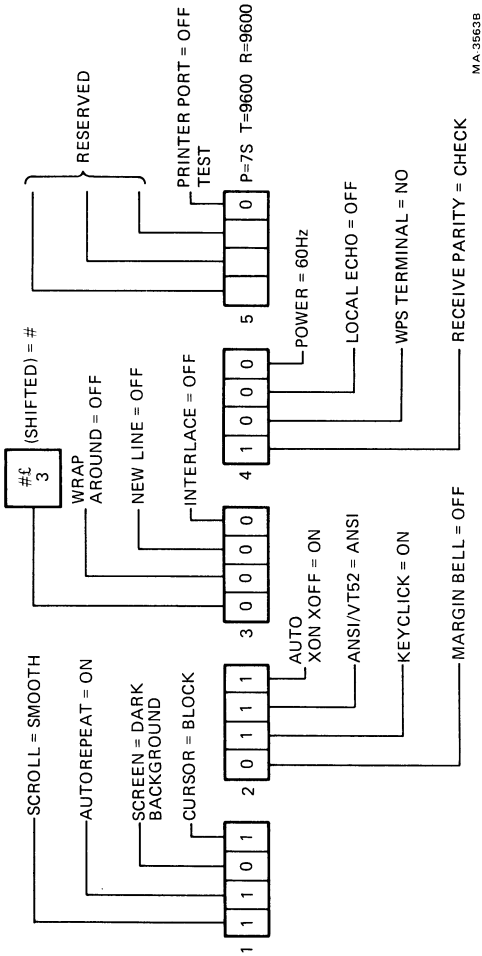
**Figure 4-5    VT100 SET-UP B Default Conditions**

MA.3563B

PRINTER PORT: P = 7S   T/R = 300

PRINT EXTENT = FULL SCREEN

PRINT TERM. CHAR. = F.F.

RESERVED

MA-5674

RESERVED

RESERVED

RESERVED

RESERVED
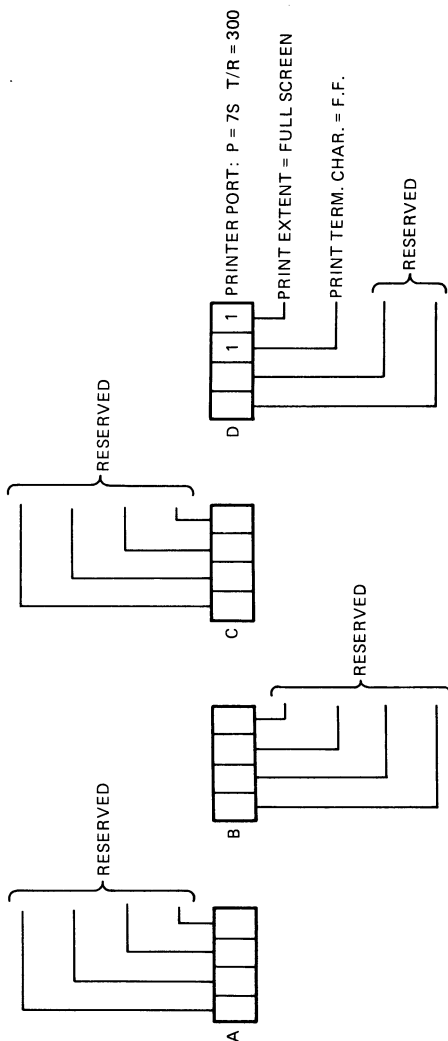
Figure 4-6    VT100 SET-UP C Default Conditions

operation characteristics. SET-UP C displays the status of editing and printer interface features. Once the desired features are selected, the SET-UP feature settings can be stored with the Save operation (refer to the *VT132 User Guide*).

## SET-UP A

SET-UP A operates as described in the *VT132 User Guide.* (Refer to the user guide for detailed information on these features.)

The characters printed by the serial printer are automatically spaced to match the VT132 screen display without regard to tab stop settings. Tab stops on the VT132 and the serial printer are ignored when printing using Auto Print, Print Screen, or Print Cursor Line.

Horizontal margins on the printer must be set as wide or wider than the number or characters per line setting of the VT132 SET-UP A. Therefore, the screen display prints as shown on the screen. A line on the screen consists of 80 character positions (80-column mode) or 132 character positions (132-column mode).

## SET-UP B

The VT1XX-AC adds operational features to the VT132. Therefore, the SET-UP B presentation changes to show the status of new SET-UP B features. The features changed are Auto XON/XOFF, Receive Speed, and Transmit Speed. Also, a WPS terminal feature and a new field 5 is added to the presentation. All other SET-UP B features are selected and operate as described in the *VT132 User Guide.* The SET-UP B feature summary looks similar to Figure 4-7. Figure 4-8 summarizes the meaning o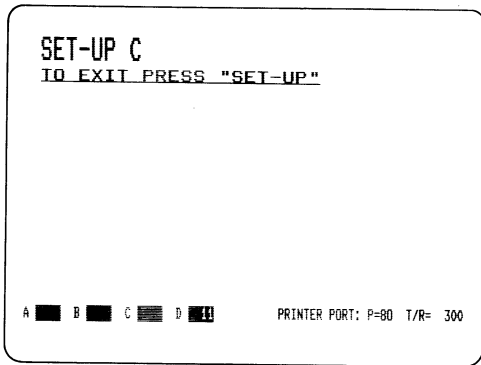f the SET-UP B presentation. Those areas in the presentation shown as reserved have no meaning at this time but are for future use.

The following paragraphs define the changed features of SET-UP B in alphabetic order.

### Auto XON/XOFF

This feature allows the VT132 to automatically generate the XON (DC1) and XOFF (DC3) control characters. XOFF is a request to the host to stop sending characters; XON is a request to resume sending characters. The host must support XON/XOFF to ensure against loss of characters; therefore this bit is forced to the on (1) condition in SET-UP B.

**NOTE**
**When the VT1XX-AC is installed the Auto
XON/XOFF feature is always selected on (1).**
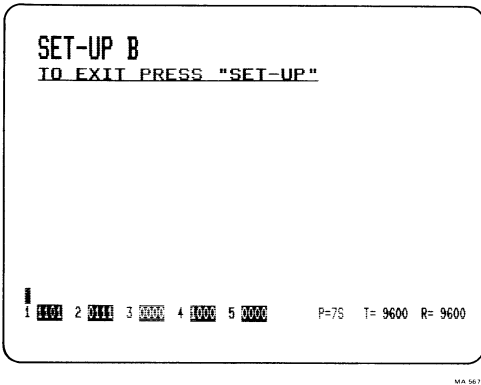


Figure 4-7      VT132 SET-UP B Presentation

The VT132 also recognizes received XOFF and XON.
Receipt of XOFF stops the VT132 from sending any
codes except XOFF and XON. A few keystrokes are
stored in a keyboard buffer. If the keyboard buffer over-
flows, keyclicks stop and the KBD LOCKED indicator
lights. Sending characters resumes upon receipt of
XON.

If XON is not received from the host (due to commu-
nication system failure), the KBD LOCKED indicator
can only be cleared by performing a Reset in SET-UP
mode. Reset destroys the contents of the VT132's input
character buffer. However, if the host computer has in-
tentionally left the VT132 in the XOFF condition, key-
board entries typed after clearing the KBD LOCKED
indicator by a Reset may be lost.

**Printer Port Test Mode**
When set to on (1), this feature selects a test mode
used in external data loopback testing of the printer in-
terface. Characters received from the host are ignored
and all keyboard entries are sent through the printer in-
terface. When the printer interface is not being tested,
this feature is selected as off (0).
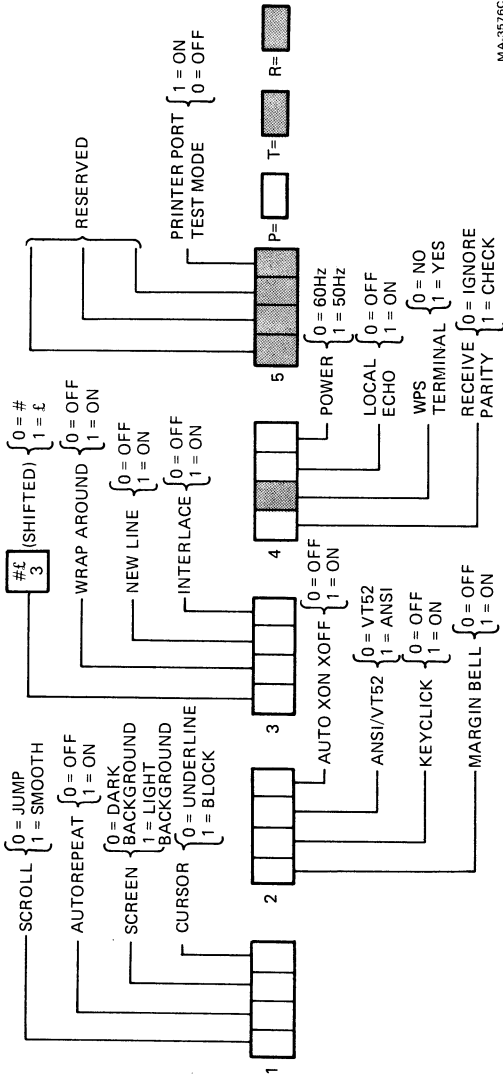
Figure 4-8    VT132 SET-UP B Summary

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> **NOTE**
> **The Printer Port Test mode feature must always be Saved as off (0).**

### Receive Speed

Selection and operation of this feature is described in the *VT132 User Guide.* However, when the VT1XX-AC is installed the maximum reliable receive speed is 9600 baud.

### Transmit Speed

Selection and operation of this feature is described in the *VT132 User Guide.* However, when the VT1XX-AC is installed the maximum reliable transmit speed is 9600 baud.

### WPS Terminal

When set to yes (1) the position of the **LINE FEED** and \ keys on the VT132 keyboard are interchanged. When set to no (0), the **LINE FEED** and / keys are located as shown in the *VT132 User Guide.*

### SET-UP C

The serial printer interface is configured using SET-UP C features. However, the editing features are not affected by the VT1XX-AC. SET-UP C is entered from SET-UP B by pressing the **5 (SET-UP A/B)** key on the main keyboard. SET-UP C features are selected and operate the same as SET-UP B features. The SET-UP C display is shown in Figure 4-9. Figure 4-10 summarizes the SET-UP C presentation.

Exit SET-UP C by pressing the **SET-UP** key which removes the VT132 from SET-UP mode, or press the **5 (SET-UP A/B)** key on the main keyboard to enter SET-UP A.

The following paragraphs define the printer features of SET-UP C.

### Print Extent

This feature determines what characters on the screen print during a Print Screen operation. When set for full screen (1), all characters on the screen print. When set for scrolling region (0), only the characters in the scrolling region print. The scrolling region is defined as the screen area between the left, right, top, and bottom margins. The top and bottom margins are specified by the host.
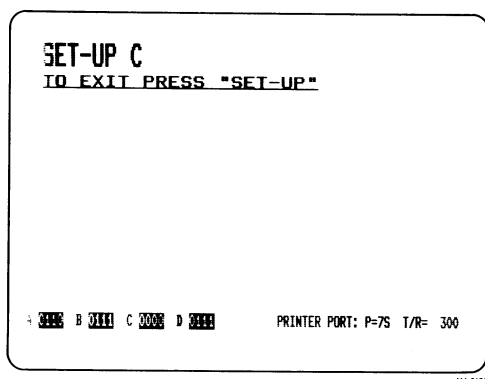
Figure 4-9    VT132 SET-UP C Presentation

**Print Termination Character**

This feature selects a print termination character after a Print Screen. When the print termination character is set to form feed (1), a form feed character is sent to the printer after the screen is printed. When set to (0), no print termination character is sent.

> **NOTE**
> **Carriage return and line feed characters are always sent to the printer when the Auto Print, Print Screen, and Print Cursor Line printing is completed.**

**Parity**

This feature defines two separate but interrelated items: data bits per character; and parity used with the serial printer. Data bits per character defines the number of data bits (7 or 8) of the characters sent and received. In 8-bit operation, the 8th bit is set to a space (or 0) for characters sent. The 8th bit of all characters received is ignored.

Parity defines the type of parity bit the VT132 generates for characters sent and checks on received characters. If no parity is selected, the parity bit is removed from the character.

The VT132 can operate using the data bits per character/parity selections in Table 4-2. Set the parity and data bits per character used with the serial printer, by performing the following steps:

MA-3573B

PRINTER PORT:  P=    T/R=

PRINT EXTENT { 0 = SCROLL REG.
1 = FULL SCREEN

PRINT TERM.CHAR. { 0 = NONE
1 = FF

ERASURE MODE { 0 = UNPRO
1 = ALL

NORMAL PROTECTED { 0 = OFF
1 = ON

D

BOLD PROTECTED { 0 = OFF
1 = ON

UNDERLINE PROTECTED { 0 = OFF
1 = ON

BLINK PROTECTED { 0 = OFF
1 = ON

REVERSE PROTECTED { 0 = OFF
1 = ON

C

TRANSMIT { 0 = DEFER
1 = IMMED.

TRANSMIT TERM.CHAR. { 0 = NONE
1 = FF

TRANSMIT EXTENT

0 0 PARTIAL PAGE
0 1 PAGE
1 0 LINE
1 1 LINE

B

EDIT MODE { 0 = OFF
1 = ON

EDIT KEY { 0 = DEFER
1 = IMMEDIATE

CHAR.SENT { 0 = UNPRO
1 = ALL

SP. COMPRES { 0 = OFF
1 = ON

A
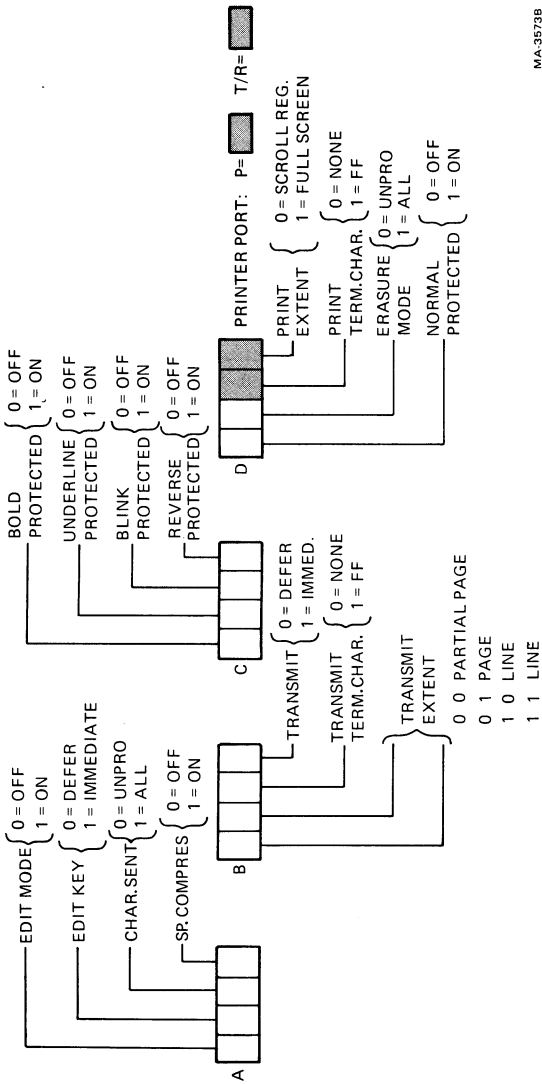
**Figure 4-10    VT132 SET-UP C Summary**

1. Place the VT132 in SET-UP C.

2. Hold down the **SHIFT** key, press the **P** key; then release both keys. Each time this key combination is pressed, the VT132 selects another data bits per character/parity selection.

**Receive and Transmit Speed**

Receive and transmit speeds for the serial printer are always the same. Split baud rates (different transmit and receive speeds) are not allowed. Transmit and receive speeds are selected by pressing either the **7 (TRANS-MIT SPEED)** or **8 (RECEIVE SPEED)** key on the main keyboard while in SET-UP C. Each time the key is pressed, the speed (baud rate) changes. The serial printer interface operates reliably at a maximum of 9600 baud (bits per second).

Table 4-3 lists the available receive and transmit speed selections. Select the speeds used with the serial printer, by performing the following steps:

1. Place the VT132 in SET-UP C.

2. Press either the **7 (TRANSMIT SPEED)** or **8 (RE-CEIVE SPEED)** key on the main keyboard. Each time the key is pressed, the feature setting changes. Either key may be used to set the baud rate because split baud rates (different transmit and receive speeds) are not allowed.

**NOTE**
**When the Receive and Transmit Speed SET-UP feature is set for 50, 75, or 110 baud (bits per second), two stop bits are used. All other selections use one stop bit.**

**SET-UP Default Conditions**

The VT132 contains a default condition for all non-volatile (NVR) memory SET-UP features. These default conditions are contained in read only memory (ROM) and are not changeable. When default conditions are invoked, all feature settings change to the default conditions. The contents of NVR memory does not change when the default condition is invoked.

There are two default conditions: a general default and a tab default. The default conditions are invoked in two ways: automatically by the VT132 when it has difficulty reading the contents of NVR memory; or manually from the keyboard.

**General Default** – The general default condition resets all VT132 feature settings. SET-UP A features are set for 80 columns per line with tab stops every eight columns. SET-UP B and SET-UP C features are shown in Figures 4-11 and 4-12, respectively. The VT132 is placed in LOCAL and the answerback message is not used.

Invoke general default from the keyboard with the following procedure:

1. Place the VT132 in SET-UP mode.
2. Hold down the **SHIFT** key, press the **D** key; then release both keys. The screen clears and after a brief time the VT132 returns to SET-UP A.

**Tab Default** – The tab default condition resets all VT132 tab stop settings and sets a new tab stop at every eighth column. Invoke tab default with the following procedure:

1. Place the VT132 in SET-UP A.
2. Hold down the **SHIFT** key, press the **T** key; then release both keys. The tab settings clear and a tab stop is set every eighth column.
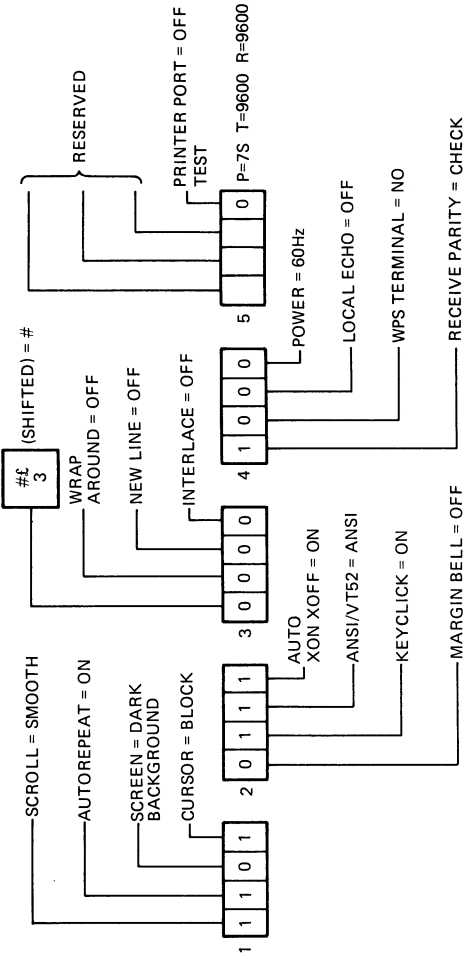
Figure 4-11 VT132 SET-UP B Default Conditions
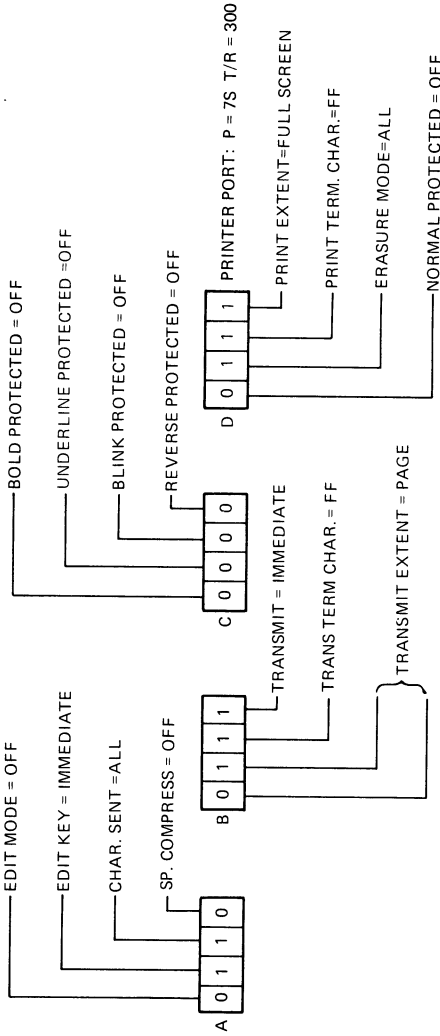
Figure 4-12    VT132 SET-UP C Default Conditions

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# 5 PROGRAMMING

**GENERAL**

This chapter describes how the host computer controls the print operations performed by the VT1XX-AC option. All of the control functions changed or added to the VT100 and VT132 terminals are described. Also, using XON and XOFF control characters to prevent input buffer overflows is discussed.

**CONTROL FUNCTIONS**

The VT1XX-AC can be controlled by a host computer using control functions. The control functions presented in this chapter are represented using the ASCII character set. The case (upper or lower) of the characters is significant and must be used as documented. The escape character, octal 033, is designated as **ESC**. Parameters are shown explicitly or designated as Ps. However, due to the complex nature of the DECREPTPARM/ DECREQTPARM sequences, the selective parameters in these sequences are labeled using abbreviations.

The VT1XX-AC operates with the video terminal in either of two major modes: VT52 or ANSI. These modes are selected using the ANSI/VT52 mode feature (SET-UP B Field 2, bit 3/ANSI/VT52 mode DECANM sequence) in the terminal.

The control functions in this chapter are presented in the following categories.

**ANSI Mode Print Commands** – ANSI standard media copy (MC) command sequences that print using the serial printer.

**ANSI Mode New Commands** – ANSI command sequences added to the terminal with the VT1XX-AC to increase terminal functionality and reporting.

**Altered ANSI Mode Commands** – ANSI command sequences that change in the terminal when the VT1XX-AC is installed.

**VT52 Mode Print Commands** – VT52-compatible command sequences that print using the serial printer.

**VT52 Mode Identify Command** – The VT52-compatible identify terminal sequence is listed in this section.

### Selecting Print Operations

The VT1XX-AC provides two print modes and two print functions. A print mode is selected by either the host computer or operator. The print mode is maintained until the host computer or operator terminates/changes the mode selection. The print modes are Auto Print (line-at-a-time) and Printer Controller.

A print function is performed by the terminal, and is initiated by the host computer or operator. Upon completion of the function, the terminal returns to its previous condition. The function stops when the operation is completed or when the operator stops the function. The print functions are Print Cursor Line and Print Screen.

The terminal can be placed in only one print mode at a time. Also, print functions should not be started while the terminal is in a print mode. Therefore, all print modes should be ended prior to selecting a new print mode or print function.

Printer status must always be checked prior to selecting a print mode or print function. Printer status is checked in ANSI mode using the Printer Status Report DECPSR sequence. Selecting a print mode or function while the serial printer is "not ready" may place the terminal in the "hung" condition (i.e., the terminal does not respond to keyboard entries, the screen cannot be updated, etc.) until the print function is completed. If the print function cannot be completed, the terminal "hung" condition can only be cleared by a Reset (RIS sequence or Reset from the keyboard in SET-UP mode).

When selecting print operations always perform the following procedures:

1. Terminate Auto Print mode. (This mode is selectable from the terminal keyboard.)

2. Ensure that the terminal is in ANSI mode.

3. Request a Printer Status Report (DECPSR) to determine if the serial printer is operational.

**NOTE**
**If the printer was on-line and now is not ready,**
**a print request causes the terminal to "hang"**
**until the print operation is completed.**

4. If the terminal was operating in VT52 mode, select VT52 mode.

5. Select the desired print operation.

**ANSI Mode Print Commands**

ANSI standard media copy (MC) commands are used for printer control along with private parameters when needed. The following print control sequences are used in ANSI mode:

> Auto Print (line-at-a-time) mode
> Printer Controller mode
> Print Cursor line function
> Print Screen function.

All print operations can be selected by the host computer. Only Auto Print and Print Screen can be selected from the terminal keyboard.

**Auto Print Mode**
**ESC [ ? 5 i**         (select)
**ESC [ ? 4 i**         (terminate)

Auto Print (line-at-a-time) is selected from the terminal keyboard or by the host computer. When Auto Print is selected, the screen display is printed one line at a time. A line on the screen is printed when the cursor moves off the line. The cursor moves off the line by a line feed, form feed, or vertical tab character. Subsequent line feeds, form feeds, or vertical tabs move the cursor one line on the screen and the line is printed. When the cursor moves off the line, the line on the screen cannot be changed before it is printed.

While a line is printing, any terminal keyboard entries are not sent to the host computer. After the line is printed, the keyboard entries are sent.

**NOTE**
**When the VT132 is in edit mode, Auto Print is**
**suspended. When the VT132 exits edit mode,**
**Auto Print continues. All other print operations**
**are not affected by VT132 edit mode.**

Tab stops on the terminal and serial printer are ignored when printing. Characters on a screen line are spaced using space or tab characters. However, once on the screen each character position contains a displayable character (including the space character octal 040). The terminal sends any position not containing a displayable character to the printer as space characters (octal 040). After the terminal sends the last displayable character of a line, it sends a carriage return (CR) and line feed (LF). The terminal trims all spaces occurring after the last printable character is sent to the printer.

If a line contains double height characters, the characters prints as two identical lines containing standard width characters. Double width characters print as standard width characters on a single line.

**Printer Controller Mode**
| | |
|---|---|
| ESC [ 5 i | (select) |
| ESC [ 4 i | (terminate) |

Printer Controller is selected by the host computer. When selected, all characters received from the host computer are sent to the serial printer without displaying, converting, or altering the characters in any way. The characters are not displayed on the screen.

> **NOTE**
> **If the terminal receives a Printer Controller request and no serial printer is installed, all characters received by the terminal are displayed on the screen.**

The terminal does not automatically insert spaces, trim spaces, provide line delimiters, or select proper character sets. Also, the active column position of the printer must always be placed to the left margin before leaving Printer Controller mode.

Terminal keyboard entries are sent to the host computer. This allows the terminal to communicate with the host while Printer Controller is selected.

If tab control characters are used, printer tab stops must be set properly. Some DEC serial printers allow tab stops to be selected through control functions sent by the host.

## Print Cursor Line Function
## ESC [ ? 1 i

Print Cursor Line is selected by the host computer. The function prints the screen line containing the cursor. The cursor position does not change. After the function is selected, the screen line containing the cursor cannot be changed before it is printed.

While a screen line is being printed, terminal keyboard entries are not sent to the host computer. After the line is printed, Print Cursor Line automatically terminates and keyboard entries are sent.

Tab stops on the terminal and serial printer are ignored when printing. Characters on a screen line are spaced using space or tab characters. However, once on the screen each character position contains a displayable character (including the space character octal 040). The terminal sends any position not containing a displayable character to the printer as space characters (octal 040). After the terminal sends the last displayable character of a line, a carriage return (CR) and line feed (LF) are sent. The terminal trims all spaces occurring after the last printable character is sent to the printer.

If a line contains double height characters, the characters print as two identical lines with standard width characters. Double width characters print as standard width characters on a single line.

## Print Screen Function
## ESC [ i

Print Screen is selected from the terminal keyboard or by the host computer. The function sends a complete copy of the screen display to the printer. Depending on the Print Extent feature (SET-UP C Field D, bit 4/ ANSI mode Print Extent DECEXT sequence) selection, either the complete screen or just the scrolling region is sent to the printer. The scrolling region is selected by the host computer using the ANSI mode Set Top and Bottom Margins DECSTBM sequence.

After Print Screen is selected, the screen contents cannot be changed before it is printed. While the screen display is being printed, terminal keyboard entries are not sent to the host computer. After the screen is printed, Print Screen automatically terminates and keyboard entries are sent.

Tab stops on the terminal and serial printer are ignored when printing. Characters on a screen line are spaced using space or tab characters. However, once on the screen each character position contains a displayable character (including the space character octal 040). The terminal sends any position not containing a displayable character to the printer as space characters (octal 040). After the terminal sends the last displayable character of a line, it sends a carriage return (CR) and line feed (LF). The terminal trims all spaces occurring after the last printable character is sent to the printer.

If a line contains double height characters, the characters print as two identical lines with standard width characters. Double width characters print as standard width characters on a single line.

**New ANSI Mode Commands**

The following ANSI sequences are added to the terminal with the VT1XX-AC option.

Print Extent mode (DECEXT)
Form Feed mode [print termination character] (DECFF)
Printer Status Report (DECPSR)
Delete Character (DCH)*
Delete Line (DL)*
Insert Line (IL)*
Insert/Replacement mode (IRM)*

A detailed description of each sequence is provided in the following paragraphs.

| **DECEXT** | **Print Extent Mode** | |
|---|---|---|
| | **(DEC Private)** | |
| To set: | **ESC [ 19 h** | (full screen) |
| To reset: | **ESC [ 19 l** | (scrolling region) |

This is a parameter applicable to the set mode (SM) and reset mode (RM). When set, all characters on the screen are sent to the printer during a Print Screen function. When reset, only characters within the scrolling region are sent. The scrolling region is contained between the top and bottom margins as selected by the DECSTBM sequence in ANSI mode.

---

\* The VT132 without the VT1XX-AC installed supports these sequences.

**DECFF**          **Form Feed Mode (DEC Private)**
                   **[print termination character]**
To set:            **ESC [ 18 h**        (form feed)
To reset:          **ESC [ 18 l**        (none)

This is a parameter applicable to the set mode (SM) and reset mode (RM). When set, a form feed character (octal 014) is added to the characters printed during a Print Screen function. When reset, no print termination character is added. The carriage return (octal 015) and line feed (octal 012) characters are always sent to the printer as part of the Print Screen function.

**DECPSR     Printer Status Report**
**           (DEC Private)**

The host computer uses the control sequences in Table 5-1 to determine printer status as a response to a printer status report (DECPSR). Printer status should be determined before selecting any print mode or function.

**Table 5-1    Printer Status Report**

| Description | Sequence |
|---|---|
| Host requests printer status | **ESC [ ? 1 5 n** |
| No printer response (printer DTR off during terminal power up) | **ESC [ ? 1 3 n** |
| Printer ready response | **ESC [ ? 1 0 n** |
| Printer not ready response (printer DTR off after terminal power up) | **ESC [ ? 1 1 n** |

**DCH  Delete Character**
**ESC [ Pn P**

DCH deletes Pn characters starting with the character at the cursor position. Characters to the right of the cursor move Pn spaces to the left.

## DL    Delete Line
### ESC [ Pn M

DL deletes Pn lines starting with the line containing the cursor. The remaining screen contents moves up Pn lines to fill the deleted lines on the screen. The area moved is bounded by the bottom margin of the scrolling region. The lines added to the bottom of the screen are filled with spaces whose video attributes match the preceding line. The command has no effect when the cursor is outside the scrolling region.

## IL    Insert Line
### ESC [ Pn L

IL inserts Pn lines at the cursor location within the scrolling region. New lines are filled with spaces whose video attributes match those of the preceding line. The command has no effect if the cursor is located outside the scrolling region. Lines scrolled off the screen when inserting lines are not held in terminal memory.

## IRM    Insert/Replacement Mode
To set:    **ESC [ 4 h**  (insert)
To reset:    **ESC [ 4 l**  (replacement)

This is a parameter applicable to the set mode (SM) and reset mode (RM). When set, the terminal is in insert mode and keyboard indicator L3 lights. Any incoming characters are placed at the active cursor position. All characters to the right of the cursor on the active line shift to the right. Characters shifted past the right margin are not held in terminal memory. Characters do not wrap around to the next line. When reset, the terminal is in replacement mode and keyboard indicator L3 is off. Any incoming characters overlay the character at the cursor position and the cursor advances one character position. No other characters are affected.

### Altered ANSI Mode Commands
The following ANSI sequences are altered in the terminal after installing the VT1XX-AC option:

Device Attributes (DA)
Identify Terminal (DECID)
Report Terminal Parameters (DECREPTPARM)/ (DECREQTPARM)
Invoke Confidence Test (DECTST)
Select Character Set (SCS).

## DA   Device Attributes
ESC [ Ps c

The host requests the terminal to send a device attributes control sequence by sending the DA control sequence with either no parameter or a parameter of 0. The response to the above request described is generated by the terminal as a DA control sequence as listed in Table 5-2.

The DA control sequence is also sent in response to the DECID sequence.

## DECID   Identify Terminal (DEC Private)
ESC Z

In ANSI mode this sequence causes the same response as the ANSI device attributes (DA) sequence. This sequence will not be supported in future DEC terminals; therefore DA should be used by any new software.

**Table 5-2   Device Attribute Responses**

| Options | Sequence |
|---------|----------|
| VT100 with VT1XX-AC | **ESC [ ? 1 ; 1 1 c** |
| VT100 with VT1XX-AC and graphics processor | **ESC [ ? 1 ; 1 5 c** |
| VT132 with VT1XX-AC | **ESC [ ? 4 ; 1 1 c** |
| VT132 with VT1XX-AC and graphics processor | **ESC [ ? 4 ; 1 5 c** |

## DECREPTPARM
(Report Terminal Parameters)

ESC [ <sol> ; <comm par> ; <comm ndits> ; <comm xspeed> ; <comm rspeed> ; <clkmul> ; <flags> ; <ANSI/VT52> ; <prt par> ; <prt nbits> ; <prt xspeed> ; <prt rspeed> x

With the VT1XX-AC installed, the parameters in Table 5-3 are sent on receipt of a DECREQTPARM control sequence from the host computer.

**Table 5-3    Report Terminal Parameters**

| Parameters | Value | Description |
|---|---|---|
| <sol> | 1 | This message is a request; from now on terminal only reports in response to a request. |
| | 3 | This message is a report and the terminal is only reporting on request. |
| <comm par> | 1 | No parity set for communication interface. Parity bit removed from character. |
| | 2 | Space parity set for communication interface. |
| | 3 | Mark parity set for communication interface. |
| | 4 | Odd parity set for communication interface. |
| | 5 | Even parity set for communication interface. |
| <comm nbits> | 1 | 8 data bits per character |
| | 2 | 7 data bits per character |
| <comm xspeed> | 0 | 50 |
| | 8 | 75 |
| | 16 | 110 |
| | 24 | 134.5 |
| | 32 | 150 |
| | 40 | 200 |
| | 48 | 300 |
| | 56 | 600 |
| | 64 | 1200 |

(Values 50 through 1200 in the right column are: Bits per second)

**Table 5-3  Report Terminal Parameters (Cont)**

| Parameters | Value | Description |
|---|---|---|
| | 72<br>80<br>88<br>96<br>104<br>112<br>120 | 1800<br>2000<br>2400<br>3600<br>4800<br>9600<br>19200 } Bits per second |
| \<comm rspeed\> | | (Refer to comm xspeed parameter.) |
| \<clkmul\> | 1 | Bit rate multiplier is 16. |
| \<flags\> | 0 – 15 | Communicates the four switch values in block 5 of SET-UP B; only visible to user when STP option installed. The four bits are a decimal encoded binary number. |
| \<ANSI/VT52 mode\> | 0 | VT52 mode |
| | 1 | ANSI mode |
| \<prt par\> | 1 | No parity set for printer interface. Parity bit removed from character. |
| | 2 | Space parity set for printer interface. |
| | 3 | Mark parity set for printer interface. |
| | 4 | Odd parity set for printer interface. |
| | 5 | Even parity set for printer interface. |
| \<prt nbits\> | 1 | 8 data bits per character |
| | 2 | 7 data bits per character |

Table 5-3   Report Terminal Parameters (Cont)

| Parameters | Value | Description |
|---|---|---|
| <prt xspeed> | 0 | 50 |
| | 8 | 75 |
| | 16 | 110 |
| | 24 | 134.5 |
| | 32 | 150 |
| | 40 | 200 |
| | 48 | 300 |
| | 56 | 600 |
| | 64 | 1200 |
| | 72 | 1800 |
| | 80 | 2000 |
| | 88 | 2400 |  Bits per second |
| | 96 | 3600 |
| | 104 | 4800 |
| | 112 | 9600 |
| | 120 | 19200 |
| <prt rspeed> | | (Split speeds not supported, refer to prt rspeed promoter) |

**DECREQTPARM**
**Request Terminal Parameters**
ESC [ <sol> x

The terminal sends DECREPTPARM to notify the host of the status of selected terminal parameters. The status sequence is sent when requested by the host. DECREPTPARM is sent upon receipt of a DECREQTPARM sequence. Refer to DECREPTPARM for the meaning of the <sol> selective parameter. Unsolicited reports are not allowed when the VT1XX-AC is installed.

**DECTST Invoke Confidence Test**
ESC [ 2 ; Ps y

DECTST initiates self-tests resident within the terminal. Ps is the parameter indicating the test to be performed as listed in Table 5-4. If Ps is 0, no test is performed but the screen clears and the terminal operates using the last stored SET-UP feature settings. The terminal must be on-line with the external loopback connector installed when running the loopback tests from the keyboard. (Refer to the Error Codes section in Chapter 8 for the meaning of any error codes displayed on the keyboard indicators, printer option indicator, or screen.)

**Table 5-4    Confidence Tests**

| Test | Parameters (Ps) | |
|------|:---:|-----|
| Power up self-test (ROM checksum, RAM, NVR, keyboard, AVO, and printer interface | 1 | |
| Data loopback | 2 | (external loopback connector required) |
| Power up self-test (ROM checksum, RAM, NVR, keyboard, and AVO) run continuously | 9 | (printer interface option not tested) |
| Data loopback run continuously | 10 | (external loopback connector required) |

### SCS    Select Character Sets

VT100 and VT132 terminals can display up to 254 different characters simultaneously. The characters are stored in up to five character sets, with some characters appearing within more than one character set. In 7-bit code, only 94 characters (one character set) are accessed at one time. The terminals use ANSI and ISO standards for code extension techniques (ANSI X3.41 and ISO 2022) to access the extra characters available.

As described in the ANSI and ISO standards, two of the five character sets are active at one time. The two active character sets are designated G0 and G1 by the select character sequence (SCS). G0 and G1 are invoked by codes SI (shift-in, octal 017) and SO (shift-out, octal 016) respectively. Table 5-5 lists the sequences used when designating the character sets.

When sending the screen display to the printer (during a Print Screen function, Print Cursor Line function, or in Auto Print mode), the terminal must select the proper character set. However, once a character is displayed on the screen, the terminal cannot usually determine which character set displayed the character. Therefore, the terminal uses the rules in Table 5-6 to determine the proper character set.

**NOTE**
**If multiple character sets are used with the terminal, the serial printer must support and properly use the select character sequence (SCS), shift out (SO) and shift in (SI). Otherwise, unexpected results occur.**

**Table 5-5   Character Set Selections**

| G0 Sets | G1 Sets | Character Set |
|---------|---------|---------------|
| ESC ( A | ESC ) A | United Kingdom |
| ESC ( B | ESC ) B | ASCII |
| ESC ( 0 | ESC ) 0 | Special Graphics |
| ESC ( 1 | ESC ) 1 | Alternate Character Set (standard characters) |
| ESC ( 2 | ESC ) 2 | Alternate Character Set (special graphics) |

**Table 5-6   Using Multiple Character Sets**

| VT100 Terminal | VT132 Terminal |
|----------------|----------------|
| If VT100 G0 set is either US or UK, it is assumed that G0 set of printer is the same. | It is assumed that the G0 set designated in VT132 and printer are the same. |

**NOTE**
**If either US or UK sets are used with no characters from another set, the screen display is sent without using select character sequence (SCS), shift out (SO) or shift in (SI).**

If VT100 G0 set is not
either US or UK set,
the appropriate sequence
is sent to the printer
to designate and select
the current G0 set used
by VT100 as follows:

* Transmit G0 designating
  sequence

* Transmit SI (octal 017)

**Table 5-6    Using Multiple Character Sets (Cont)**

| VT100 Terminal | VT132 Terminal |
|---|---|
| If at anytime during transmission the next character to be sent is not from current VT100 G0 set, a new G1 set is designated and selected. | If at anytime during transmission the next character to be sent is not from current VT132 G0 set, a new G0 set is designated and selected. |
| **NOTE**<br>**G0 set is never redesignated.** | **NOTE**<br>**G1 set is never redesignated.** |
| A new character set is chosen as follows: VT100 searches for character set containing the character. Character sets are searched in following order: | A new character set is chosen as follows: VT132 searches for character set containing the character. Character sets are searched as follows: |
| * Special Graphics Set<br>* Alternate Character ROM Set<br>* Alternate Character ROM Special Graphics Set | * If character is present in default character set, it is assumed character is from that set.<br><br>* The pound sterling character is always assumed to be from the UK character set.<br><br>* The error (■), SUB, CAN, and special graphics character octal 141 are always transmitted as SUB octal 032.<br><br>The character sets are then searched in the following order:<br><br>* Special Graphics Set<br>* Alternate Character ROM Set |

Table 5-6 Using Multiple Character Sets (Cont)

| VT100 Terminal | VT132 Terminal |
|---|---|
| | * Alternate Character ROM Special Graphics Set |
| Character set is designated and selected as follows: | Character set is designated and selected as follows: |
| * Transmit G1 designating sequence for character set required. | * Transmit G0 designating sequence for character set required. |
| * Transmit SO (octal 016), if not previously sent. | |
| * Transmit character | * Transmit character |
| If multiple character sets were used during printing, the printer is placed in its original G0 set after printing is completed. | If multiple character sets were used during printing, the printer is placed in its original G0 set after printing is completed. |

### VT52 Mode Print Commands

In VT52 mode, VT52 sequences originally used by the VT1XX-KA option are used for printer control. The following print control sequences are used in VT52 mode:

Auto Print (line-at-a-time) mode
Printer Controller mode
Print Cursor Line function
Print Screen function.

All print operations can be selected by the host computer. Only Auto Print and Print Screen can be selected from the terminal keyboard.

**NOTE**
**Prior to selecting a print mode or function, request a Printer Status Report (DECPSR) in ANSI mode. Determine if the serial printer is**

**operational. If the printer was on-line and now is not available, a print request "hangs" the terminal (i.e., terminal does not respond to operator keystrokes, screen cannot be updated, etc.). A hung terminal is cleared by making the serial printer available or performing a Reset.**

## Auto Print Mode

| | |
|---|---|
| **ESC ∧** | (select) |
| **ESC –** | (terminate) |

Auto Print (line-at-a-time) mode is selected from the terminal keyboard or by the host computer. When selected, the screen display is printed one line at a time. A screen line is printed when the cursor moves off the line. The cursor moves off the line by a line feed, form feed, or vertical tab character. Subsequent line feeds, form feeds, or vertical tabs move the cursor one line on the screen and the line is printed. When the cursor moves off the line, the line cannot be changed before it is printed.

While a line is printing, any terminal keyboard entries are not sent to the host computer. After the line prints, the keyboard entries are sent.

Tab stops on the terminal and serial printer are ignored when printing. Characters on a screen line are spaced using space or tab characters. However, once on the screen each character position contains a displayable character (including the space character octal 040). The terminal sends any position not containing a displayable character to the printer as space characters (octal 040). After the terminal sends the last displayable character of a line, it sends a carriage return (CR) and line feed (LF). The terminal trims all spaces occurring after the last printable character is sent to the printer.

## Printer Controller Mode

| | |
|---|---|
| **ESC W** | (select) |
| **ESC X** | (terminate) |

Printer Controller mode is selected by the host computer. When selected, all characters received from the host are sent to the serial printer without displaying, converting, or altering the characters in any way. The characters are not displayed on the screen.

**NOTE**
**If the terminal receives a Printer Controller mode request and no serial printer is installed, all characters received by the terminal are displayed on the screen.**

The terminal does not automatically insert spaces, trim spaces, provide line delimiters, or select proper character sets. Also, the active column position on the printer must always be on the left margin before leaving Printer Controller mode.

Terminal keyboard entries are sent to the host computer. This allows the terminal to communicate with the host while Printer Controller is selected.

If tab control characters are used, the printer tab stops must be set properly. Some DEC serial printers allow tab stops to be selected through control functions sent by the host.

### Print Cursor Line Function
### ESC V

Print Cursor Line is selected by the host computer. The function prints the screen line containing the cursor. The cursor position does not change. After the function is selected, the screen line containing the cursor cannot be changed before it is printed.

While a screen line is being printed, terminal keyboard entries are not sent to the host. After the line is printed, Print Cursor Line automatically terminates and keyboard entries are sent.

Tab stops on the terminal and serial printer are ignored when printing. Characters on a screen line are spaced using space or tab characters. However, once on the screen each character position contains a displayable character (including the space character octal 040). The terminal sends any position not containing a displayable character to the printer as space characters (octal 040). After the terminal sends the last displayable character of a line, it sends a carriage return (CR) and line feed (LF). The terminal trims all spaces occurring after the last printable character is sent to the printer.

If a line contains double height characters, the charac-. ters print as two identical lines with standard width characters. Double width characters print as standard width characters on a single line.

### Print Screen Function
### ESC ]

Print Screen is selected from the terminal keyboard or by the host computer. The function sends a complete copy of the screen display to the serial printer.

After Print Screen is selected, the screen contents cannot be changed before it is printed. While the screen dis-

play is being printed, terminal keyboard entries are not sent to the host computer. After the screen is printed, the function automatically terminates and the keyboard entries are sent.

Tab stops on the terminal and serial printer are ignored when printing. Characters on a screen line are spaced using space or tab characters. However, once on the screen each character position contains a displayable character (including the space character octal 040). The terminal sends any position not containing a displayable character to the printer as space characters (octal 040). After the terminal sends the last displayable character of a line, it sends a carriage return (CR) and line feed (LF). The terminal trims all spaces occurring after the last printable character is sent to the printer.

If a line contains double height characters, the characters print as two identical lines with standard width characters. Double width characters print as standard width characters on a single line.

### VT52 Mode Identify Command

The response to the DECID escape sequence ESC Z (DEC Private) is ESC/Z. This is the same as the terminal response in VT52 mode without the VT1XX-AC option installed.

> **NOTE**
> **Option information must be obtained in ANSI mode using the device attributes (DA) sequence.**

### Preventing Input Character Buffer Overflow

With the VT1XX-AC installed, the terminal operates the host computer interface at speeds up to 9600 baud. However, the terminal may not be able to process the incoming characters at that speed. Therefore, an input buffer that uses XON/XOFF control characters (DC1/DC3) stores incoming characters.

Incoming characters are stored in a 128 character buffer that processes them on a first-in/first-out basis. When the buffer is storing 32 characters, the terminal sends octal 023 (XOFF or DC3). The host computer should stop sending data when the XOFF control character is received. Eventually, if the host computer stops sending data, the terminal processes the characters in the buffer. When 16 characters remain in the buffer the terminal sends octal 021 (XON or DC1) to request the host computer to resume sending characters.

If the host computer fails to respond to an XOFF in a timely manner, the buffer continues to fill. The terminal sends a second XOFF when the buffer contains 112 characters. This second XOFF is a last warning that the host computer must stop sending data to avoid a buffer overflow. When the 128-character capacity of the buffer is exceeded the buffer overflows. When the buffer overflows, it discards incoming characters. (For further information on XON/XOFF control characters, refer to the appropriate user guide's programming chapter.)

The operator can hold screen data by using the **NO SCROLL** key, or the **CTRL S** and **CTRL Q** key sequences. The terminal also recognizes received XOFF and XON control characters. XOFF stops the terminal from sending any codes except XOFF and XON. Keystrokes are stored in a keyboard buffer (some keys send two or three codes, e.g., cursor controls). If the keyboard buffer overflows, keyclicks stop and the KBD LOCKED indicator lights. Sending resumes on receipt of XON. If XON is not received due to communication system failure, the KBD LOCKED condition can be cleared by performing a reset operation. However, if the host computer has intentionally left the terminal in XOFF, keyboard entries made after clearing the KBD LOCKED indicator may be lost.

**NOTE**
**Performing a Reset destroys the contents of the input character buffer.**

If the operator wants to stop sending characters to the printer, the **LINE/LOCAL** key or the **CTRL S** and **CTRL Q** key sequences of the serial printer are used. (Refer to the serial printer documentation for further printer operating procedures.)

The printer's DTR signal has a higher priority than XON/XOFF control characters. The OFF condition of the printer's DTR stops sending data even if the printer interface option receives XON. When the printer's DTR signal goes from OFF to ON it is assumed that the XON condition is indicated.

**NOTE**
**No input character buffer is provided for the printer interface since serial printers generally should not send data. However, a hardware serial input connection is provided and XON/XOFF control characters from the printer are recognized in order to prevent printer input buffer overflows.**

# 6 COMMUNICATION

## GENERAL
This chapter describes the serial printer interface connector and the VT1XX-AC option signals.

## INTERFACE
The host computer and printer interfaces adhere to Electronic Industry Association (EIA) standard RS-232-C and CCITT recommendation V.28. Printer interface input voltages are all signals designated "to the terminal" and are interpreted as shown in Table 6-1. Printer interface output voltages are all signals designated "from the terminal" and are interpreted as indicated in Table 6-1. (Refer to the terminal user guide for specific interface information on the communication interface.)

The printer interface connector is a 25-pin "DB" (EIA RS-232-C type) connector mounted on the STP (printer interface) module. Connector pin numbering is shown in Figure 6-1. Pin assignments for the printer interface connector are listed in Table 6-2. Pins not specified are not used by the VT1XX-AC option. Each signal on the printer option connector is described in the following paragraphs.

### Chassis Ground – Pin 1
This conductor is electrically bonded to the terminal chassis which is connected to the ground lead of the ac power cord. This conductor cannot be used for reference potential.

### Terminal Transmit Data (from the terminal) – Pin 2
The terminal sends serially encoded characters to the printer on this conductor. The conductor is held in the mark state when characters are not being sent.

**Table 6-1    Printer Interface Voltage Interpretations**

| Input Voltage | Interpretation |
|---|---|
| −25 V to −0.2 V or open circuit | Mark or OFF |
| 0.2 V to +0.2 V | Undefined; condition not allowed |
| +0.2 V to +25 V or short circuit | Space or ON |
| Voltages ⟩ ±25 V | Undefined; condition not allowed |

| Output Voltage | Interpretation |
|---|---|
| −6 V to −4 V | Mark or OFF |
| −4 V to +4 V | Not used by printer interface |
| +4 V to +6 V | Space or ON |

**Table 6-2    Printer Interface Connector Pin Assignments**

| Pin | Signal Designation |
|---|---|
| 1 | Chassis Ground |
| 2 | Terminal Transmit Data |
| 3 | Terminal Receive Data |
| 6 | Data Set Ready |
| 7 | Signal Ground |
| 20 | Data Terminal Ready |

**Terminal Receive Data (to the terminal) – Pin 3**

The terminal receives serially encoded XON and XOFF control characters on this conductor. All other characters are ignored.

**Data Set Ready (to the video terminal) – Pin 6**

The terminal receives data terminal ready (DTR) from the printer on this conductor. If DTR from the serial printer has not been on since the terminal was powered up or reset, the VT1XX-AC aborts all print requests. When the terminal is aborting a Printer Controller request, any data received is displayed on the screen.
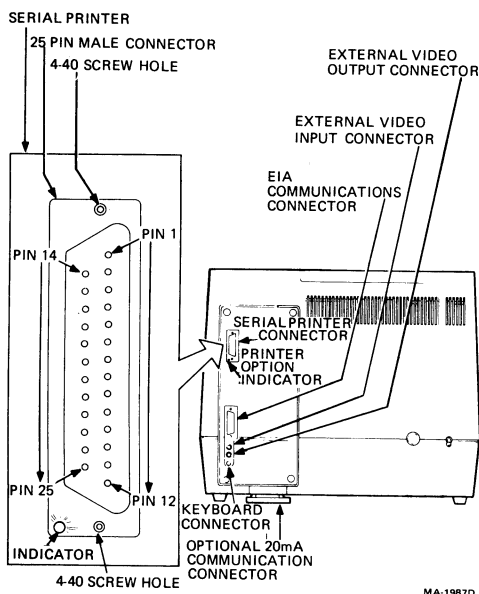
Figure 6-1    Printer Interface Connector and Pin
              Numbers

Once DTR from the serial printer is on, the VT1XX-AC assumes a serial printer is connected to the printer interface and is ready to print. From this time on, the printer's DTR conductor indicates printer status. If DTR is turned off, it is assumed that the serial printer is powered off, is in LOCAL, or is out of paper. Print requests received while DTR is off, cause the VT1XX-AC indicator to blink and suspend all terminal operations. (The terminal appears to be in the "hung" condition having no response to keyboard entries, the screen is not updated, etc.). When DTR is turned on again, the VT1XX-AC indicator remains constantly lit and the print operation is completed. (Refer to Figure 6-1 to locate the indicator.)

The printer's DTR signal has a higher priority than XON/XOFF control characters. The OFF condition of the printer's DTR stops sending data even if the printer interface option receives XON. When the DTR signal goes from OFF to ON it is assumed that the XON condition is indicated.

**Signal Ground or Common Return – Pin 7**

This conductor establishes the common ground reference potential for all voltages on the interface.

**Data Terminal Ready (from the terminal) – Pin 20**

This conductor is on whenever the terminal is on. The DTR signal is usually received by the printer as Data Set Ready. This signal is generally required by the printer before operation can begin.

# 7 INSTALLATION

## GENERAL

This chapter describes installing the VT1XX-AC serial printer interface option into a VT100 or VT132 terminal. When installing the VT1XX-AC in a VT100, the terminal controller board and advanced video option (AVO) board must be configured. Depending on the type of AVO installed, soldered jumpers may be required. When installing the VT1XX-AC into a VT132, note that the terminal controller and AVO boards have been previously configured for option installation.

> **CAUTION**
> **It is recommended that a DIGITAL Field Service representative install this option. When the VT1XX-AC is installed by the customer, any damage to either the terminal or the option is the responsibility of the customer.**

## Installation Tools

The tools required to install the option are:

Flathead screwdriver
Phillips head screwdriver
Soldering tools (depends on AVO installed)
    Soldering iron
    Solder
    Brush and cleaning fluid
    Wire cutter
    Solder removing tool
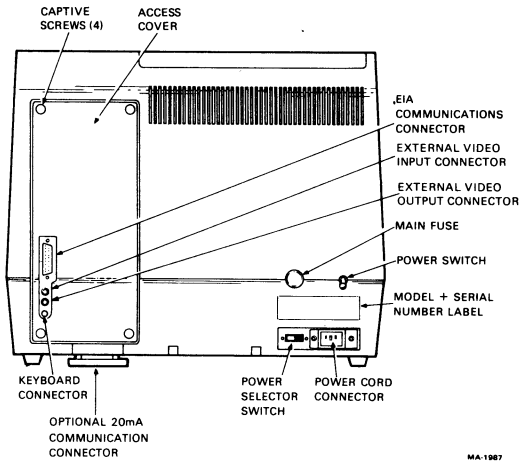
Figure 7-1        Terminal Connectors, Controls, and
                          Access Cover

## INSTALLATION WITH VT100 TERMINAL

Determine the present SET-UP features.

1. Enter SET-UP mode and record the present SET-UP features. (Refer to the *VT100 User Guide* for the meaning of these features.) The feature selections must be entered after the VT1XX-AC is installed.

Remove all cables.

2. Refer to Figure 7-1 to locate the controls and cable connectors. Turn the power switch off and unplug the ac power cord.
3. Unplug the keyboard cable.
4. Unplug any cables connected to the composite video input or output connectors. Release the cables by pressing the connector in and turn the connector one-quarter turn counterclockwise.
5. Disconnect the communication cable.

   If the terminal uses EIA communication, the cable is secured to the rear panel by two (4-40)
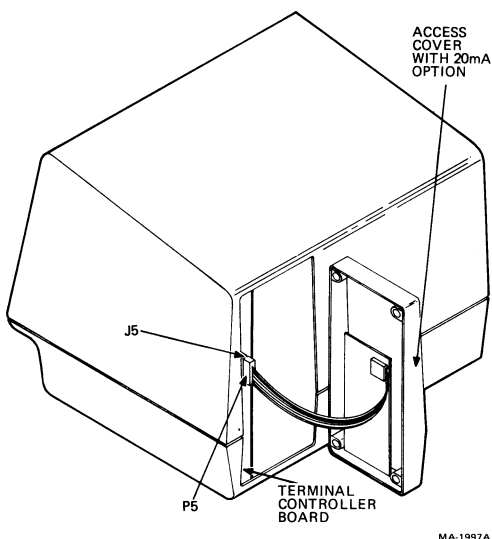
Figure 7-2        20 mA Current Loop Option Cable

screws. The screws are located on either side of the communication connector.

If the terminal uses the 20 mA current loop option, the cable is secured by two locking tabs. Ensure that the locking tabs on either side of the connector are disengaged.

Remove the terminal access cover.

6.  Remove the terminal access cover by loosening the four 6-32 $\times$ 1-3/8 captive screws holding the cover in place. (Refer to Figure 7-1 for screw locations.)

If the 20 mA current loop option is installed, gently open the cover and disconnect the female P5 cable connector of the 20 mA current loop board from the terminal controller board male J5 connector. (Refer to Figure 7-2 to locate the cable connector.)

Remove the terminal controller board.

7.  Remove the terminal controller board by gently but firmly pulling the board straight out from the rear of the terminal.
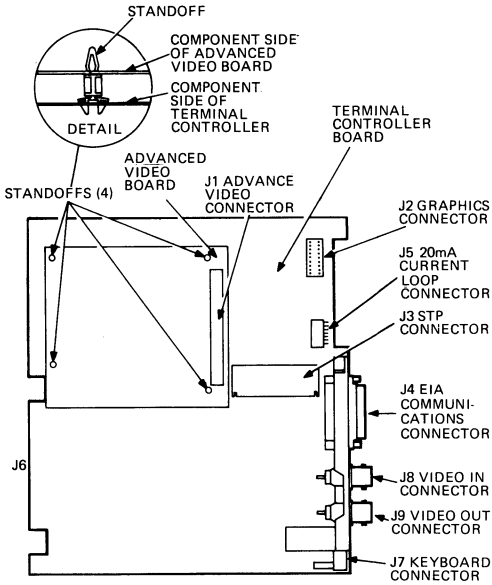
Figure 7-3        Advanced Video Option Location and Installation

Remove the advance video option board (if installed).

8. Place the terminal controller board on a flat surface, component side up. Determine if the AVO board is installed. (Refer to Figure 7-3 to locate the AVO board.) If the board is installed, grasp it by the edges and gently but firmly pry it straight up and off the terminal controller board.

Configure the terminal controller board.

9. Remove the old ROM ICs (ROMs 0 – 3) from the terminal controller board. (Refer to Figure 7-4 to locate the ROM ICs.) To remove the IC insert a screwdriver blade between the socket and ROM IC. Carefully twist the screwdriver to separate the ROM IC from the socket.

**NOTE**
**These ROM ICs must be saved. In the event of terminal controller board failure, these ROM ICs must be replaced before the board is returned for repair.**
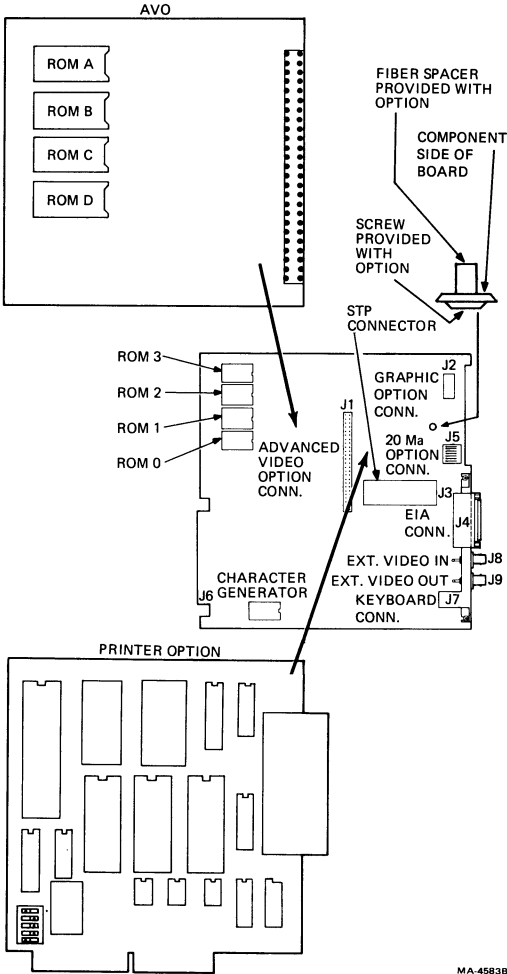


Figure 7-4    Terminal Controller Board with Advanced Video Option and Printer Option

10. Unpack the new terminal controller board ROM ICs supplied with the VT1XX-AC option. (Refer to Table 7-1 to identify the terminal controller ROMs.) Do not remove the ROMs from the conductive foam. Gently press the foam against the surface of the terminal controller board. Remove the ROM ICs from the foam by grasping the body of the ROM IC at the sides adjacent to the pins.

**Table 7-1    VT100 Terminal Controller Board
ROM IC Part Numbers**

| ROM IC | Part Number |
| --- | --- |
| ROM 0 | 23-095E2 |
| ROM 1 | 23-096E2 |
| ROM 2 | 23-139E2 |
| ROM 3 | 23-140E2 |

11. Install the new terminal controller board ROM ICs supplied with the VT1XX-AC option. (Refer to Figure 7-4 for socket locations and to Table 7-1 for ROM IC part numbers.) The notches at the end of the ROM IC body and board socket must be positioned at the same end. Ensure that all ROM IC pins are straight and evenly spaced before trying to insert the ROM IC into the board socket. (Refer to Figure 7-5 when installing ROM ICs onto the terminal controller board.)

Insert the ROM IC into the board socket evenly. Press the top surface of the ROM IC until fully inserted. If excessive resistance occurs, remove the ROM IC and check for proper pin alignment. After the ROM ICs are inserted, ensure that the ROM IC pins are properly installed into the board sockets.

12. Mount the fiber spacer to the terminal controller board with one of the 4-40 screws provided with the VT1XX-AC option. (Refer to Figure 7-4 when installing the fiber spacer.)

Configure the advanced video option board.

13. Remove all old ROM ICs (ROMS ABCD) from the AVO board. (Refer to Figure 7-4 to locate the ROM ICs to be removed.) To remove the ROM IC
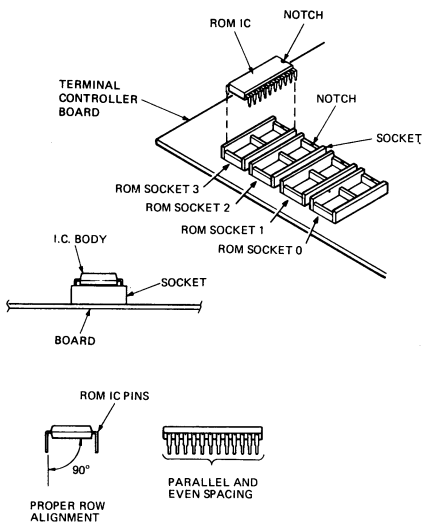
Figure 7-5      Terminal Controller Module ROM IC
                Installation

insert a screwdriver blade between the socket and
the ROM IC. Carefully twist the screwdriver to
separate the ROM IC from the socket.

**NOTE**
**These ROM ICs are discarded after the termi-
nal successfully completes the tests described in
Chapter 8. In the event of advanced video board
failure, all ROM ICs must be removed before
the board is returned for repair.**

14. Determine if the AVO board contains dip switch
    packs. If switch packs are provided, select the
    switch settings shown in Figure 7-6. If switch packs
    are not provided jumpers must be soldered into the
    board. Solder the jumpers into the locations in-
    dicated in Figure 7-6.

15. Unpack the AVO ROM ICs supplied with the
    VT1XX-AC option. (Refer to Table 7-2 to identify
    the AVO ROMs.) Do not remove the ROMs from
    the conductive foam. Gently press the foam against
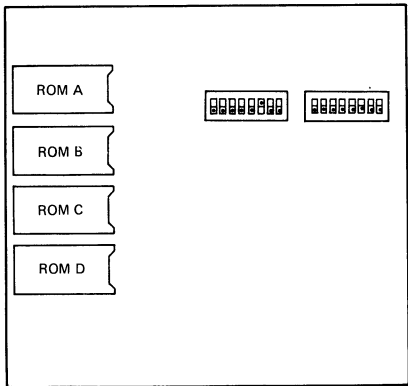
NOTE:
DOT ON SWITCH SHOWS
THE SIDE DEPRESSED

MA-4389B
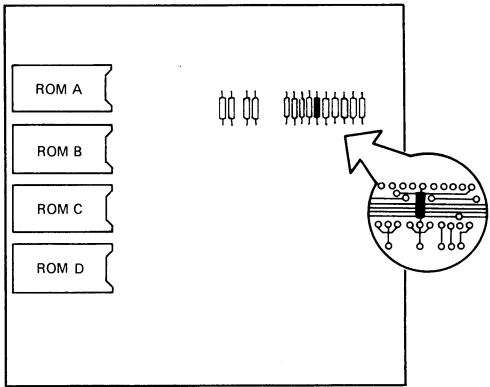
NOTE:
JUMPER IN
JUMPER OUT

MA4389A

Figure 7-6    Advanced Video Option Board
Configuration

the surface of the AVO board. Remove the ROM
ICs from the foam by grasping the body of the
ROM IC at the sides adjacent to the pins.

16. Install the AVO ROM ICs supplied with the
VT1XX-AC option. (Refer to Figure 7-4 for ROM
IC socket locations and to Table 7-2 for ROM IC

**Table 7-2    VT100 Advanced Video Option Board
               ROM IC Part Numbers**

| ROM IC | Part Number |
|--------|-------------|
| ROM A  | 23-184E2 or 23-186E2 |
| ROM B  | 23-185E2 or 23-187E2 |
| ROM C  | Not used |
| ROM D  | Not used |
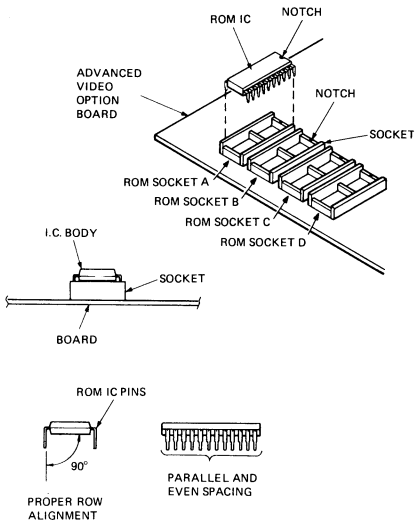


Figure 7-7    Advanced Video Option Board
              ROM IC Installation

part numbers.) Each ROM IC must be installed into a specific socket. The notches at the end of the ROM IC body and board socket must be positioned at the same end. Ensure that all ROM IC pins are straight and evenly spaced before trying to insert the ROM IC into the board socket. (Refer to Figure 7-7 when installing ROM ICs onto the AVO board.)

Insert the ROM IC into the board socket evenly. Press the top surface of the ROM IC until fully installed. If excessive resistance occurs, remove the

ROM IC and check for proper pin alignment. After the ROM ICs are inserted, ensure that the ROM IC pins are properly installed into the board sockets.

Install the advanced video option board.

17. If the AVO board was not previously installed, locate the four mounting holes in the terminal controller board and install a standoff in each. The standoffs are provided in the AVO option kit. (Refer to Figure 7-3 for standoff locations.)

18. Grasp the AVO board by the edges and carefully align female connector J1 on the AVO board with male connector J1 on the terminal controller board. (Refer to Figures 7-3 and 7-4 for connector locations.) Press the AVO board onto the terminal controller board. If excessive resistance occurs, remove the AVO board and check for proper pin alignment.

Install the printer interface option board.

19. Install the printer interface board into the STP J3 connector of the terminal controller board. Ensure that the printer interface board is fully inserted into the connector. (Refer to Figure 7-4 when installing the printer interface board.)

20. Secure the printer interface option board to the terminal controller board with the remaining 4-40 screw provided with the VT1XX-AC option. Thread the screw through the printer board into the fiber spacer mounted on the terminal controller board in step 12.

Reinstall the terminal controller board.

21. Reinstall the terminal controller board in the left-most slot in the card cage. Ensure that the board is fully inserted into the connector within the terminal.

Remove the 20 mA current loop option board from the access cover (if installed).

22. Remove the two 6-32 × 0.62 screws and two spacers holding the 20 mA connector onto the bottom of the access cover. (Refer to Figure 7-8 when removing the 20 mA option.)
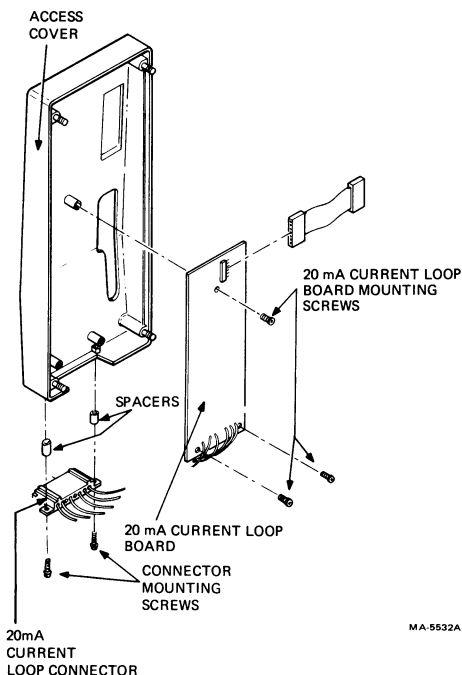
Figure 7-8        20 mA Current Loop Option Board
                  Installation

23. Remove the three 6-32 × 0.312 screws holding the
    20 mA option to the access cover.

    **NOTE**
    **The access cover is discarded after the terminal
    successfully completes the tests described in
    Chapter 8.**

Install the 20 mA current loop option board onto the new
access cover (if installed).

24. Install the 20 mA option onto the access cover pro-
    vided with the VT1XX-AC. Use the three screws
    removed in step 23.

25. Install the 20 mA connector to the bottom of the ac-
    cess cover. Use the two screws and spacers removed
    in step 22.
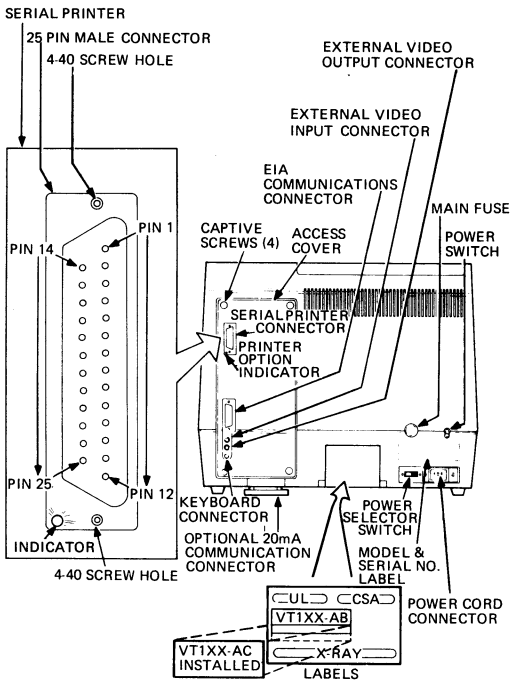
Figure 7-9      Video Terminal Rear View

Install the access cover.

26. If the 20 mA current loop option is installed con-
nect female connector P5 on the 20 mA board to
the male connector P5 on the terminal controller
board. (Refer to Figure 7-2 when installing the 20
mA connector.)

27. Position the access cover and tighten the four cap-
tive screws. (Refer to Figure 7-9 for screw loca-
tions.)

**NOTE**
**If the 20 mA current loop option is installed**
**and loopback testing is desired, skip this step.**

Select the SET-UP features and perform the option
checkout procedure.

28. Refer to Figure 7-9 to locate the cable connector and power switch. Plug in the keyboard cable.

29. Connect the power cord.

30. Turn the power switch on. The terminal and the VT1XX-AC perform an internal self-test. The terminal with the VT1XX-AC installed initially fails the self-test as indicated by several long tones.

    **NOTE**
    **The terminal only fails the self-test until the SET-UP features are reentered and a Save Operation is performed.**

    Continue this procedure unless other self-test failures are encountered. (Refer to Chapter 8 for further information on power up and self-test indicators.)

31. Enter the SET-UP feature settings noted in step 1 of this procedure. (Refer to the *VT100 User Guide* and the VT100 SET-UP Mode in Chapter 4 of this guide to set the features.)

    **NOTE**
    **Perform a Save procedure after the desired SET-UP features are selected.**

32. Perform the internal self-test, communication interface data loopback test, and the printer interface data loopback test as described in Chapter 8.

Attach labels.

33. Position the two option designation labels onto the rear of the terminal as shown in Figure 7-9. Remove the backing paper and press the label into position.

34. Turn the keyboard over and transfer the feature settings on the SET-UP label onto the new SET-UP label provided with the VT1XX-AC. The feature presentation has been changed. (Refer to the VT100 SET-UP mode in Chapter 4 for details on feature settings.)

35. Remove the backing paper on the new SET-UP label and place the label over the old SET-UP label on the bottom of the keyboard.

Remove old keyboard key. (Ignore this step if the terminal is used on a word processing system.)

PRESS HERE
TO REMOVE KEY                    ENTER KEY

MA5530A
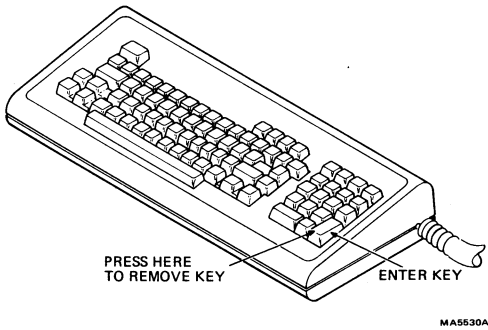
Figure 7-10    VT100 Keyboard

36. Remove the **ENTER** key from the auxiliary keypad
    by pressing the lower edge of the key. (Refer to Fig-
    ure 7-10 for the **ENTER** key position.)

Install new keyboard key.

37. Install the **(PRINT)/ENTER** key received with the
    VT1XX-AC in the same position as the key remov-
    ed in step 36. Gently press the new keycap into
    place.

Reconnect cables.

38. Refer to Figure 7-9 when installing cables. Reinstall
    the communication cable removed in step 5 of this
    procedure. If the EIA cable is equipped with a
    ground lead, connect the ground lead to one of the
    4-40 screws securing the cable to the terminal.

39. Install the printer cable. The printer cable is se-
    cured to the rear panel by two (4-40) screws. The
    screws are located on either side of the connector.
    Connect the ground lead of the cable to one of the
    4-40 screws securing the cable to the terminal.

40. Connect the composite video cables removed in step
    4 of this procedure, if installed.

## INSTALLATION WITH VT132 TERMINAL

**NOTE**
**The VT132 requires ROMs not included with the VT1XX-AC. Steps 8 and 10 identify the ROMs required.**

Determine the present SET-UP features.

1. Enter SET-UP mode and record the present SET-UP features. (Refer to the *VT132 User Guide* for the meaning of these features.) The feature selections must be entered after the VT1XX-AC is installed.

Remove all cables.

2. Refer to Figure 7-1 to locate the controls and cable connectors when performing this procedure. Turn the power switch off and unplug the ac power cord.

3. Unplug the keyboard cable.

4. Unplug any cables connected to the composite video input or output connectors. To release the cables press the connector in and turn one-quarter turn counterclockwise.

5. Disconnect the communication cable.

    If the terminal uses EIA communication, the cable is secured to the rear panel by two (4-40) screws. The screws are located on either side of the communication connector.

    If the terminal uses the 20 mA current loop option, the cable is secured by two locking tabs. When disconnecting the cable ensure that the locking tabs on either side of the connector are disengaged.

Remove the terminal access cover.

6. Remove the terminal access cover by loosening the four 6-32 × 1-3/8 captive screws holding the cover in place. (Refer to Figure 7-1 for screw locations.)

    If the 20 mA current loop option is installed, gently open the cover and disconnect the female cable connector P5 on the 20 mA current loop board from the terminal controller board male connector J5. (Refer to Figure 7-2 to locate the cable connector.)

Remove the terminal controller board.

7. Remove the terminal controller board by gently but firmly pulling the board straight out from the rear of the terminal.

Verify the configuration of the terminal controller board.

8. Verify the terminal controller board ROM IC part numbers. (Refer to Table 7-3 for ROM IC part numbers and Figure 7-4 for ROM IC locations.)

   **NOTE**
   **If the proper ROM ICs are not installed on the terminal controller board, the VT1XX-AC installation procedure cannot be completed. Contact a Terminals Product Group customer or a DIGITAL Field Service office for further information on proper ROM IC installation.**

**Table 7-3    VT132 Terminal Controller Board ROM IC Part Numbers**

| ROM IC | Part Number |
|--------|-------------|
| ROM 0  | 23-180E2    |
| ROM 1  | 23-181E2    |
| ROM 2  | 23-182E2    |
| ROM 3  | 23-183E2    |

9. Mount the fiber space to the terminal controller board with one of the 4-40 screws provided with the VT1XX-AC. (Refer to Figure 7-4 when installing the fiber spacer.)

Verify the configuration of the advanced video option board.

10. Verify the advanced video option board ROM IC part numbers. (Refer to Table 7-4 for ROM IC part numbers and Figure 7-4 for ROM IC locations.)

    **NOTE**
    **If the proper ROM ICs are not installed on the advanced video option board, the VT1XX-AC installation procedure cannot be completed. Contact a Terminals Product Group customer**

**or a DIGITAL Field Service office for further information on proper ROM IC installation.**

**Table 7-4    VT132 Advanced Video Option Board ROM IC Part Numbers**

| ROM IC | Part Number |
| --- | --- |
| ROM A | 23-224E2 or 23-236E2 |
| ROM B | 23-225E2 or 23-237E2 |
| ROM C | 23-226E2 or 23-238E2 |
| ROM D | 23-227E2 or 23-239E2 |

Install the printer interface option board.

11. Install the printer interface board into STP connector J3 on the terminal controller board. Ensure that the printer interface board is fully inserted into the connector. (Refer to Figure 7-4 when installing the printer interface board.)

12. Secure the printer interface option board to the terminal controller board with the remaining 4-40 screw provided with the VT1XX-AC. Thread the screw through the printer board into the fiber spacer mounted on the terminal controller board in step 9.

Reinstall the terminal controller board.

13. Reinstall the terminal controller board in the leftmost slot in the card cage. Ensure that the board is fully inserted into the connector within the terminal.

Remove the 20 mA current loop option board from the access cover (if installed).

14. Remove the two 6-32 × 0.62 screws and two spacers holding the 20 mA connector onto the bottom of the access cover. (Refer to Figure 7-8 when removing the 20 mA communications option.)

15. Remove the three 6-32 × 0.312 screws holding the 20 mA current loop option board to the access cover.

**NOTE**
**The access cover is discarded after the terminal successfully completes the tests described in Chapter 8.**

Install the 20 mA current loop option board onto the new access cover (if installed).

16. Install the 20 mA option onto the access cover provided with the VT1XX-AC. Use the three screws removed in step 15.

17. Install the 20 mA connector to the bottom of the access cover. Use the two screws and spacers removed in step 14.

Install the access cover.

18. If the 20 mA option is installed connect female connector P5 on the 20 mA board to male connector J5 on the terminal controller board. (Refer to Figure 7-2 when installing the 20 mA current loop connector.)

19. Position the access cover and tighten the four captive screws. (Refer to Figure 7-9 for screw locations.)

**NOTE**
**If the 20 mA current loop option is installed and loopback testing is required, skip this step.**

Select the SET-UP features and perform the option checkout procedure.

20. Refer to Figure 7-9 to locate the cable connector and power switch. Plug in the keyboard cable.

21. Connect the power cord.

22. Turn the power switch on. The terminal and the VT1XX-AC performs an internal self-test. The terminal with the VT1XX-AC installed initially fails the self-test as indicated by several long tones.

**NOTE**
**The terminal only fails the self-test until the SET-UP features are reentered and a Save Operation is performed.**

Continue this procedure unless other self-test failures are encountered. Refer to Chapter 8 for further information on power up and self-test indicators.

23. Enter the SET-UP feature settings noted in step 1 of this procedure. Refer to the *VT132 User Guide* and the VT132 SET-UP mode in Chapter 4 to set the features.

**NOTE**
**Perform a Save procedure after the desired SET-UP features are selected.**

24. Perform the internal self-test, communication interface data loopback test, and the printer interface data loopback test as described in Chapter 8.

Attach label.

25. Position the VT1XX-AC designation label onto the rear of the terminal as shown in Figure 7-9. Remove the backing paper and press the label into position.

**NOTE**
**The VT1XX-AB label is not required with the VT132 terminal. The VT132 always contains the advanced video option as standard equipment.**

26. Turn the keyboard over and transfer the feature settings of the serial printer interface onto the SET-UP label. The feature presentation has been changed. (Refer to the VT132 SET-UP mode in Chapter 4 for details on feature settings.)

Reconnect cables.

27. Refer to Figure 7-9 when installing cables. Reinstall the communication cable removed in step 5 of this procedure. If the EIA cable is equipped with a ground lead, connect the ground lead to one of the 4-40 screws securing the cable to the terminal.

28. Install the printer cable. The cable is secured to the rear panel by two (4-40) screws. The screws are located on either side of the connector. Connect the ground lead of the cable to one of the 4-40 screws securing the cable to the terminal.

29. Connect the composite video cables removed in step 4 of this procedure, if installed.

# 8 OPTION CHECKOUT

## GENERAL

This chapter describes the procedures used to verify proper operation of the VT1XX-AC option. The error codes section of this chapter describes a normal power up sequence and the codes used by the terminal to indicate hardware failures.

## SELF-TESTS

The terminal and the VT1XX-AC are equipped with internal self-tests that automatically perform each time the terminal is powered up. The terminal with the VT1XX-AC installed can perform an extensive loopback test on both the communication interface and the printer interface. During the data loopback test, the transmit and receive conductors of the connector being tested are attached to each other using a special external loopback connector. Data is transferred through the interface and tested for errors. Any errors detected are indicated as a character displayed on the screen. (Refer to the error codes section of this chapter for further information on error displays produced by the terminal.)

### Power Up Self-Test

The power up self-test may be started in either of the following ways.

> NOTE
> The ON LINE/LOCAL feature must always be Saved in the ON LINE condition. If the LOCAL condition is Saved in nonvolatile RAM the VT1XX-AC is not tested.

1. Turn the terminal power switch on. (Refer to Figure 7-9 to locate the switch.)

2. Reset the terminal in SET-UP mode,

   or

3. Type the following sequence in LOCAL to perform the test,

   **ESC [ 2 ; 1 y**

   or

   type the following sequence in LOCAL to perform the test continuously.

   **ESC [ 2 ; 9 y**

   The terminal displays **Wait** while executing the test. When successfully completed the screen clears.

   **NOTE**
   **The continuously running test ends only if an error is found or power is turned off. The VT1XX-AC is not tested during the continuous test.**

   Any error found by the power up self-test is displayed on the screen, and/or L1 through L4 on the keyboard, or on the VT1XX-AC indicator. (Refer to the Error Codes section of this chapter for further information on error displays produced by the terminal.)

## Communication Interface Data Loopback Test

Use the following procedures to perform the communication interface data loopback test. (Refer to Figure 7-9 to locate the power switch and cable connectors.)

1. With the power switch off, disconnect the communication cable and install the appropriate data loopback connector on the communication interface connector. Data loopback connector part number 12-15336 is for EIA communications; part number 70-15503-00 is for 20 mA current loop communications.

2. If the 20 mA option is installed, remove the access cover. Remove the cover by loosening the four 6-32 $\times$ 1-3/8 captive screws holding the cover in place. Set both switches to the NORMAL position and reinstall the access cover. (Refer to Figure 7-9 for screw locations and Figure 8-1 for switch locations.)
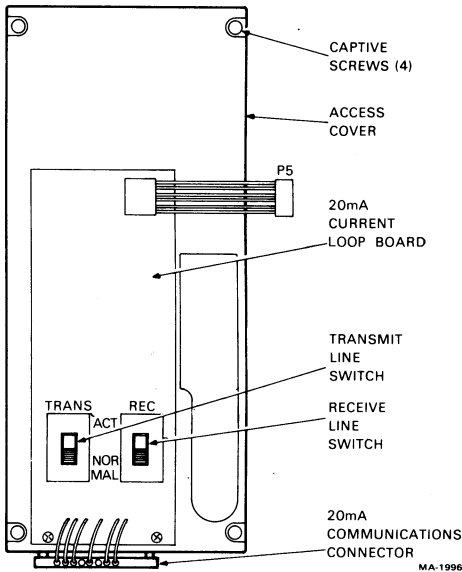
Figure 8-1    20 mA Current Loop Option Switches

3. Turn the power switch on. The terminal performs the internal self-test.
4. Enter SET-UP B by pressing the **SET-UP** key and then the **5 [SETUP A/B/(C)]** key on the main keyboard.
5. Ensure that the terminal communication interface transmit and receive speeds are the same. (Refer to Chapter 4 for further information on selecting communication speeds.)
6. Place the terminal in ANSI compatible mode (in SET-UP B group 2 switch 3 equals 1).
7. Place the terminal ON LINE and perform the Save operation (**SHIFT S**).
8. Exit SET-UP mode by pressing the **SET-UP** key.
9. Type the following sequence to perform the test,

    **ESC [ 2 ; 2 y**

    or

type the following sequence to perform the test continuously.

**ESC [ 2 ; 1 0 y**

The terminal displays **Wait** while executing the test. When successfully completed the screen clears.

**NOTE**
**The continuously running test ends only if an error is found or the power switch is turned off.**

Any error found by the data loopback test is displayed on the screen. (Refer to the error codes section of this chapter for further information on error displays produced by the terminal.)

10. Turn the power switch off.

11. If the 20 mA option is installed remove the access cover and return the switches to their original configuration. (Refer to step 2 of this procedure for further information on access cover removal and replacement and switch locations.)

12. Remove the loopback connector and reinstall the communication cable.

**Printer Interface Data Loopback Test**

Use the following procedures to perform the printer interface data loopback test. Refer to Figure 7-9 to locate the power switch and cable connectors.

1. Turn the power switch off. Install the data loopback connector onto the printer interface connector. The data loopback connector part number is 12-15336. This connector is also used to perform the EIA communication interface data loopback test.

2. Turn the power switch on. The terminal performs the internal self-test.

3. Enter SET-UP B by pressing the **SET-UP** key and then the **5 [SETUP A/B/(C)]** key on the main keyboard.

4. Place the terminal in ANSI compatible mode (in SET-UP B group 2 switch 3 equals 1) and perform a Save operation **(SHIFT S)**.

5. Place the terminal in Printer Port Test mode (in SET-UP B group 5 switch 4 equals 1). The terminal cannot receive data from the communication interface in this mode.

   **NOTE**
   **Never Save the Printer Port Test mode SET-UP feature setting as a 1.**

6. Enter SET-UP C by pressing the **5 [SETUP A/B/ (C)]** key on the main keyboard.

7. Select the proper printer receive/transmit speed using either the **7 (TRANSMIT SPEED)** or **8 (RECEIVE SPEED)** keys on the main keyboard.

8. Place the terminal ON LINE.

9. Exit SET-UP mode by pressing the **SET-UP** key. The video terminal displays **PRINTER PORT TEST MODE.**

10. Type the following sequence while ON LINE to perform the test,

   **ESC [ 2 ; 2 y**

   or

   type the following sequence while ON LINE to perform the test continuously.

   **ESC [ 2 ; 1 0 y**

   The terminal displays **Wait** while executing the test. When successfully completed the screen clears.

   **NOTE**
   **The continuously running test ends only if an error is found or the power switch is turned off.**

   Any error found by the data loopback test is displayed on the terminal screen. (Refer to the error codes section of this chapter for further information on error displays produced by the terminal.)

11. Turn the power switch off. Remove the loopback connector and install the printer cable.

## ERROR CODES

The terminal and the VT1XX-AC are equipped with internal self-tests that automatically perform each time the terminal is powered up. Successful completion of self-tests is indicated by all of the following conditions:

- All keyboard indicators turn on for one second and then turn off

- Either ON LINE or LOCAL indicator lights

- Momentary bell tone sounds

- Blinking cursor appears on screen

- VT1XX-AC indicator turns on, off, and on.

    **NOTE**
    **The VT1XX-AC indicator is visible just below the printer interface connector (Figure 7-9).**

Any self-test failure is indicated by one or more of the following conditions:

- Lighted keyboard indicator (other than ON LINE or LOCAL)

- Character displayed on screen under blinking cursor

- Unlighted VT1XX-AC indicator.

If performing any self-test produces an error, the test stops automatically. There are two broad categories of errors: fatal and nonfatal. Fatal errors cause the terminal to immediately stop all operation and require immediate repair action by a service representative. No intelligible information is displayed on the screen. However, the screen may not be blank, but may contain a random pattern of characters. The only error indication (except the hung terminal) is a possible error code displayed on keyboard indicators L1 through L4, or if the VT1XX-AC indicator is off. No terminal functions including lighting of indicators is guaranteed on a fatal error. Possible fatal errors and keyboard indicator codes are listed in Table 8-1.

Nonfatal errors allow the terminal to operate until repair action is performed by a service representative. The terminal is forced to LOCAL, and an error code character is displayed in the upper-left corner of the screen, under the blinking cursor. Additionally, if one or more non-

**Table 8-1    Keyboard Indicator Error Codes**

| Error | L1 | L2 | L3 | L4 |
|-------|-----|-----|-----|-----|
| ROM 0 checksum error | off | off | off | on |
| ROM 1 checksum error | off | off | on | off |
| ROM 2 checksum error | off | off | on | on |
| ROM 3 checksum error | off | on | off | off |
| Main data RAM error | off | on | off | on |

**NOTE**
**Verify proper installation of ROM ICs in**
**VT1XX-AC.**

fatal errors occurred while the test was repeating continuously, the entire screen flashes from white to black to white about once a second as an alarm. This continues until the terminal is reset.

There are four types of nonfatal errors:

"Advanced Video Option" data RAM (AVO)

"Nonvolatile" data RAM checksum error (SET-UP feature NVR)

Keyboard missing or malfunction (KBD)

Communication or printer interface data loopback error (Printer interface testing is performed in Printer Port Test mode.)

Table 8-2 shows the possible nonfatal error characters that may appear on the screen and the failure each character represents.

**Table 8-2    Displayed Error Code**

| Char | Fault Detected | | | |
| | AVO | NVR | KBD | DATA |
|---|---|---|---|---|
| 1 | X | | | |
| 2 | | X | | |
| 3 | X | X | | |
| 4 | | | X | |
| 5 | X | | X | |
| 6 | | X | X | |
| 7 | X | X | X | |
| 8 | | | | X |
| 9 | X | | | X |
| : | | X | | X |
| ; | X | X | | X |
| ⟨ | | | X | X |
| = | X | | X | X |
| ⟩ | | X | X | X |
| ? | X | X | X | X |

**NOTE**
**If character 4 is displayed ensure that keyboard character is plugged in.**