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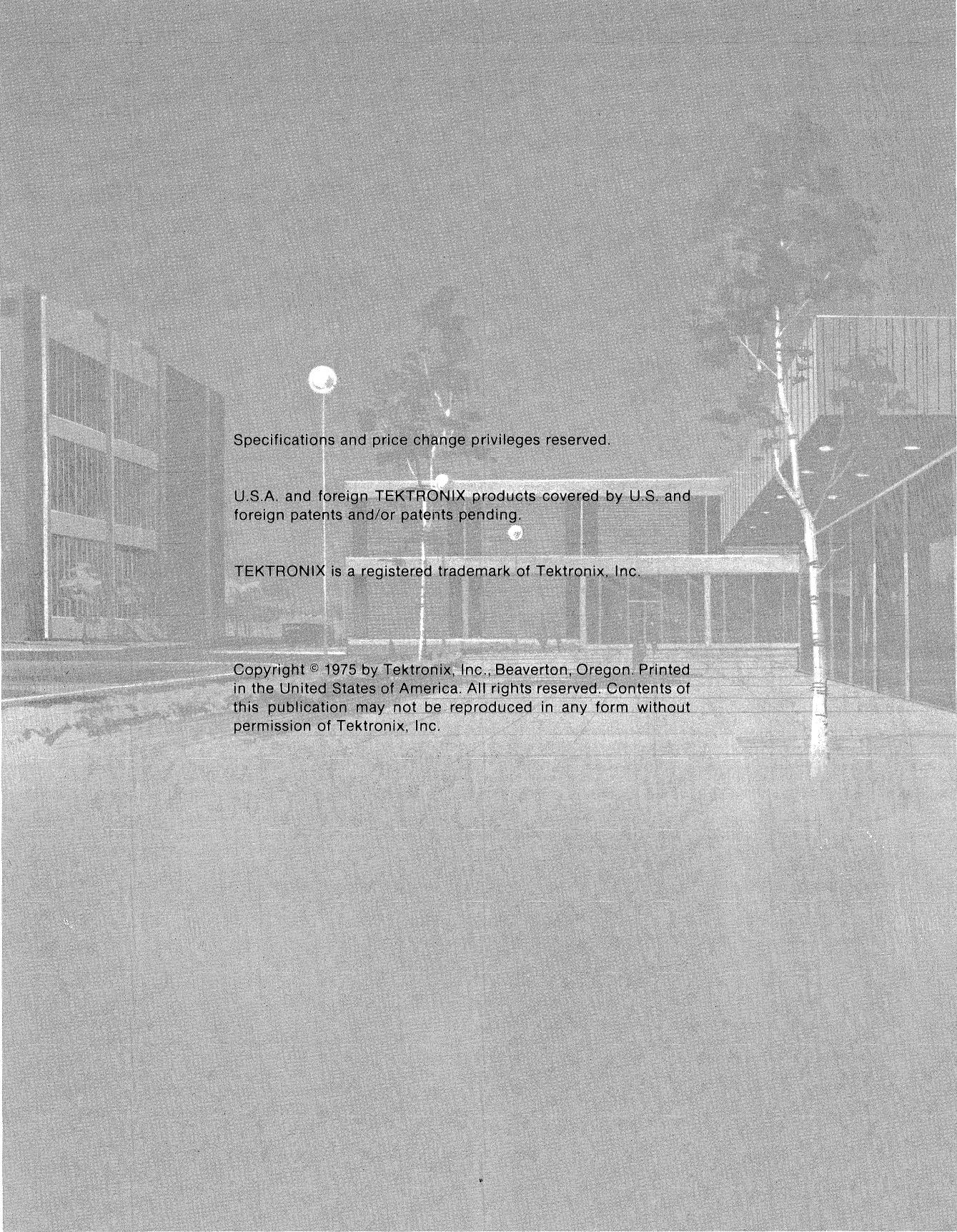
**4006-1  
COMPUTER DISPLAY  
TERMINAL  
USERS**

**INSTRUCTION MANUAL**

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A black and white photograph of a modern building at night. The building has large windows and a covered walkway. There are trees and a street lamp in the foreground. The image is slightly grainy and has a dark, moody atmosphere.

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Fig. 1-1. 4006-1 Computer Display Terminal.



# SECTION 1

## SYSTEM DESCRIPTION

The 4006-1 Computer Display Terminal is a communications link and display device for use with a wide range of computer systems. It provides the user with an economical device that combines flexibility with ease of operation. The 4006-1 also provides the user with hard copy capability (with an optional Hard Copy Unit).

The 4006-1 is a combination Display Terminal and keyboard which is designed for desk-top operation. The unit is completely self-contained and has the display, keyboard, operating controls, and electronic circuitry to operate the display and to communicate with the computer.

The basic unit is designed to operate (via telephone lines) in Full Duplex mode. An optional half-duplex interface is available which provides interface capability with a wide range of computers and timesharing systems. The terminal is designed to be directly or remotely connected (through a Modem) to the computer. Thus the computer can be directly controlled by the user of the terminal.

The 4006-1 has three basic operating modes, Alphanumeric (Alpha), Graphic (Graph) and hard copy. The Alpha mode permits entry and display of letters, numbers and special characters to the computer to control the computer operation and to provide the user with a visual display of the entry and the computer response. The Graph mode allows the operator to display graphic information (charts, graphs, etc.). An optional Hard Copy Unit is available to provide the user with a permanent copy of the information displayed on the screen. The hard copy can be initiated by the operator from the terminal keyboard, or Hard Copy Unit, or by computer command. The Terminal and Hard Copy Unit are shown in Fig. 1-2.

The computer can be programmed with special instructions (Software) designed for the specific customer applications, providing maximum flexibility and use of the computer/terminal capabilities. The user controls the computer (by keyboard keys and special commands), providing the desired information, specifying the opera-

tion to be performed, and how to display the answer on the display screen. The format and command information for the computer must be provided in the proper format. The basic computer commands are provided in Table 1-1. Specific computer response to the commands, special command sequences and special functions of these commands or sequences are provided in the "Software Instruction Manuals" or "Program Sheets" describing the operating system.

The user controls the program (and computer) from the keyboard and the computer's results are sent back to the terminal for display. The computer generates these answers in the form of numbers or letters. The 4006-1 can display these results directly (as received) or they can be displayed in the form of graphs and pictures (using Graph mode).

The combination of alphanumeric and graphic display modes provides a powerful extension of the man-machine interface. The selection of these modes can be controlled by the operator or may be selected by the computer. This provides maximum versatility of the terminal display and enables the Graph and Alpha modes to be combined in the same display to provide the maximum amount of usable information.

The terminal also has a View/Hold feature. This feature automatically places the terminal display in a Hold condition (dimmed display to prevent residual images from remaining on the screen) after a period of inactivity. The screen is automatically restored to normal intensity (View condition) when display data is received (from the keyboard or computer).

In summary, the 4006-1 Computer Display Terminal provides a wide range of functions and optional configurations which are available to the user. The 4006-1 is designed to be desk mounted and can operate in any of three mode:

1. Alpha mode—Provides the entry and display of printing characters (alpha and numeric).

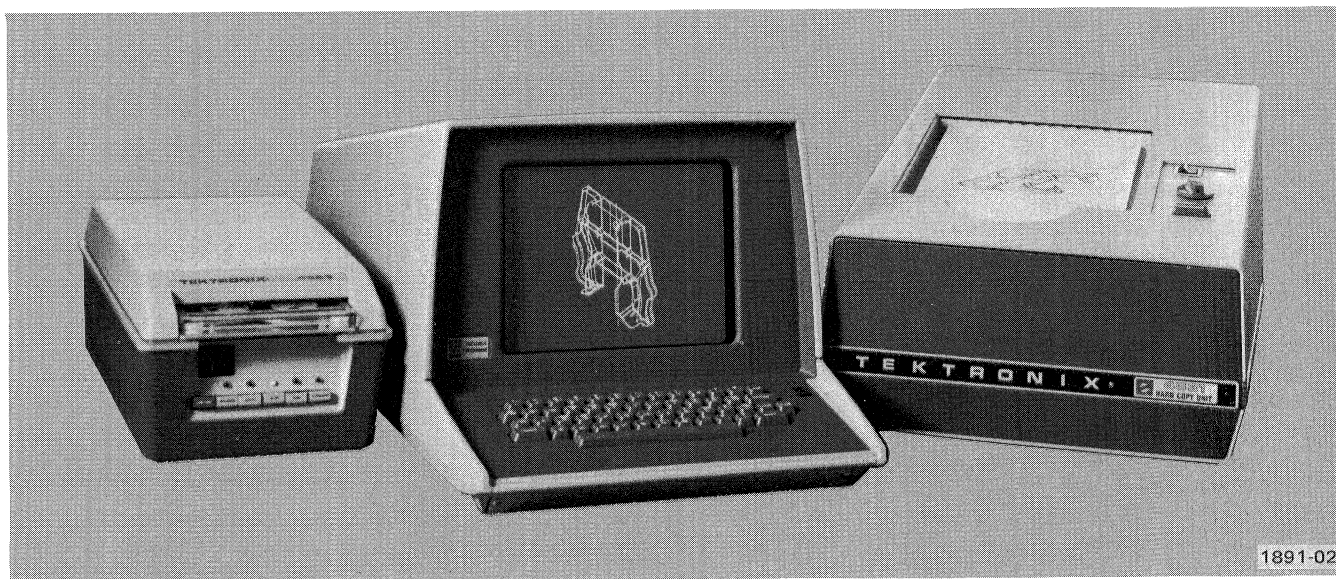


Fig. 1-2. 4006-1 Terminal and 4631 Hard Copy Unit (shown with optional 4923 Tape Recorder).

2. Graph mode—Provides display of graphic information for the generation of pictures, graphs, and other pictorial information.

3. Hard Copy mode—Provides the ability to produce a permanent copy of the display information (requires an optional Hard Copy Unit).

A detailed description of the various operator controls and indicators is provided in Section 2.

**TABLE 1-1**  
**Keyboard Command Description**

| Keyboard Entry | Description   |
|----------------|---|
| A through Z    | Enter alpha characters. The characters are displayed on the screen as entered. <sup>1</sup> Sent to the computer as data or part of a command sequence. |
| 0 through 9    | The numbers are displayed on the screen as entered. Sent to the computer as data or part of a command sequence.   |

<sup>1</sup>The keyboard characters are displayed if the ECHO/NORM strap option (or switch) is set to the ECHO position. If the strap (or switch) is set to NORM, the display information must be provided by a computer or modem echo.

**TABLE 1-1 (cont)**

| Keyboard Entry | Description  |
|----------------|--|
| PAGE           | Erases the display, resets the terminal to Alpha mode and sets the cursor to the Home position. The PAGE key had no effect on the computer or interface operation.   |
| RETURN         | Moves the cursor to the first character position of the present line (unless the CR→LF strap option is selected). The CR is transmitted to the computer as a control byte.   |
| LINE FEED      | Moves the cursor down one line. Does not cause a space or carriage return. Transmitted to the computer as a LF character.  |
| RUBOUT         | Has no effect on the terminal display in Alpha mode. In Graph mode RUBOUT is one of two valid low Y bytes available from the keyboard. Transmitted to the computer as a DEL character. The computer response is determined by the operating program. |

TABLE 1-1 (cont)

| Keyboard Entry | Description   |
|----------------|---|
| SHIFT          | Allows selection and display of the special symbols shown on the upper portion of the keys. The keyboard is upper case only and the alpha keys are all displayed as capitals. Shift is also used to reset Hold condition and to enter some special control commands.                |
| ALT MODE       | A special key which transmits the code for a right brace (}) to the computer. The ALT MODE key does not have any effect on the display in Alpha mode. ALT MODE is one of two valid low Y bytes available from the keyboard in Graph mode.   |
| BREAK          | The BREAK key applies a spacing signal to the interface communications line as long as the key is held. BREAK is normally used to interrupt the computer. However, the specific function depends on the computer and operating system.  |
| COPY           | Initiates a hard copy of the display if the Hard Copy Unit is installed and ready.  |
| CTRL           | The control key is used to obtain special functions and operations from the standard keys. To obtain these functions the CTRL key is held down while the additional key(s) is pressed.  |
| CTRL G         | Transmits a BEL command to the computer. The BEL command is used to ring the bell on the terminal. The bell tone is used to alert the operator to a special condition or operation. The exact application of the bell tone is dependent on the operating system and customer needs. |

TABLE 1-1 (cont)

| Keyboard Entry         | Description   |
|------------------------|---|
| CTRL I                 | Simulates a Horizontal Tab (HT) command from the computer. Moves the cursor one space to the right.   |
| CTRL J                 | Same as LINE FEED.  |
| CTRL SHIFT K           | Simulates an ESC (Escape) from the computer. ESC is used as an arming character by the terminal logic.  |
| CTRL SHIFT K<br>CTRL L | Simulates the computer ESC FF command to the terminal and transmits the PAGE command to the computer.   |
| CTRL M                 | Same as RETURN (CR).  |
| CTRL SHIFT M           | Simulates a computer GS (Graph Set) command and transmits the command to the computer. The GS command sets the terminal to Graph mode and initiates a dark vector (the first vector after a GS command will not be shown on the display). |
| CTRL SHIFT O           | Simulates a computer US (Up Shift) command and transmits the command to the computer. The US command resets the terminal from Graph to Alpha mode.  |
| CTRL SHIFT K<br>CTRL W | Simulates a computer ESC ETB (Make Copy) command and transmits the command to the computer. The ESC ETB command is used to initiate a hard copy (same as COPY key).   |





# SECTION 2

## FAMILIARIZATION

### INTRODUCTION

This section describes the basic operator controls and indicators of the 4006-1 Display Terminal. The basic controls consist of the keyboard, power, and hard copy controls. The keyboard configuration is shown in Fig. 2-1.

**POWER** The POWER switch is located on the back of the Display Unit and is used to control the Terminal power.

**HC INT** The Hard Copy Intensity control is located on the back of the Display Unit and is used to adjust the hard copy scan. The Hard Copy Intensity control should be adjusted so the scan signal on the screen just starts to write, then back the adjustment off so the scan signal does not write (store). This will provide the conditions for optimum quality hard copies.

### PAGE

The PAGE key is a special function key which is used to erase the display. When the key is pressed, the entire display is erased and the alpha cursor moves to the upper left corner of the screen (Home position). If the key is pressed while the terminal is in Graph Mode, the last point is saved in graphic memory, and the terminal is reset to Alpha mode. The PAGE key has no effect on the interface operation and no signals are sent to the computer.

### RETURN

Transmits the ASCII CR (carriage return) character to the computer. A CR from the computer (or local echoed) will cause the alpha cursor to be positioned at the left hand starting point of the present line. If a CR is received when the terminal is in Graph mode, the terminal is set to Alpha mode.

### WAIT INDICATOR PROVIDED WITH OPTIONAL HALF-DUPLEX INTERFACE



NOTE: SOME VERSIONS OF THE KEYBOARD WILL NOT HAVE THE TTY CODES (WRU, TAPE, TAPE, TAB, X OFF, EOT AND FORM) ON THE KEYCAPS. THE 'FORM' LABEL OVER THE 'L' IS REPLACED BY \

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Fig. 2-1. 4006-1 Keyboard Configuration.

**NOTE**

*The CR may also cause a Line Feed (LF) to be performed (strap option). In addition, the CR may cause the alpha cursor to return to the center margin of the screen instead of the left margin. The center margin is automatically selected when a line feed is detected during the 35th line of the display screen. Repeated CRs or LFs will be to the center margin until a LF is performed from the 35th line, or a PAGE is detected. The cursor will then return to the left margin. It should be noted that any information which is written past the center of the screen will be written over.*

**COPY** The COPY key is used to initiate a hard copy of the display screen. When the COPY key is pressed, the terminal screen goes busy until the copy has been made. The Hard Copy Unit (4631) will produce a permanent copy of the information on the display screen.

**BREAK** The BREAK key places the terminal/computer interface in a spacing condition and is used to interrupt the computer during data transfer. The interrupt operation is dependent on the computer system and the signal remains active as long as the key is pressed.

**LINE FEED** The LINE FEED key transmits the ASCII LF character to the computer. A LF causes the cursor to move down one line. A line feed from line 35 of the display causes the cursor to return to line one and shifts the margin.

**SHIFT** The SHIFT key is used to obtain special characters and symbols available from the keyboard<sup>1</sup>. These special symbols are shown on the key-caps directly above the standard display characters. The

SHIFT key is also used in conjunction with the CTRL key to obtain special control functions. In addition, pressing the shift key while the display is in the Hold condition (dimmed display to prevent residual images on the crt) will cause the display to return to normal viewing level.

**SPACE** The SPACE bar is used to transmit the ASCII SP (Space) character to the computer. When received from the computer (or local echoed) the SP code will cause the alpha cursor to move one space to the right on the display. Spacing past the end of a line causes the cursor to return to the first character position of the next line.

**CTRL** The CTRL (Control) key is used to enable control characters. Control characters are command information which is sent to the computer (or received from the computer) to control the terminal/computer operation. At least two keys must be pressed to obtain a control character (except CR and LF) the CTRL key is held down while the desired key is pressed to provide the command. Some control functions require the SHIFT key to be pressed in addition to the CTRL and regular keys. For example, to enter Graph mode, the operator presses CTRL SHIFT M. The various control functions are described in Section 3 of this manual.

The remaining keys on the keyboard transmit and display the standard alphabetic, numeric, and special characters shown on the key-caps.

## BASIC OPERATION

The following information describes the operation of the terminal in the various operating modes. It is intended to provide you with an introduction to the modes, the

<sup>1</sup>The 4006-1 Display Terminal is "upper case" only and the SHIFT key does not select an upper case character set.



procedures to perform operations and a general knowledge of the terminal from the users point of view.

## ECHO

The 4006-1 is designed to operate with the keyboard data echoed (sent back to the display) by the computer, modem, or displayed directly by the control logic. When the terminal is not connected to the computer, the ECHO/NORM strap on the logic card must be in the ECHO position. The procedure for installing this jumper strap is contained in Section 3 of this manual.

### NOTE

*If the half-duplex interface option is installed, the ECHO/NORM strap option is replaced by a rear panel switch.*

## Establishing Computer Communications

The 4006-1 can be connected to the computer interface through a telephone line (via a Modem) or directly connected through a cable. If the terminal is directly connected to the computer, the interface is always enabled (providing ac power is on and the interface cable is properly connected). For remote operation (via the modem/telephone line), communication is established by dialing the computer using the telephone/modem.

The transmit and receive baud rates are independently selectable using the rear panel Baud Rate switches. The rear panel switch allows selection of 75, 110, 150, 300, 600, 1200, 2400, or 4800 baud.

### NOTE

*The transmit and receive baud rates switches must be set to the same position if the ECHO/NORM strap (or switch) is set to ECHO.*

The transmit and receive baud rates are dependent on the operating system (computer interface) and/or the modem used to communicate to the computer.

Additional information on the computer/terminal interface connections is provided in Section 4.

## OPERATING MODES

The 4006-1 has three basic operating modes, Alphanumeric (Alpha), Graphic Plot (Graph), and Hard

Copy mode. Each of these modes (and a basic operating procedure) is described in greater detail in the following paragraphs.

## Alpha Mode

In Alpha mode the terminal is used to transmit and/or display any of the printable keyboard characters. A non-storing alpha cursor is displayed on the screen to indicate the next writing position. The display screen is capable of displaying up to 35 lines of information with a maximum of 74 characters per line. The display screen has a right and left margin (with automatic carriage return/line feed at the right margin) as well as a center margin. The center margin is automatically selected when the logic detects a line feed during the 35th line of the display while in the left margin. This center margin provides additional display area after 35 lines of information have been placed on the display screen. Once the center margin has been selected, a line feed and carriage return past the 35th line will cause the cursor to return to the left hand margin of line one (back to the "home" position).

When the terminal is initially powered up, the PAGE key must be pressed to erase the screen and position the cursor to the Home position. The PAGE key resets the terminal logic to Alpha mode and clears the display.

**Alpha Mode Operation.** The following procedure will enable the new user to proceed in a step-by-step sequence through the various Alpha mode controls and functions. The ECHO/NORM strap (or switch) must be set to ECHO for the following checks.

### CAUTION

*Before operating the 4006-1, be sure that the terminal is properly grounded using a three-prong power plug. Refer to the Installation Instructions (Section 4) for additional wiring information.*

1. Verify that the interface cable (or Modem) is not connected. This prevents the terminal from transmitting or receiving information during the following steps.
2. Turn on ac power. The power switch is located on the right rear of the terminal. Allow the terminal to warm up until a bright green tint appears on the display screen.

### NOTE

*During initial installation or after prolonged periods of inactivity, a 20 minute warm up period is recommended before beginning operation.*

## Familiarization—4006-1 Users

3. Press the PAGE key and note that the display screen is erased (the bright green tint disappears and the alpha cursor appears in the upper left corner of the display).

4. Type any of the alpha or numeric characters on the keyboard and note that the characters appear on the screen. Note also that the alpha cursor moves with each character entered to indicate the position of the next character to be written.

5. Press the SPACE bar and note that the alpha cursor moves one character space each time the bar is pressed.

6. Press the RETURN key and note the cursor returns to the left-hand margin.

7. Press the SPACE bar several times, then press the LINE FEED key and note that the cursor moves down one line each time the key is pressed. The cursor should move to the same position on the next line and should not return to the left margin.

8. Using the alphanumeric and LINE FEED keys, position the cursor away from the Home position. Press the PAGE key and note that the display is erased and the cursor returns to the Home position (first character position of line one).

9. Press and hold CTRL and press G key. Note that an audible tone is heard from the speaker.

10. Enter a few characters from the keyboard and wait. After approximately 90 seconds (without keyboard entry) the terminal enters "Hold" condition. The Hold condition allows the terminal to dim the display (when no data is being entered), prolonging the life of the display screen (crt). Press the SHIFT key (or any display character) and note that the screen returns to normal brightness and the information previously entered is still present.

11. Using the keyboard, enter data until the terminal reaches the right-hand margin. Note that the cursor automatically returns to the left margin and moves down one line each time the right margin is detected.

12. Enter Line Feeds until the cursor is positioned on the bottom of the screen (35th line). Enter a Line Feed and RETURN and note that the cursor returns to the center margin of line one instead of the Home position. This center margin permits the display of two columns of information. It should be noted however that any information from the left column which was written past the center

of the screen will be written over by the information in the right column. If a LF and RETURN are performed from line 35 of column two, the cursor will return to the Home position (left margin of line one). The display configuration is shown in Fig. 2-2.

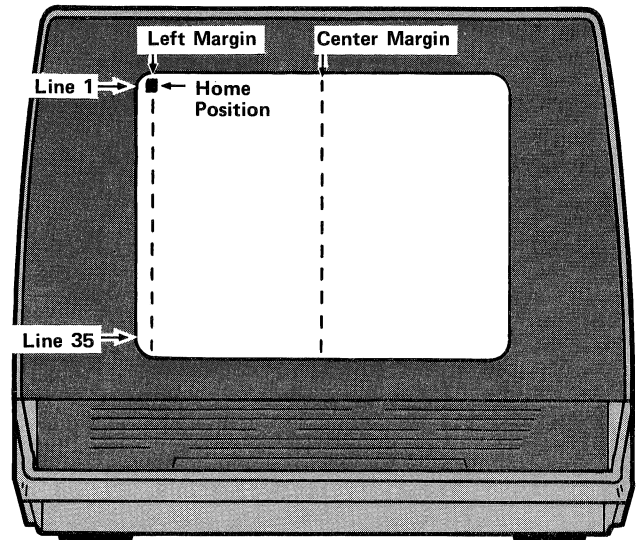


Fig. 2-2. Display Format.

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## Graphic Plot Mode

The Graphic Plot mode provides the user with up to 1,048,576 unique addressable points which can be addressed from the computer for plotting of graphic information. Of these, 798,720 are capable of being displayed in the quality display area of the screen. The remainder of the addresses can be stored but will not be displayed (some may be displayed outside the quality display area). The 1,048,576 address points are obtained by using 1024 addresses for the vertical (Y) axis (780 of which are displayable) and 1024 addresses for the horizontal (X) axis. The display area is shown in Fig. 2-3.

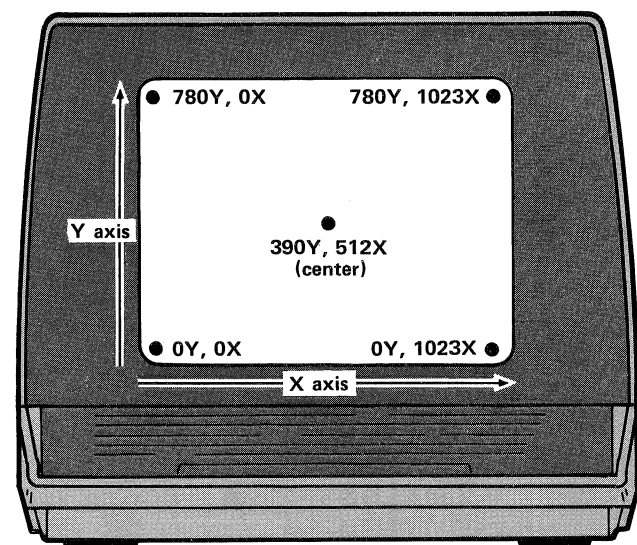


Fig. 2-3. Graphic Display Positions.

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When operating in Graph mode, the display points are sent to the terminal in the form of addresses which are decoded by the logic to draw the specified graphic display. Each address message consists of up to four data bytes, two bytes provide the Y information and two bytes provide the X information. The bytes are sent to the computer (or entered from the keyboard) in the following format:

HIY, LOY, HIX, LOX

These bytes are entered by various keys on the keyboard. The characters corresponding to the XY coordinates are shown in Fig. 2-5.

**Graph Mode Operation.** The following procedure will permit you to operate the terminal in Graph mode and become familiar with the graph functions.

1. Note the position of the alpha cursor. Enter CTRL SHIFT M (GS command to the terminal) and note that the cursor disappears.

2. Enter + RUBOUT 0 @ from the keyboard. This sequence sends the address for 383Y and 512X to the screen.

#### NOTE

*The RUBOUT key causes the transmission of the DEL character to the computer during normal operation.*

The above keyboard sequence should have no visible effect on the terminal. This command sequence simply placed the terminal in Graph mode (the CTRL SHIFT M) and positioned the beam to the addressed position. The first vector (after a GS command) is called a Dark Vector. It allows you to position the beam to a pre-determined point before you start to draw. The first vector after a GS command is always a dark vector.

3. Enter @ from the keyboard. This will execute the second vector and a dot should appear near the center of

the screen. (The dot appears since the second address was to the same point as the first vector.)

4. Enter SPACE RUBOUT SPACE L. This sends the address for the 31Y and 12X coordinates. The terminal should display a vector (line) from the center of the screen to the lower left-hand corner as shown in Fig. 2-4. You will also note that the vector is not drawn until the last character of the address (L) is entered.

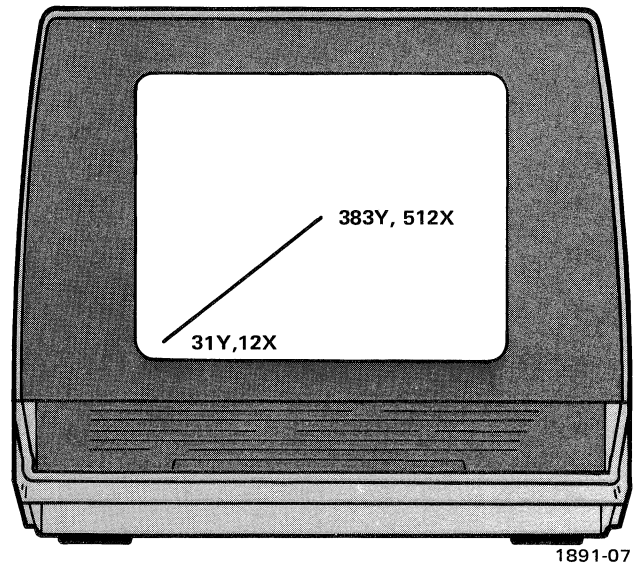


Fig. 2-4. Displayed Vector.

5. Return to Alpha mode by entering CTRL SHIFT O (US command) from the keyboard. Note that the alpha cursor appears at the position of the last vector address drawn. Now space ten SPACE commands (using the SPACE bar) and note that the cursor moves away from the end of the vector. Return the terminal to Graph mode by pressing CTRL SHIFT M.

6. Return the vector to the last point drawn by pressing L on the keyboard. No change will be seen on the screen until the L is pressed a second time (the initial vector after GS is a dark vector). When a second L is entered a dot should be seen at the end of the vector previously drawn. This procedure demonstrates the ability of the terminal to "remember" graphic display information even if you change to Alpha mode to enter information on the screen. The alpha information has no effect on the graphic display (however, both the alpha and the graphic information will be displayed).



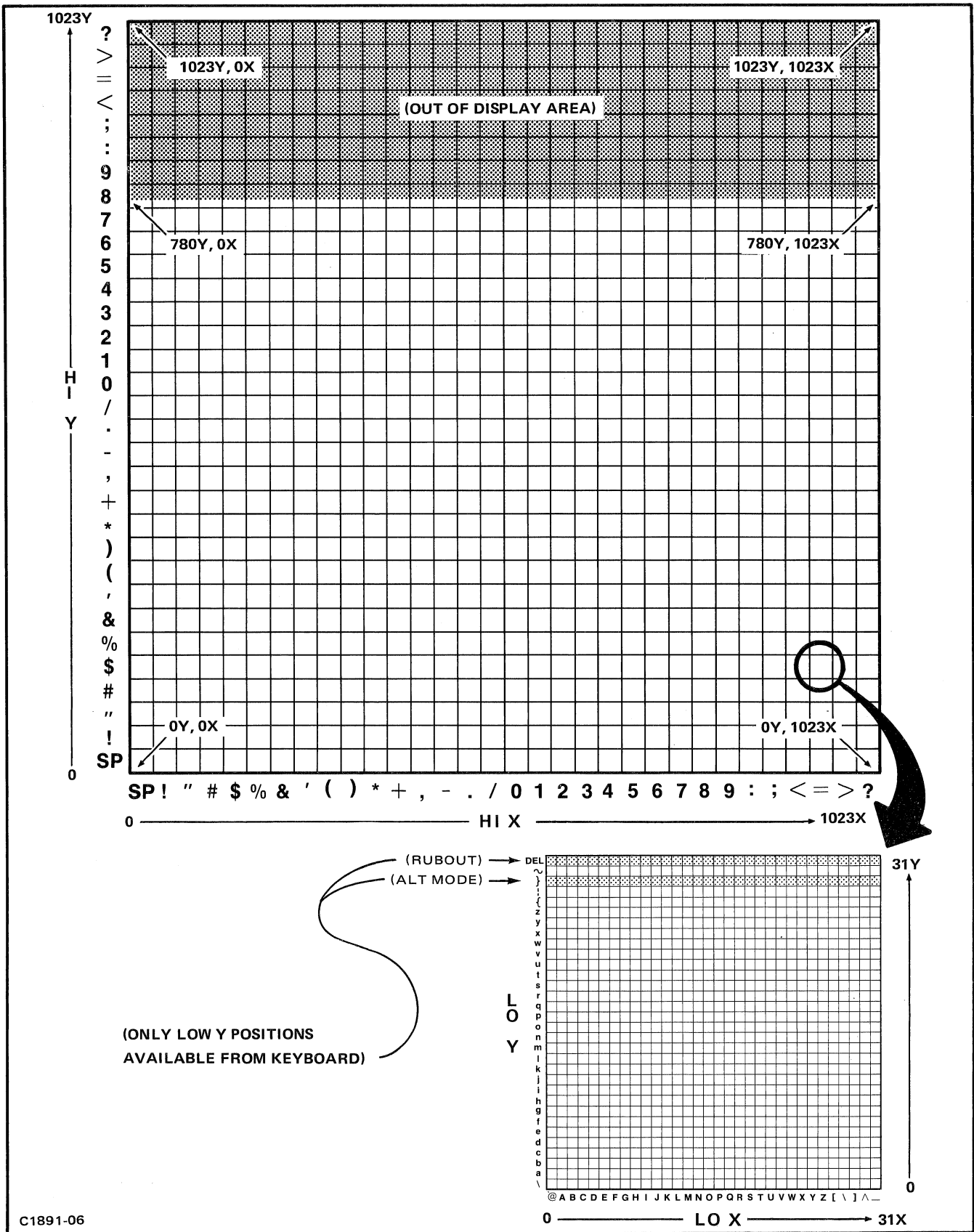


Fig. 2-5. X-Y Coordinates.

7. Wait approximately 90 seconds (without keyboard entry). The display should enter Hold mode. Press the SHIFT key and the display should return to normal.

**Resetting Graph Mode.** When operating in Graph mode, the terminal can be restored to Alpha mode by any one of several methods. The function used to return the terminal to Alpha mode is dependent on the operation being performed and if the display is to be saved. The Graph mode reset commands are described in Table 2-1.

*NOTE*

*When operating at 4800 baud, the operator (or programmer) should allow ample time to complete a vector before resetting Graph mode. Failure to do this can result in incomplete vectors.*

**TABLE 2-1**  
**Graph Mode Reset Commands**

| Computer Command | Keyboard Equiv.                      | Remarks   |
|------------------|--------------------------------------|---|
| US               | CTRL<br>SHIFT O                      | Resets the terminal to Alpha mode, the alpha cursor appears at the last point specified in Graph mode. If the last point addressed is off the display area, the cursor appears on the first line of the display.                              |
| CR               | RETURN<br>or<br>CTRL M               | Resets the terminal to Alpha mode. The cursor will appear at the beginning of the line corresponding to beam position when the CR was received. If the CR→LF strap option is installed, the cursor appears at the beginning of the next line. |
| ESC FF           | CTRL<br>SHIFT K<br>CTRL L<br>or PAGE | Master reset to the terminal display, erases the screen, resets the terminal to Alpha mode and positions the cursor to Home position.   |

In Graph mode the normal address for a vector to be drawn consists of four address bytes as previously explained. In some cases, all four bytes do not have to be sent. At 4800 baud two byte times are required to complete a vector. The X and Y coordinate information only needs to be supplied if both the X and Y coordinates are changed

for the next point. It should be noted that the low X byte is always required as it initiates the actual drawing of the vector. The address byte formats which are accepted by the 4006-1 are shown in Table 2-2.

**TABLE 2-2**  
**Graph Address Byte Formats**

| HIY | LOY | HIX | LOX |
|-----|-----|-----|-----|
| X   | X   | X   | X   |
| X   | X   |     | X   |
| X   |     |     | X   |
|     | X   | X   | X   |
|     | X   |     | X   |
|     |     |     | X   |

**X = Changed or required byte.**

**Hard Copy Mode**

The Hard Copy mode is used to make a permanent copy of the information displayed on the screen. With the 4006-1 and a Hard Copy Unit (see Fig. 2-6), a permanent copy of any information displayed can be obtained. The following procedure describes how to initiate a hard copy.

1. Check to be sure that the Hard Copy Unit is connected to the terminal.
2. Enter the desired information on the screen using the keyboard (the information can be alpha, graphic, or a combination of the two).
3. After ensuring that the display is correct, hold the CTRL key and press SHIFT K, then press CTRL and W. This simulates an ESC ETB (make copy) command from the computer. The Hard Copy Unit will respond to the command by sending a signal to the terminal which sweeps the entire display, transferring the displayed information to the Hard Copy Unit. The entire operation requires approximately 18 seconds to complete and the hard copy will contain all of the information from the display screen (except the alpha cursor).
4. Make additional copies by pressing the COPY key on the 4006-1 keyboard and the MAKE COPY button on the Hard Copy Unit. You will notice that the hard copy operation is performed the same way, regardless of the method of initiation.

This completes the familiarization procedures for the 4006-1 terminal. The remainder of this manual contains programming, installation, and reference information.

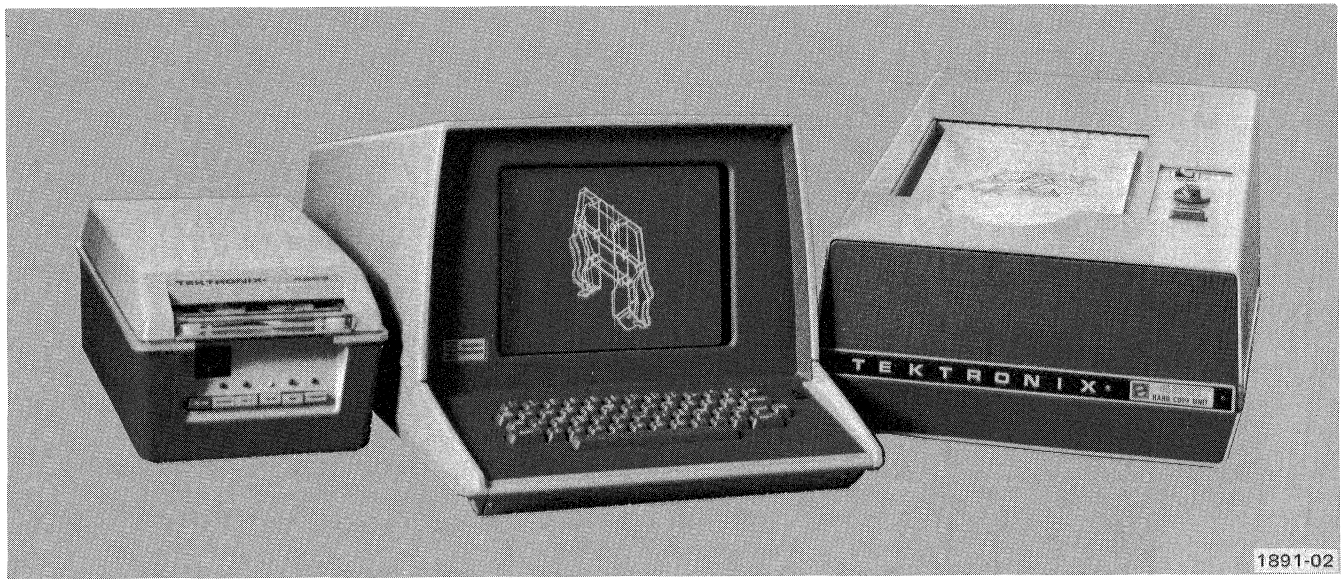


Fig. 2-6. 4006-1 Terminal and 4631 Hard Copy Unit (shown with optional 4923 Tape Recorder).



# SECTION 3

## PROGRAMMING CONSIDERATIONS

### OPERATING MODES

#### General Information

The operating modes of the 4006-1 are selected or changed by the computer data containing the proper control character information to the terminal, or by manual entry from the keyboard. Entry of the data from the keyboard can be displayed on the screen (locally echoed) by use of the ECHO/NORM strap (or rear panel switch if the half-duplex interface option is installed). If the ECHO/NORM strap (or switch) is in the NORM position, the display data must be echoed by the computer or modem.

#### NOTE

*The 4006-1 Terminal does not respond to BS (Backspace) or VT (Vertical Tab) commands. If the 4006-1 is used with existing Tektronix PLOT 10 software (i.e. Advanced Graphing II Vertical Labeling Routines) or customer programs which use these commands the software routines must be modified. The BS and VT operations can be performed by setting the terminal to Graph mode, repositioning the cursor, and placing the terminal back in Alpha mode. Future revisions of TCS software will have provisions in the program to perform these operations.*

The basic operating and subordinate conditions are listed in the following outline:

1. Alpha
  - a. Margins
  - b. View & Hold Conditions
2. Graphic Plot
  - a. Dark Vectors
  - b. Coordinate Addresses
  - c. Shortened Addresses
  - d. Manual Operation
  - e. Resetting Graph mode
3. Hard Copy

#### Alpha Mode

In the Alpha mode, the 4006-1 is used to display any of the 64 printing characters (including the space character). Lower case letters received will be printed as upper case. A non-storing cursor is displayed on the screen to indicate the next writing position. The display screen allows up to 35 lines of up to 74 characters.

**Margins.** The first character position of each line is called the Left Margin. When the writing position spaces past the 74th character position, (the right side of the display screen) the 4006-1 initiates an automatic carriage return and line feed. The Center Margin is a left hand margin which is located vertically in the center of the screen. The center margin is automatically selected at the end of the 35th line of text when followed by a carriage return and line feed. The advantage of using the center margin is that you can get two columns of copy: however, if any of the first column lines extend over one half of the screen they will be covered by the second column.

Home position on the screen (in Alpha mode) is near the upper left corner of the display at coordinates  $Y = 767$  and  $X = 0$ . The Home position corresponds to the first character position of line 1 and is automatically selected after a PAGE (erase the screen) or a carriage return and line feed are performed from the 35th line of the center margin.

During the initial power up sequence the 4006-1 screen will light up with a bright green glow. A PAGE (or ESC FF from the computer) will erase the screen, reset the terminal to Alpha mode and position the cursor to the Home position.

**View & Hold Conditions.** If no data is received for about 90 seconds, the 4006-1 goes from View (normal display intensity) to Hold (dimmed display). In Hold, the information on the display is retained but the intensity is lowered. The Hold condition is used to prolong the life of the display screen. The 4006-1 will return to View when any displayable data is received (or entered from the keyboard) or the SHIFT key is pressed. View and Hold are enabled in both Alpha and Graphic Plot modes.

## Programming Considerations—4006-1 Users

### Graphic Plot (Graph)

In Graph mode, the 4006-1 uses 1024 addressable points on each axis to draw vectors on the screen. 780 of these points are visible in the quality display area on the vertical (Y) axis of the display screen. The XY coordinates for the corners (and center) of the display screen are shown in Fig. 3-1.

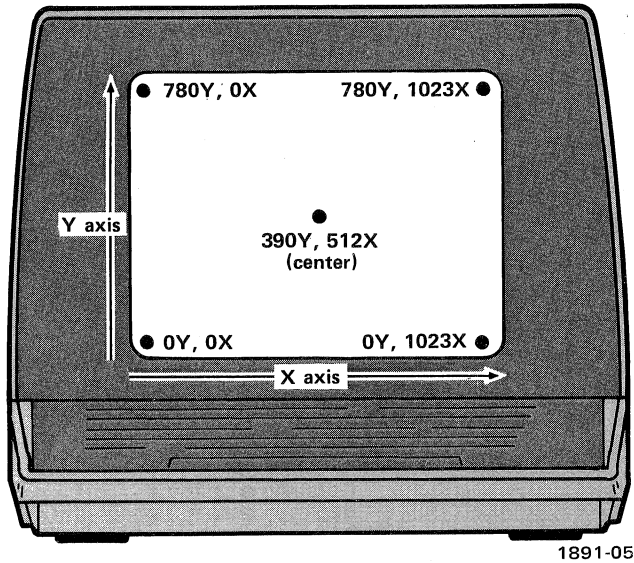


Fig. 3-1. Display Screen Coordinates.

Graph mode is initiated by an ASCII GS from the computer or a CTRL SHIFT M from the keyboard. Once Graph mode is set, vectors can be drawn on the screen by receiving Y and X coordinate data from the computer or by entering the data from the keyboard.

**Dark Vectors.** The first coordinate address received after setting Graph mode positions the beam to a starting point. The starting point is not displayed (dark vector). The second coordinate address will cause a vector to be drawn from the starting point to the new coordinate. The first vector after the receipt of a GS command will always be a dark vector and will not be displayed on the screen.

If a GS command is received while the terminal is in Graph mode, the next coordinate address will establish a new starting point for drawing vectors (a dark vector is drawn from the last coordinate address to the new address).

**Coordinate Addresses.** Graphic plot information is sent to the terminal in a 4 byte sequence containing the High and Low order Y information and the High and Low order X information. Each byte contains two tag bits and five binary bits. The tag bits define the byte (High Y, Low Y, etc.) and the binary bits identify the coordinates. This scheme of supplying information to the terminal means that the bytes can be encoded to ASCII characters. The coordinate data from the computer (or keyboard) must be in the following order:

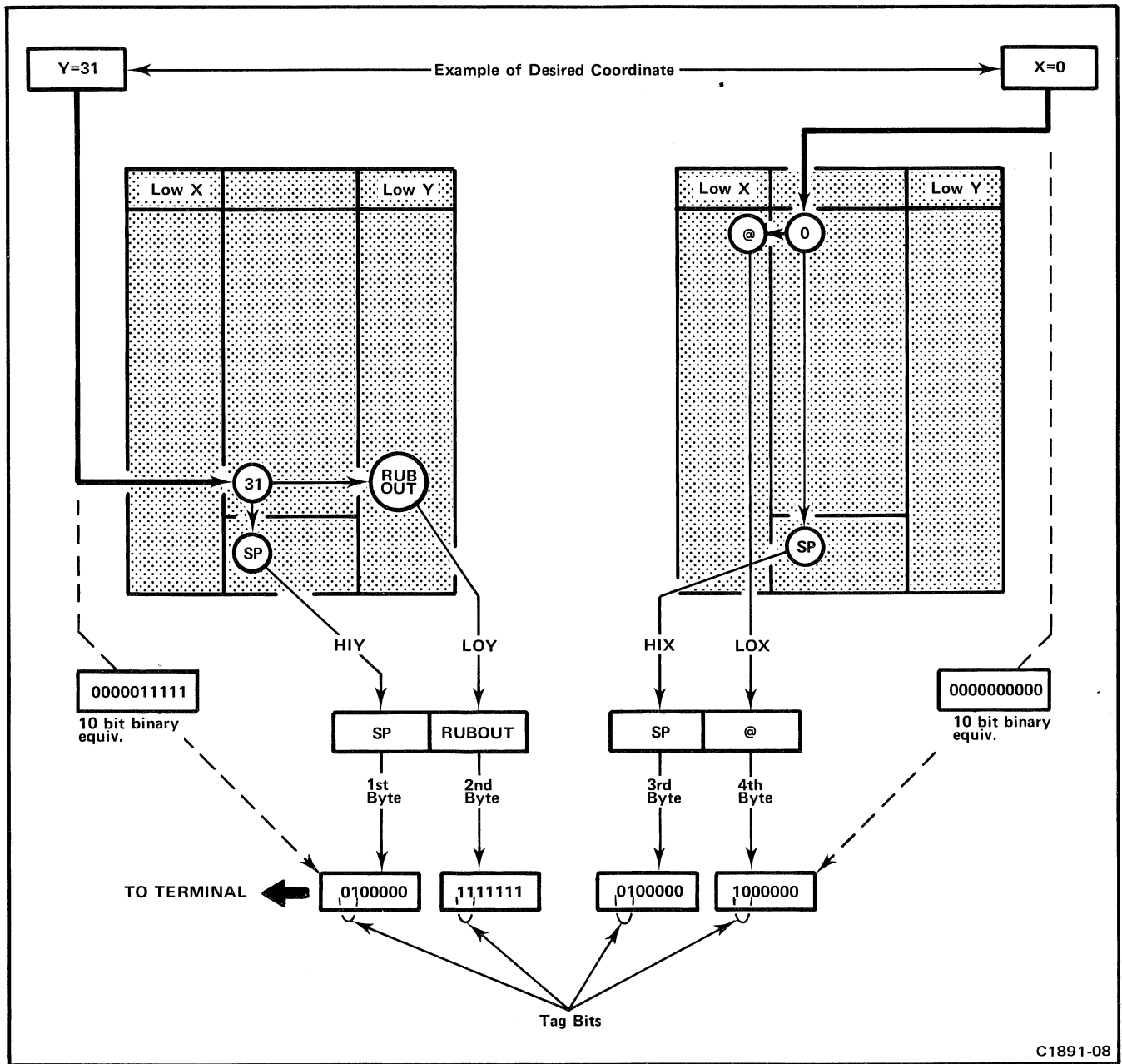
HIY, LOY, HIX, and LOX.

A complete conversion chart for the coordinates of the display screen and the corresponding ASCII characters is provided in Appendix A. The use of the Chart is explained in Fig. 3-2. Fig. 3-2 shows the process of selecting the four bytes to display coordinates Y = 31 and X = 0.

#### NOTE

*The only valid LOY coordinates which can be entered from the keyboard are obtained by using the RUBOUT key (DEL character) and the ALT MODE key (closing brace).*

The coordinate conversion information will normally be provided by using a computer subroutine; however, the conversion chart is useful when the computer subroutine is not convenient.



C1891-08

Fig. 3-2. Coordinate Conversion.

## Programming Considerations—4006-1 Users

**Shortened Address.** After the first GS command, the initial 4 bytes must be sent to the terminal to specify the starting point. Once the starting point has been established, additional bytes that do not change need not be sent (except for the LOX byte). If the HIX byte is changed, the LOY byte must be sent. The number of bytes required by the terminal depends on the bytes which change from the preceding point. However the LOX byte must always be sent to initiate the drawing of a point or vector. A list of the required coordinate bytes is provided in Table 3-1.

**TABLE 3-1**  
Required Coordinate Bytes

| HIY | LOY | HIX | LOX |
|-----|-----|-----|-----|
| X   | X   | X   | X   |
| X   | X   |     | X   |
| X   |     |     | X   |
|     | X   | X   | X   |
|     | X   |     | X   |
|     |     |     | X   |

X = changed or required byte.

**NOTE**

*When using a shortened address, bear in mind that the terminal requires approximately 3.5 ms to draw a vector. If another coordinate address is received before the vector has been completed the terminal will start to move to the new address. This problem can be avoided when operating at 4800 baud by following a shortened address with a NUL character before sending the next coordinate address. A NUL is not required when operating at 2400 baud or less.*

**Manual Operation.** Normally graph plotting will not be performed from the terminal keyboard since only the RUBOUT and ALT MODE keys can be used to specify LOY bytes. The following procedure describes a basic operation in Graph mode using the keyboard. A more detailed procedure is contained in Section 2 of this manual.

**NOTE**

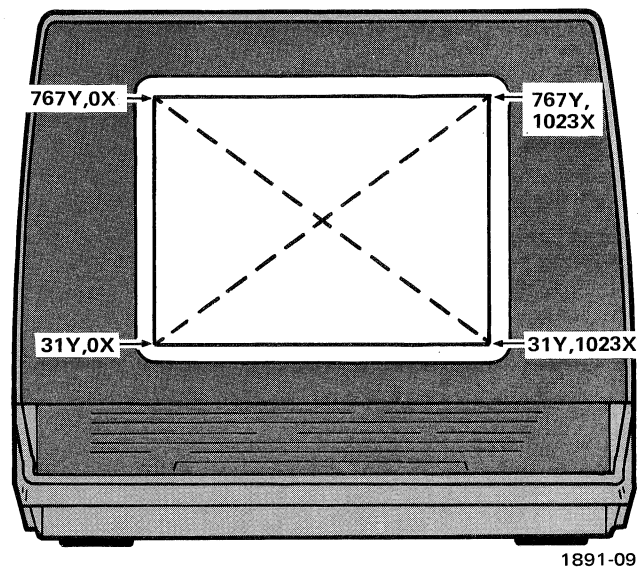
*In the following procedure the **BOLD** characters (steps 5 through 8) do not need to be sent.*

1. Place the ECHO/NORM strap (or switch) in the ECHO position.
2. Turn on the 4006-1 ac power and allow the unit to warm up. Press PAGE to erase the display screen and reset the terminal logic.

3. Enter CTRL SHIFT M (GS command) from the keyboard.
4. Enter SPACE RUBOUT SPACE @ (corresponds to Y=31, X=0).
5. Enter 7 **RUBOUT SPACE @** (corresponds to Y=767, X=0).
6. Enter 7 RUBOUT ? \_ (corresponds to Y=767, X=1023).
7. Enter SPACE **RUBOUT ? \_** (corresponds to Y=31, X=1023).
8. Enter **SPACE RUBOUT SPACE @** (corresponds to Y=31, X=0).

The resulting display on the screen should correspond to the pattern shown in Fig. 3-3. The diagonal vectors can be drawn as follows:

1. Enter 7 RUBOUT ? \_ (corresponds to Y=767, X=1023). This will draw the diagonal vector to the upper right-hand corner of the screen. If a dark vector is desired before starting the next vector, enter CTRL SHIFT M.
2. Enter 7 RUBOUT SPACE @ (corresponds to Y=767, X=0).



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**Fig. 3-3. Graph Display.**

3. Enter SPACE RUBOUT ? \_ (corresponds to Y31, X=1023).

**Resetting Graph Mode.** On completion of Graph mode operation, the 4006-1 can be returned to Alpha mode by any one of the following methods:

- US control character (CTRL SHIFT O from keyboard)
- CR control character (RETURN or CTRL M from the keyboard)
- ESC FF command sequence (PAGE or CTRL SHIFT K CTRL L from the keyboard).

### Hard Copy Mode

In the Hard Copy mode, the 4006-1 provides the necessary signals to generate a permanent copy of the 4006-1 display. Hard copy operation is initiated by pressing the COPY switch on the keyboard, pressing the MAKE COPY switch on the 4631, entering a CTRL SHIFT K followed by a CTRL W from the keyboard or by receipt of an ESC ETB command (make copy) from the computer.

Any of the above sequences will initiate the Hard Copy operation. During the actual copying of the display information the Hard Copy Unit controls the terminal operation and scanning signal. During the copy cycle the screen will be busy to the operator and the computer.

## ASCII CODE FUNCTIONS


The ASCII Code Functions Chart (Fig. 3-4) shows the various ASCII characters and their binary bit configurations (bits 1 through 7). The number in the upper right-hand corner of each square represents the decimal equivalent of the character. The two columns marked CONTROL contain the abbreviations for the corresponding ASCII control characters. The shaded area on the chart indicates those characters which cannot be transmitted from the terminal keyboard (they will be displayed as upper case characters if received from the computer). All six columns of information are used when receiving graphic plot information from the computer.

## CONTROL CHARACTERS

The control characters which will be recognized by the 4006-1 are listed in Table 3-2.

| B  |    | I  |    | T  |    | S  |    | CONTROL |     | HIGH X & Y GRAPHIC INPUT |    | LOW X |    | LOW Y |              |
|----|----|----|----|----|----|----|----|---------|-----|--------------------------|----|-------|----|-------|--------------|
| 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | 16      | 17  | 18                       | 19 | 20    | 21 | 22    | 23           |
| 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | NUL     | DLE | SP                       | ø  | @     | P  | \     | p            |
| 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | SOH     | DC1 | !                        | 1  | A     | Q  | a     | q            |
| 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | STX     | DC2 | "                        | 2  | B     | R  | b     | r            |
| 0  | 0  | 1  | 1  | 0  | 0  | 0  | 0  | ETX     | DC3 | #                        | 3  | C     | S  | c     | s            |
| 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | EOT     | DC4 | \$                       | 4  | D     | T  | d     | t            |
| 0  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | ENQ     | NAK | %                        | 5  | E     | U  | e     | u            |
| 0  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | ACK     | SYN | &                        | 6  | F     | V  | f     | v            |
| 0  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | BEL     | ETB | '                        | 7  | G     | W  | g     | w            |
| 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | BS      | CAN | (                        | 8  | H     | X  | h     | x            |
| 1  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | HT      | EM  | )                        | 9  | I     | Y  | i     | y            |
| 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | LF      | SUB | *                        | :  | J     | Z  | j     | z            |
| 1  | 0  | 1  | 1  | 0  | 0  | 0  | 0  | VT      | ESC | +                        | ;  | K     | [  | k     | {            |
| 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | FF      | FS  | ,                        | <  | L     | \  | l     | ~            |
| 1  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | CR      | GS  | -                        | =  | M     | ]  | m     | }            |
| 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | SO      | RS  | .                        | >  | N     | ^  | n     | ~            |
| 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | SI      | US  | /                        | ?  | O     | _  | o     | RUBOUT (DEL) |

Shaded area indicates characters which are not available from the keyboard. These characters will print as upper case when received from the computer. } and RUBOUT will not space or print.

 Control characters not recognized by the 4006-1 as in previous Tektronix Graphic Terminals.

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Fig. 3-4. ASCII Code Functions.

## STRAP OPTIONS

Strap options are available on the 4006-1 logic card which permit the user to change the operating configuration of the terminal. The strap options are shown in Table 3-3.



Access to the strap options is obtained by removing the top cover of the terminal. The ac power cord should always be disconnected when the cover is removed.

The optional half-duplex interface options are shown in Table 3-4. The strap option locations are shown in Fig. 3-5.




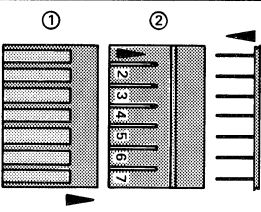
**TABLE 3-2**  
**Control Character Description**

| Control Character | Decimal  | Binary             | Keyboard Equiv.        | Function in 4006-1   |
|-------------------|----------|--------------------|------------------------|--|
| BEL               | 7        | 0000111            | CTRL G                 | Enables tone from speaker.   |
| HT                | 9        | 0001001            | CTRL I                 | Causes the cursor to move one space to the right.                            |
| LF                | 10       | 0001101            | CTRL J or LINE FEED    | Line Feed.   |
| CR                | 13       | 0001101            | CTRL M or RETURN       | Carriage Return.   |
| ESC               | 27       | 0011011            | CTRL SHIFT K           | First control character of ESC FF or ESC ETB sequence.                       |
| GS                | 29       | 0011101            | CTRL SHIFT M           | Sets terminal to Graph mode.   |
| US                | 31       | 0011111            | CTRL SHIFT O           | Sets terminal to Alpha mode.   |
| ESC FF            | 27<br>12 | 0011011<br>0001100 | CTRL SHIFT K<br>CTRL L | Erases screen, returns terminal to Alpha and places cursor to home position. |
| ESC ETB           | 27<br>23 | 0011011<br>0010111 | CTRL SHIFT K<br>CTRL W | Initiates Hard Copy.   |

**TABLE 3-3**  
**Strap Options**

| Feature                | Options | Description   |
|------------------------|---------|---|
| CR→LF                  |         | <ol style="list-style-type: none"> <li>1. Carriage Return does not cause line feed.</li> <li>2. Carriage Return does cause automatic line feed.</li> </ol>  |
| ECHO/NORM <sup>1</sup> |         | <ol style="list-style-type: none"> <li>1. ECHO—Display data is provided by the terminal logic.</li> <li>2. NORM—Display data is returned to the terminal by modem or computer.</li> </ol>           |
| Data Strap             |         | <ol style="list-style-type: none"> <li>1. Bit 8 is selected as a data bit.</li> <li>2. Bit 8 is selected as a parity bit. This strap is used with the Data Select strap described below.</li> </ol> |

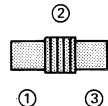

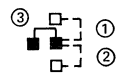


TABLE 3-3 (cont)

| Feature             | Options   | Description  |
|---------------------|---|--|
| Data Select         |  | <ol style="list-style-type: none"> <li>High (even). If the Data Strap is set to BIT 8, bit 8 is set high. If the Data Strap is set to PARITY, even parity is selected.</li> <li>Low (odd). If the Data Strap is set to BIT 8, bit 8 is set low. If the Data Strap is set to PARITY, odd parity is selected.</li> </ol> |
| Interface Connector |  | <ol style="list-style-type: none"> <li>Direct Connect to computer.</li> <li>Telephone/Modem connection to computer.</li> </ol>   |

<sup>1</sup>Replaced by a rear panel switch if the optional half-duplex interface is installed.

TABLE 3-4

Half-Duplex Interface Strap Options

| Options              | Positions <sup>2</sup>  | Description  |
|----------------------|---|--|
| MODE SWITCH          |  | <ol style="list-style-type: none"> <li>Full Duplex operation.</li> <li>Half Duplex Normal operation.</li> <li>Half Duplex Supervisor operation.</li> </ol> |
| TURNAROUND CHARACTER |  | <ol style="list-style-type: none"> <li>Carriage Return and EOT or ETX.</li> <li>Line Feed and EOT or ETX.</li> <li>Neither.</li> </ol>                     |
| BLANKING CHARACTER   |  | <ol style="list-style-type: none"> <li>SOH (Control A).</li> <li>STX (Control B).</li> <li>Non-Blanking.</li> </ol>  |
| MODEM TYPE           |  | <ol style="list-style-type: none"> <li>RS-232-A.</li> <li>RS-232-C.</li> </ol>   |
| EOT/ETX              |  | <ol style="list-style-type: none"> <li>ETX</li> <li>EOT</li> </ol> } Turn around Character.  |

<sup>2</sup>The straps are shown in the positions they are normally set to when the card is shipped from the factory.

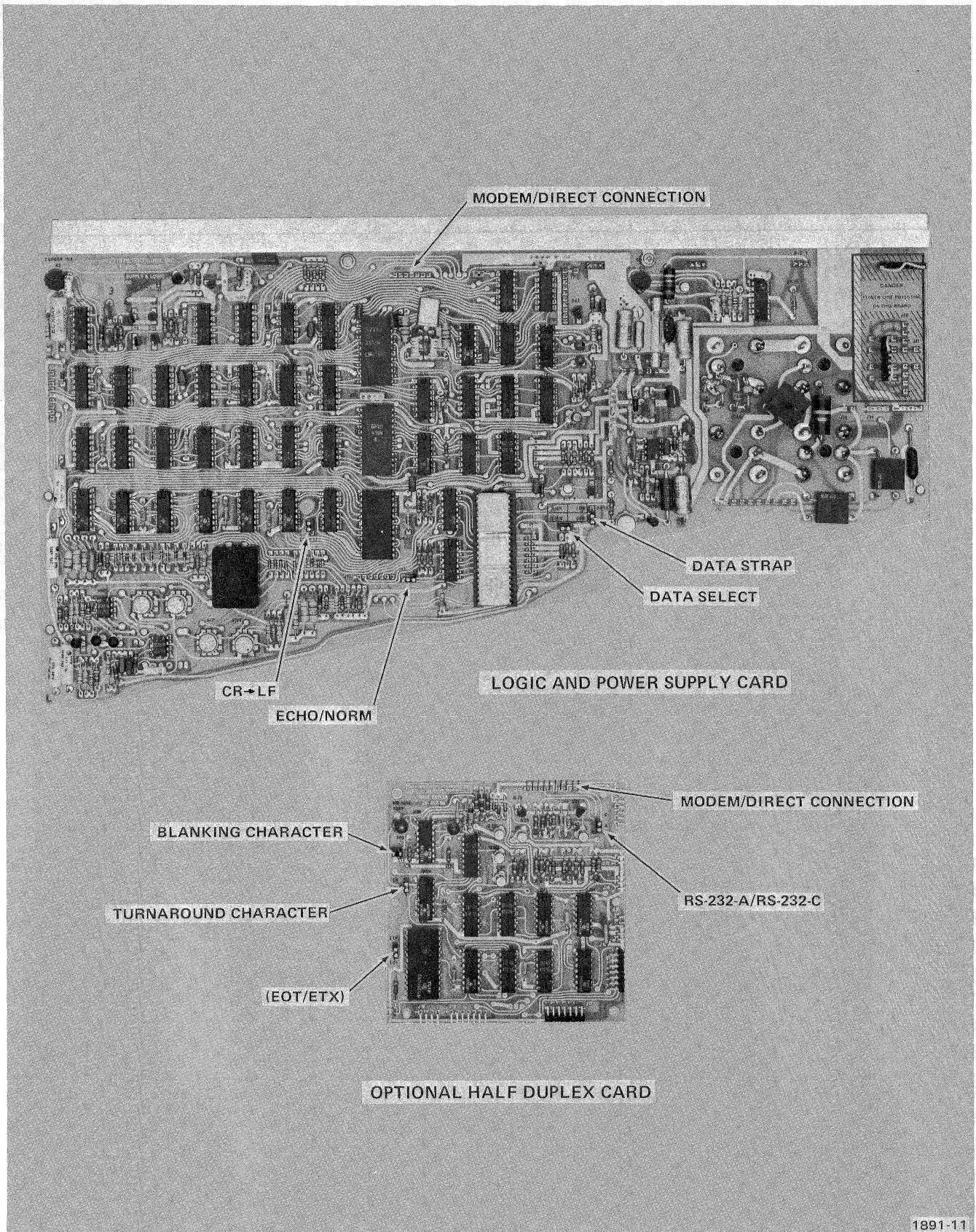


Fig. 3-5. Strap Option Locations.

# SECTION 4

## INSTALLATION

### General

The 4006-1 Computer Display Terminal is completely self-contained and is designed for desk-top operation. The following procedures describe the installation and checkout of the terminal and the optional accessories.

When unpacking the unit, it should be removed from the shipping container and carefully inspected for any visible signs of shipping damage. Any damage should be reported to the carrier and the local Tektronix Sales Representative immediately.

### INSTALLATION

The following is a description of the operations required to install the terminal, perform the initial checkout of operation, and connect the terminal to the computer. Detailed procedures for the various operations are contained on the following pages.

1. Unpack the terminal and place it on a convenient work surface.
2. Remove the top cover from the terminal.
3. Set the Line voltage strap to the proper line voltage (if local power is not 115 V, 60 Hz).
4. Set the ECHO/NORM strap (or ECHO/NORM switch if the half-duplex option is installed) to the ECHO position.
5. Connect the interface cable from the Hard Copy Unit to J1000 on the back of the terminal if a Hard Copy unit is to be used with the terminal.
6. Apply power to the terminal (and Hard Copy Unit if applicable).
7. Verify the off line operation of the terminal (and Hard Copy Unit) using the checkout procedure provided in Section 2.
8. Turn off power to the terminal (and Hard Copy Unit).
9. Connect the computer interface cable to the terminal. For direct connection the plug is installed so that P32-1 mates with J32-7 on the Logic card. For communications through a modem, P32-1 mates with J32-1.
10. Set the required Transmit and Receive baud rates on the rear panel switches.

#### NOTE

*If keyboard data is echoed by the terminal logic the transmit and receive baud rates must be the same.*

11. Set the ECHO/NORM strap (or switch) to the required position. (If the strap or switch is set to the NORM position the echo of keyboard generated data must be provided by the computer or modem.)
12. If the half-duplex interface is installed set the desired strap options on the Half Duplex card and set the Interface mode switch to the proper position (Full Duplex, Half Duplex Normal, or Half Duplex Supervisor).
13. Replace the top cover.
14. Apply power to the terminal (and Hard Copy Unit).
15. Establish communications with the computer and verify proper operation of the terminal and computer.

### Cover Removal



*Always turn off power and disconnect the power cord when removing or installing the cover.*

1. Remove the two screws from the rear of the unit (see Fig. 4-1).

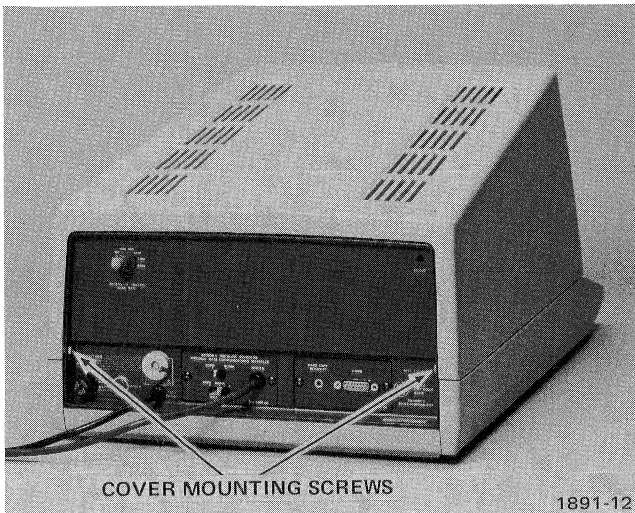


Fig. 4-1. Cover Removal.

2. Slide the cover forward until it stops (approximately 3/8 inch).

3. Carefully lift the cover off the terminal and set it aside.

**NOTE**

*The crt mask on the front of the display screen can be removed if desired. The mask is held in place by the cover. Be sure to replace the mask before replacing the cover on the terminal.*

**Line Voltage Selection**



*The 4006-1 is intended to operate on a single phase power source which has one of its current carrying conductors (grounding) connected to Safety Earth (ground potential). Operation from other power sources which have both current carrying conductors live with respect to ground (such as phase-to-phase on a multi-phase system or across the legs of a 117-234 volt single phase three-wire system) is not recommended since only the line conductor has over-current (fuse) protection within the instrument.*

The 4006-1 is designed to operate on a 115 or 230 volt nominal line voltage source with a frequency of 48 to 440 Hz. In addition, any of three voltage ranges for the 115 or 230 vac may be selected. The ac power connector is a three-wire polarized plug with one lead connected directly to the instrument frame to provide electric shock protec-

tion. Connect this plug only to a three-wire outlet which has a safety ground. If the unit is connected to any other power source, the 4006-1 frame must be connected to a safety ground system. The connector configuration and color coding is shown in Fig. 4-2.

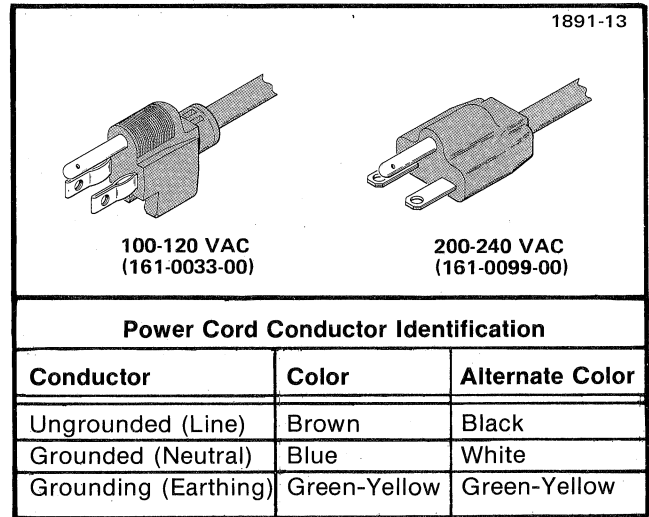


Fig. 4-2. AC Power Connectors.

The appropriate line voltage is selected by the use of jumpers on the rear of the Logic/Power Supply card. Two jumpers are provided, one for the 115 vac range and one for the 230 vac range. Jumper positions for the various line voltages are shown in Fig. 4-3.

When operating with line voltages in the 230 volt range the line fuse and the power cord must be changed. For 100, 115, or 120 volt operation the line fuse is a 1.6 A (Slo-blo).

When converting the terminal to 200, 230 or 240 volt operation, the power cord is replaced with the 200-240 vac power cord (161-0099-00) and the fuse value is changed to a .8 A (Slo-blo).

To select the proper line voltage jumper position, measure the voltage at the power outlet to which the terminal is to be connected. Position the jumper (Fig. 4-3) and set the Yellow voltage indicator on the rear of the terminal to indicate the strap position. The indicator is set by loosening the screw and turning the indicator until the proper voltage appears in the window. It should be noted that this is only an indicator and has no control over the actual operating voltage selected.

**Strap Options**

The strap options should be set according to customer needs. The 4006-1 strap options are described in Table 3-3. The Half Duplex card strap options are described in Table 3-4.



1. Verify that the crt mask is properly positioned on the front of the display screen.

2. Stand behind the terminal (so the cover guides are easily visible) and carefully position the cover on the terminal. The cover must be positioned approximately 3/8 inch forward of the cover latches for proper contact.

3. Slide the cover to the rear, making sure that the latches are engaged.

4. Replace the two cover locking screws through the rear panel (see Fig. 4-1).

### INITIAL CHECKOUT

The 4006-1 can be checked off line for proper operation by performing the Alpha and Graphic checkout procedures detailed in Section 2. After completing the checkout procedure and verifying operation the terminal is ready to be connected to the computer.

The terminal can be connected directly to the computer or can interface through a modem/telephone line.

#### Direct Connection to Computer

A direct connection is used when the computer and terminal are located close to each other and the connection can be made using the interface cable directly. For direct connection, the interface connector on the logic card (J32) is plugged in so that pin 1 on the jack mates with pin 7 of the plug.

Verify the Baud Rate switch setting, and the computer connection.

Verify the terminal is connected to a three-wire power receptacle and apply power.

#### Phone Line (Modem) Connection

A telephone connection can be made when the computer/terminal distance is too great for direct connection. When this type of connection is used, additional equipment (in the form of modems) is required. A modem is required on each end of the telephone line, one at the terminal end, and one at the computer end. There are any number of modems available and the particular one used will depend on your needs.

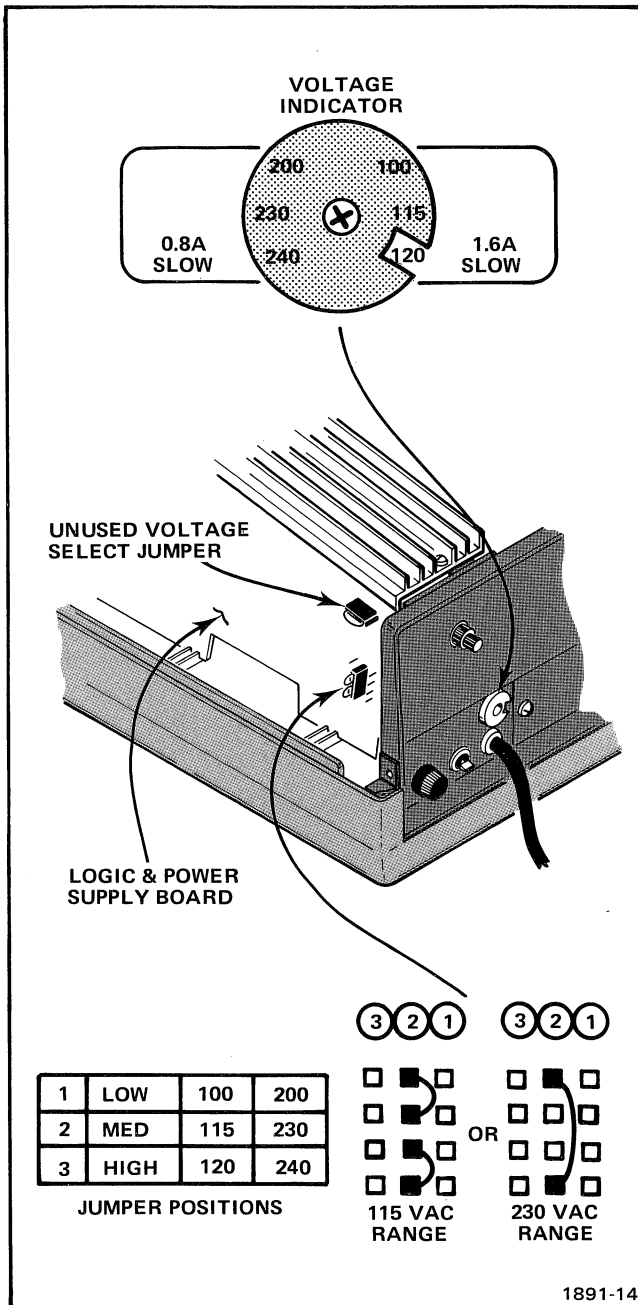


Fig. 4-3. Line Voltage Selection.

#### Cover Replacement

Replace the top cover of the terminal using the following procedure:

**CAUTION**

Always turn off power and disconnect the power cord from facility power when removing or replacing the cover.

## Installation—4006-1 Users

Phone line connection is accomplished as follows:

1. Check that the interface connector (J32) to verify that pin 1 of the jack mates with pin 1 of the plug.
2. Verify that the selected baud rate (transmit and receive) corresponds to the baud rate required by the modem and the computer channel.
3. Verify that the terminal is connected to a three-wire power outlet.
4. Verify that the 4006-1 interface cable is properly connected to the modem (data set).
5. Turn on ac power to the terminal, wait for the terminal to warm up, then press the PAGE key to erase the screen and clear the terminal logic.
6. Using the telephone, dial the computer number. The modem at the computer end will respond by transmitting an audible tone. When the tone is heard, actuate the modem (specific details concerning modem actuation will depend on the type of modem used).

7. The terminal is now connected to the computer and ready for on-line operation. The particular sign-on and operating procedures vary with the different time-sharing and computer systems.

## INSTALLATION OF OPTIONS

### Half-Duplex Interface

The 4006-1 contains all of the necessary logic and controls to operate on a full duplex system at baud rates of from 75 to 4800 baud. An optional half-duplex interface is available to provide compatibility to half-duplex channels. The half-duplex option may be ordered from the factory installed in a terminal or may be ordered as a kit and installed in the field. The following procedure describes field installation of the half-duplex option.

1. Turn off ac power and disconnect the power cord.
2. Remove the top cover from the 4006-1.
3. Remove the two screws which mount the interface cable panel to the back of the terminal (see Fig. 4-4).

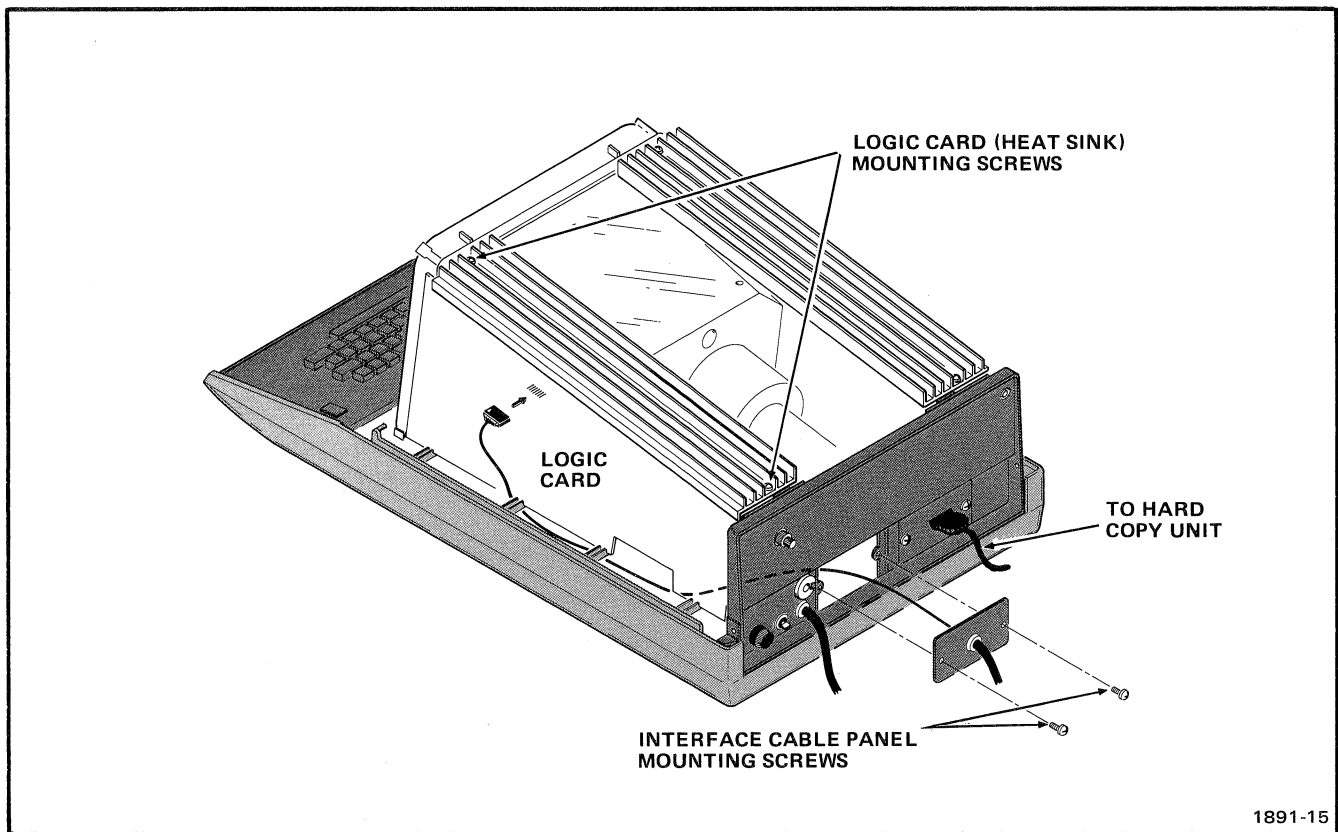


Fig. 4-4. Panel and Logic Card Mounting.

4. Remove the interface cable panel and interface cable assembly.

5. Install the half-duplex rear panel using existing hardware.

6. Route the cable assembly from the rear panel under the logic card.

7. Position the half-duplex card on the spacers and secure the card using two screws. (See Fig. 4-5).

8. Remove the keyboard LED plug (by inserting a fingernail under the edge of the plug and lifting up or by reaching under the back of the keyboard and pushing up on the plug). Install the LED (WAIT) indicator assembly by pressing it into the keyboard cutout.

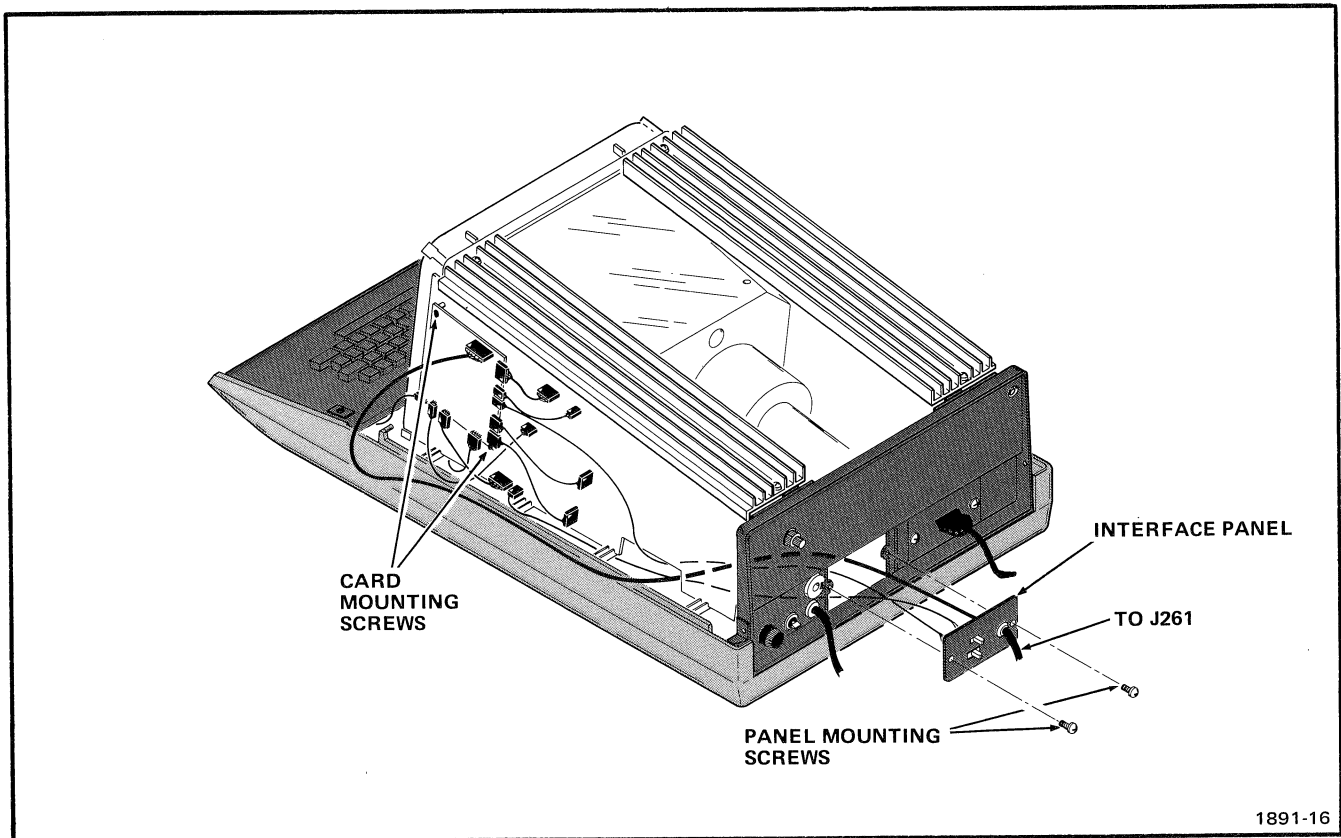


Fig. 4-5. Half-Duplex Card Installation.

## Installation—4006-1 Users

9. Connect the cables from the half-duplex card to the logic card (see Fig. 4-5) as follows:

| Half-Duplex Card | Description  |
|------------------|--|
| J11              | Interface cable from back panel to J261 (modem connector). |
| J12              | To J32 on Logic card.                                      |
| J13              | To J33 on Logic card (jumper must be removed from J33).    |
| J14              | To Mode switch cable from rear panel.                      |
| J15              | To J44 (power connector) on Logic card.                    |
| J16              | To J45 (Interlogic connector) on Logic card.               |
| J17              | Cable from keyboard connector assembly.                    |
| J18              | To J47 on Logic card.                                      |
| J19              | To J31 on Logic card (jumper must be removed from J31).    |
| J20              | To LED cable assembly.                                     |

10. Remove the jumper from the ECHO/NORM strap and connect the ECHO cable from the rear panel to the ECHO strap pins (J46).

11. Set the strap options as required. The strap options are described in Section 3 of this manual.

This completes the half-duplex installation. The operation can be verified using the following procedure:

- a. Set the ECHO/NORM switch to ECHO.
- b. Short pins 4 and 5 of J261 (this can be done with the blade of a screwdriver).

- c. Set the mode switch to HALF DUPLEX SUPERVISOR. The WAIT indicator (on the keyboard) should blink.

- d. Set the mode switch to HALF DUPLEX NORMAL position and enter the selected turnaround character from the keyboard. The WAIT indicator should come on and stay on. Enter any other character from the keyboard and the indicator should go off.

12. Remove the short from J261.

13. Replace the cover on the terminal.

### Viewing Hood

The viewing hood is designed to snap onto the front of the display terminal. The hood is installed by positioning the lip on the top edge of the hood under the crt mask and snapping the hood in place (see Fig. 4-6). To remove the hood simply lift up from the bottom and the hood will swing free of the mask. Disengage the lip (from under the top of the mask) and set the hood aside.

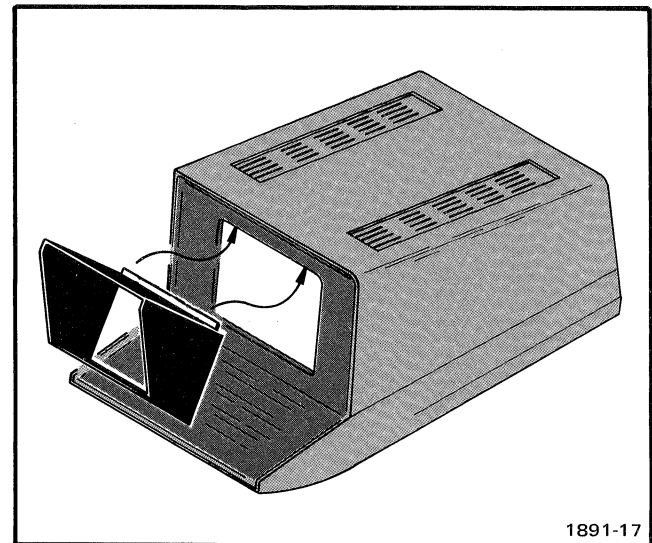


Fig. 4-6. Viewing Hood Installation.

# APPENDIX A

## GRAPHIC BYTE CONVERSION CHART

| Low Order X |      | X or Y Coordinate |    |    |     |     |     |     |     | Low Order Y |              |
|-------------|------|-------------------|----|----|-----|-----|-----|-----|-----|-------------|--------------|
| ASCII       | DEC. |                   |    |    |     |     |     |     |     | DEC.        | ASCII        |
| @           | 64   | 0                 | 32 | 64 | 96  | 128 | 160 | 192 | 224 | 96          | `            |
| A           | 65   | 1                 | 33 | 65 | 97  | 129 | 161 | 193 | 225 | 97          | a            |
| B           | 66   | 2                 | 34 | 66 | 98  | 130 | 162 | 194 | 226 | 98          | b            |
| C           | 67   | 3                 | 35 | 67 | 99  | 131 | 163 | 195 | 227 | 99          | c            |
| D           | 68   | 4                 | 36 | 68 | 100 | 132 | 164 | 196 | 228 | 100         | d            |
| E           | 69   | 5                 | 37 | 69 | 101 | 133 | 165 | 197 | 229 | 101         | e            |
| F           | 70   | 6                 | 38 | 70 | 102 | 134 | 166 | 198 | 230 | 102         | f            |
| G           | 71   | 7                 | 39 | 71 | 103 | 135 | 167 | 199 | 231 | 103         | g            |
| H           | 72   | 8                 | 40 | 72 | 104 | 136 | 168 | 200 | 232 | 104         | h            |
| I           | 73   | 9                 | 41 | 73 | 105 | 137 | 169 | 201 | 233 | 105         | i            |
| J           | 74   | 10                | 42 | 74 | 106 | 138 | 170 | 202 | 234 | 106         | j            |
| K           | 75   | 11                | 43 | 75 | 107 | 139 | 171 | 203 | 235 | 107         | k            |
| L           | 76   | 12                | 44 | 76 | 108 | 140 | 172 | 204 | 236 | 108         | l            |
| M           | 77   | 13                | 45 | 77 | 109 | 141 | 173 | 205 | 237 | 109         | m            |
| N           | 78   | 14                | 46 | 78 | 110 | 142 | 174 | 206 | 238 | 110         | n            |
| O           | 79   | 15                | 47 | 79 | 111 | 143 | 175 | 207 | 239 | 111         | o            |
| P           | 80   | 16                | 48 | 80 | 112 | 144 | 176 | 208 | 240 | 112         | p            |
| Q           | 81   | 17                | 49 | 81 | 113 | 145 | 177 | 209 | 241 | 113         | q            |
| R           | 82   | 18                | 50 | 82 | 114 | 146 | 178 | 210 | 242 | 114         | r            |
| S           | 83   | 19                | 51 | 83 | 115 | 147 | 179 | 211 | 243 | 115         | s            |
| T           | 84   | 20                | 52 | 84 | 116 | 148 | 180 | 212 | 244 | 116         | t            |
| U           | 85   | 21                | 53 | 85 | 117 | 149 | 181 | 213 | 245 | 117         | u            |
| V           | 86   | 22                | 54 | 86 | 118 | 150 | 182 | 214 | 246 | 118         | v            |
| W           | 87   | 23                | 55 | 87 | 119 | 151 | 183 | 215 | 247 | 119         | w            |
| X           | 88   | 24                | 56 | 88 | 120 | 152 | 184 | 216 | 248 | 120         | x            |
| Y           | 89   | 25                | 57 | 89 | 121 | 153 | 185 | 217 | 249 | 121         | y            |
| Z           | 90   | 26                | 58 | 90 | 122 | 154 | 186 | 218 | 250 | 122         | z            |
| [           | 91   | 27                | 59 | 91 | 123 | 155 | 187 | 219 | 251 | 123         | {            |
| \           | 92   | 28                | 60 | 92 | 124 | 156 | 188 | 220 | 252 | 124         |              |
| ]           | 93   | 29                | 61 | 93 | 125 | 157 | 189 | 221 | 253 | 125         | }            |
| ^           | 94   | 30                | 62 | 94 | 126 | 158 | 190 | 222 | 254 | 126         | ~            |
| _           | 95   | 31                | 63 | 95 | 127 | 159 | 191 | 223 | 255 | 127         | RUBOUT (DEL) |
|             |      | 32                | 33 | 34 | 35  | 36  | 37  | 38  | 39  |             |              |
|             |      | SP                | !  | "  | #   | \$  | %   | &   | ,   |             |              |

High Order X & Y



GRAPHIC BYTE CONVERSION CHART (cont)

| Low Order X |      | X or Y Coordinate |     |     |     |     |     |     |     | Low Order Y |              |
|-------------|------|-------------------|-----|-----|-----|-----|-----|-----|-----|-------------|--------------|
| ASCII       | DEC. |                   |     |     |     |     |     |     |     | DEC.        | ASCII        |
| @           | 64   | 256               | 288 | 320 | 352 | 384 | 416 | 448 | 480 | 96          | '            |
| A           | 65   | 257               | 289 | 321 | 353 | 385 | 417 | 449 | 481 | 97          | a            |
| B           | 66   | 258               | 290 | 322 | 354 | 386 | 418 | 450 | 482 | 98          | b            |
| C           | 67   | 259               | 291 | 323 | 355 | 387 | 419 | 451 | 483 | 99          | c            |
| D           | 68   | 260               | 292 | 324 | 356 | 388 | 420 | 452 | 484 | 100         | d            |
| E           | 69   | 261               | 293 | 325 | 357 | 389 | 421 | 453 | 485 | 101         | e            |
| F           | 70   | 262               | 294 | 326 | 358 | 390 | 422 | 454 | 486 | 102         | f            |
| G           | 71   | 263               | 295 | 327 | 359 | 391 | 423 | 455 | 487 | 103         | g            |
| H           | 72   | 264               | 296 | 328 | 360 | 392 | 424 | 456 | 488 | 104         | h            |
| I           | 73   | 265               | 297 | 329 | 361 | 393 | 425 | 457 | 489 | 105         | i            |
| J           | 74   | 266               | 298 | 330 | 362 | 394 | 426 | 458 | 490 | 106         | j            |
| K           | 75   | 267               | 299 | 331 | 363 | 395 | 427 | 459 | 491 | 107         | k            |
| L           | 76   | 268               | 300 | 332 | 364 | 396 | 428 | 460 | 492 | 108         | l            |
| M           | 77   | 269               | 301 | 333 | 365 | 397 | 429 | 461 | 493 | 109         | m            |
| N           | 78   | 270               | 302 | 334 | 366 | 398 | 430 | 462 | 494 | 110         | n            |
| O           | 79   | 271               | 303 | 335 | 367 | 399 | 431 | 463 | 495 | 111         | o            |
| P           | 80   | 272               | 304 | 336 | 368 | 400 | 432 | 464 | 496 | 112         | p            |
| Q           | 81   | 272               | 305 | 337 | 369 | 401 | 433 | 465 | 497 | 113         | q            |
| R           | 82   | 274               | 306 | 338 | 370 | 402 | 434 | 466 | 498 | 114         | r            |
| S           | 83   | 275               | 307 | 339 | 371 | 403 | 435 | 467 | 499 | 115         | s            |
| T           | 84   | 276               | 308 | 340 | 372 | 404 | 436 | 468 | 500 | 116         | t            |
| U           | 85   | 277               | 309 | 341 | 373 | 405 | 437 | 469 | 501 | 117         | u            |
| V           | 86   | 278               | 310 | 342 | 374 | 406 | 438 | 470 | 502 | 118         | v            |
| W           | 87   | 279               | 311 | 343 | 375 | 407 | 439 | 471 | 503 | 119         | w            |
| X           | 88   | 280               | 312 | 344 | 376 | 408 | 440 | 472 | 504 | 120         | x            |
| Y           | 89   | 281               | 313 | 345 | 377 | 409 | 441 | 473 | 505 | 121         | y            |
| Z           | 90   | 282               | 314 | 346 | 378 | 410 | 442 | 474 | 506 | 122         | z            |
| [           | 91   | 283               | 315 | 347 | 379 | 411 | 443 | 475 | 507 | 123         | {            |
| \           | 92   | 284               | 316 | 348 | 380 | 412 | 444 | 476 | 508 | 124         |              |
| ]           | 93   | 285               | 317 | 349 | 381 | 413 | 445 | 477 | 509 | 125         | }            |
| ^           | 94   | 286               | 318 | 350 | 382 | 414 | 446 | 478 | 510 | 126         | ~            |
| _           | 95   | 287               | 319 | 351 | 383 | 415 | 447 | 479 | 511 | 127         | RUBOUT (DEL) |
|             |      | 40                | 41  | 42  | 43  | 44  | 45  | 46  | 47  |             |              |
|             |      | (                 | )   | *   | +   | ,   | -   | .   | /   |             |              |

High Order X & Y

GRAPHIC BYTE CONVERSION CHART (cont)

| Low Order X |     | X or Y Coordinate |     |     |     |     |     |     |     | Low Order Y |              |
|-------------|-----|-------------------|-----|-----|-----|-----|-----|-----|-----|-------------|--------------|
| ASCII       | DEC |                   |     |     |     |     |     |     |     | DEC.        | ASCII        |
| @           | 64  | 512               | 544 | 576 | 608 | 640 | 672 | 704 | 736 | 96          | '            |
| A           | 65  | 513               | 545 | 577 | 609 | 641 | 673 | 705 | 737 | 97          | a            |
| B           | 66  | 514               | 546 | 578 | 610 | 642 | 674 | 706 | 738 | 98          | b            |
| C           | 67  | 515               | 547 | 579 | 611 | 643 | 675 | 707 | 739 | 99          | c            |
| D           | 68  | 516               | 548 | 580 | 612 | 644 | 676 | 708 | 740 | 100         | d            |
| E           | 69  | 517               | 549 | 581 | 613 | 645 | 677 | 709 | 741 | 101         | e            |
| F           | 70  | 518               | 550 | 582 | 614 | 646 | 678 | 710 | 742 | 102         | f            |
| G           | 71  | 519               | 551 | 583 | 615 | 647 | 679 | 711 | 743 | 103         | g            |
| H           | 72  | 520               | 552 | 584 | 616 | 648 | 680 | 712 | 744 | 104         | h            |
| I           | 73  | 521               | 553 | 585 | 617 | 649 | 681 | 713 | 745 | 105         | i            |
| J           | 74  | 522               | 554 | 586 | 618 | 650 | 682 | 714 | 746 | 106         | j            |
| K           | 75  | 523               | 555 | 587 | 619 | 651 | 683 | 715 | 747 | 107         | k            |
| L           | 76  | 524               | 556 | 588 | 620 | 652 | 684 | 716 | 748 | 108         | l            |
| M           | 77  | 525               | 557 | 589 | 621 | 653 | 685 | 717 | 749 | 109         | m            |
| N           | 78  | 526               | 558 | 590 | 622 | 654 | 686 | 718 | 750 | 110         | n            |
| O           | 79  | 527               | 559 | 591 | 623 | 655 | 687 | 719 | 751 | 111         | o            |
| P           | 80  | 528               | 560 | 592 | 624 | 656 | 688 | 720 | 752 | 112         | p            |
| Q           | 81  | 529               | 561 | 593 | 625 | 657 | 689 | 721 | 753 | 113         | q            |
| R           | 82  | 530               | 562 | 594 | 626 | 658 | 690 | 722 | 754 | 114         | r            |
| S           | 83  | 531               | 563 | 595 | 627 | 659 | 691 | 723 | 755 | 115         | s            |
| T           | 84  | 532               | 564 | 596 | 628 | 660 | 692 | 724 | 756 | 116         | t            |
| U           | 85  | 533               | 565 | 597 | 629 | 661 | 693 | 725 | 757 | 117         | u            |
| V           | 86  | 534               | 566 | 598 | 630 | 662 | 694 | 726 | 758 | 118         | v            |
| W           | 87  | 535               | 567 | 599 | 631 | 663 | 695 | 727 | 759 | 119         | w            |
| X           | 88  | 536               | 568 | 600 | 632 | 664 | 696 | 728 | 760 | 120         | x            |
| Y           | 89  | 537               | 569 | 601 | 633 | 665 | 697 | 729 | 761 | 121         | y            |
| Z           | 90  | 538               | 570 | 602 | 634 | 666 | 698 | 730 | 762 | 122         | z            |
| [           | 91  | 539               | 571 | 603 | 635 | 667 | 699 | 731 | 763 | 123         | {            |
| \           | 92  | 540               | 572 | 604 | 636 | 668 | 700 | 732 | 764 | 124         |              |
| ]           | 93  | 541               | 573 | 605 | 637 | 669 | 701 | 733 | 765 | 125         | }            |
| ^           | 94  | 542               | 574 | 606 | 638 | 670 | 702 | 734 | 766 | 126         | ~            |
| _           | 95  | 543               | 575 | 607 | 639 | 671 | 703 | 735 | 767 | 127         | RUBOUT (DEL) |
|             |     | 48                | 49  | 50  | 51  | 52  | 53  | 54  | 55  |             |              |
|             |     | 0                 | 1   | 2   | 3   | 4   | 5   | 6   | 7   |             |              |

High Order X & Y

GRAPHIC BYTE CONVERSION CHART (cont)

| Low Order X |      | X or Y Coordinate |     |     |     |     |     |     |      | Low Order Y |              |
|-------------|------|-------------------|-----|-----|-----|-----|-----|-----|------|-------------|--------------|
| ASCII       | DEC. |                   |     |     |     |     |     |     |      | DEC.        | ASCII        |
| @           | 64   | 768               | 800 | 832 | 864 | 896 | 928 | 960 | 992  | 96          | `            |
| A           | 65   | 769               | 801 | 833 | 865 | 897 | 929 | 961 | 993  | 97          | a            |
| B           | 66   | 770               | 802 | 834 | 866 | 898 | 930 | 962 | 994  | 98          | b            |
| C           | 67   | 771               | 803 | 835 | 867 | 899 | 931 | 963 | 995  | 99          | c            |
| D           | 68   | 772               | 804 | 836 | 868 | 900 | 932 | 964 | 996  | 100         | d            |
| E           | 69   | 773               | 805 | 837 | 869 | 901 | 933 | 965 | 997  | 101         | e            |
| F           | 70   | 774               | 806 | 838 | 870 | 902 | 934 | 966 | 998  | 102         | f            |
| G           | 71   | 775               | 807 | 839 | 871 | 903 | 935 | 967 | 999  | 103         | g            |
| H           | 72   | 776               | 808 | 840 | 872 | 904 | 936 | 968 | 1000 | 104         | h            |
| I           | 73   | 777               | 809 | 841 | 873 | 905 | 937 | 969 | 1001 | 105         | i            |
| J           | 74   | 778               | 810 | 842 | 874 | 906 | 938 | 970 | 1002 | 106         | j            |
| K           | 75   | 779               | 811 | 843 | 875 | 907 | 939 | 971 | 1003 | 107         | k            |
| L           | 76   | 780               | 812 | 844 | 876 | 908 | 940 | 972 | 1004 | 108         | l            |
| M           | 77   | 781               | 813 | 845 | 877 | 909 | 941 | 973 | 1005 | 109         | m            |
| N           | 78   | 782               | 814 | 846 | 878 | 910 | 942 | 974 | 1006 | 110         | n            |
| O           | 79   | 783               | 815 | 847 | 879 | 911 | 943 | 975 | 1007 | 111         | o            |
| P           | 80   | 784               | 816 | 848 | 880 | 912 | 944 | 976 | 1008 | 112         | p            |
| Q           | 81   | 785               | 817 | 849 | 881 | 913 | 945 | 977 | 1009 | 113         | q            |
| R           | 82   | 786               | 818 | 850 | 882 | 914 | 946 | 978 | 1010 | 114         | r            |
| S           | 83   | 787               | 819 | 851 | 883 | 915 | 947 | 979 | 1011 | 115         | s            |
| T           | 84   | 788               | 820 | 852 | 884 | 916 | 948 | 980 | 1012 | 116         | t            |
| U           | 85   | 789               | 821 | 853 | 885 | 917 | 949 | 981 | 1013 | 117         | u            |
| V           | 86   | 790               | 822 | 854 | 886 | 918 | 950 | 982 | 1014 | 118         | v            |
| W           | 87   | 791               | 823 | 855 | 887 | 919 | 951 | 983 | 1015 | 119         | w            |
| X           | 88   | 792               | 824 | 856 | 888 | 920 | 952 | 984 | 1016 | 120         | x            |
| Y           | 89   | 793               | 825 | 857 | 889 | 921 | 953 | 985 | 1017 | 121         | y            |
| Z           | 90   | 794               | 826 | 858 | 890 | 922 | 954 | 986 | 1018 | 122         | z            |
| [           | 91   | 795               | 827 | 859 | 891 | 923 | 955 | 987 | 1019 | 123         | {            |
| \           | 92   | 796               | 828 | 860 | 892 | 924 | 956 | 988 | 1020 | 124         |              |
| ]           | 93   | 797               | 829 | 861 | 893 | 925 | 957 | 989 | 1021 | 125         | }            |
| ^           | 94   | 798               | 830 | 862 | 894 | 926 | 958 | 990 | 1022 | 126         | ~            |
| _           | 95   | 799               | 831 | 863 | 895 | 927 | 959 | 991 | 1023 | 127         | RUBOUT (DEL) |
|             |      | 56                | 57  | 58  | 59  | 60  | 61  | 62  | 63   |             |              |
|             |      | 8                 | 9   | :   | ;   | <   | =   | >   | ?    |             |              |

High Order X & Y

# APPENDIX B

## SPECIFICATIONS

The following specifications for the 4006-1 Terminal are included for information only. These are approximate values and are subject to change without notice.

### Physical Specifications

#### Dimensions

|        |                        |
|--------|------------------------|
| Height | 12.4 inches (31.5 cm)  |
| Width  | 15.1 inches (38.4 cm)  |
| Length | 27.75 inches (70.4 cm) |

|        |  |
|--------|--|
| Weight | 50 lbs (23 kg)<br>60 lbs (27 kg) Shipping weight |
|--------|--|

### Electrical Specifications

|                   |  |
|-------------------|--|
| Power Consumption | 105 watts maximum at 1.1 amps.   |
| Line Voltage      | 115 or 230 volts nominal. Line voltages are strappable within the terminal to select 100, 115, 120, 200, 230, or 240 volts (+5 to -10%). |
| Frequency         | 48 to 440 Hz. When operating on 66 to 440 Hz the input voltage tolerances are $\pm 5\%$ .  |
| Line Fuse         | 1.6 amp (slow-blow) when operating on 100-120 V. 0.8 amp (slow-blow) when operating on 200-240 V.  |

#### NOTE

*The internal +5 volt power supply for the terminal logic is protected by a 2.5 amp fast-blow fuse.*

### Environmental Specifications

|             |  |
|-------------|--|
| Temperature | -40 to +65°C—non-operating<br>+10 to +40°C—operating     |
| Humidity    | 0 to 95% non-condensing                                  |
| Altitude    | To 50,000 feet—non-operating<br>To 15,000 feet—operating |

### Display Specifications

|                     |  |
|---------------------|--|
| Display Area        | 7.5 x 5.625 inches (19.05 x 14.3 cm) quality display area. This provides a display of 35 lines of 74 characters per line in Alpha mode.  |
| Printing Characters | The Terminal has the capability of displaying 63 different characters (upper case only). The characters are printed on a dot matrix with a stored character size of .06 x .114 inches. |
| Cursor              | 8 x 8 matrix which is displayed on the screen in Alpha mode to indicate the next writing position.   |
| Margins             | A left margin is located at the left edge of the quality display area and a center margin is located at center of the quality display area.  |

### Alpha Display Characteristics

|              |  |
|--------------|--|
| Special Keys | SPACE bar (or a space code from the computer) will cause the cursor to move 0.105 inch right. LINE FEED key (or LF from the computer) will move the cursor down 0.168 inch.<br><br>RUBOUT key transmits DEL (ASCII 127 <sub>10</sub> ), does not space or print.<br><br>ALT MODE key transmits the Right Brace (ASCII 125 <sub>10</sub> ), does not space or print.<br><br>BREAK key causes the interface transmit line to go to a spacing condition as long as the key is held. |
|--------------|--|

### Graphic Display Characteristics

|              |   |
|--------------|---|
| Display Area | 1024 (horizontal) x 780 (vertical) addressable points. The terminal will receive 1024 x 1024 points however only 780 of the vertical axis points are visible in the quality display area. |
|--------------|---|

## Appendix B—4006-1 Users

|                     |  |
|---------------------|--|
| Vector Drawing Time | 3.6 ±.2 ms (all vectors)                       |
| Length Error        | 1%   |
| Line Straightness   | Within 0.5% deviation from mean straight line. |

### Interface Specifications

|                |  |
|----------------|--|
| Discipline     | The Interface is a basic serial interface which conforms to EIA Standard RS-232-C. The Interface operates in full-duplex mode with or without computer echoing characters. |
| Data Format    | Serial, Asynchronous ASCII.  |
| Baud Rate      | Transmit and receive baud rates are independently selectable (via rear panel switches) for 75, 110, 150, 300, 600, 1200, 2400, or 4800 baud.                               |
| Line Drivers   | 5 volts or greater (+ and -) at 2 mA increasing to 15 volts (+ and -) at lesser loads. The line drivers will withstand short-circuit to ground.                            |
| Line Receivers | 3 volts (+ and -) nominal with 25 volts (+ and -) maximum. Nominal input resistance is 4.7 kilohms.  |
| Data Formats   |  |
| Transmit       | Start bit (spacing), 8 data bits, and 2 stop bits (marking) Bit 8 is strap selectable for odd or even parity or for marking or spacing.                                    |
| Receive        | Start bit, 8 data bits, one stop bit (minimum).  |

### Miscellaneous Specifications

|   |  |
|---|--|
| Hold Status   | If the terminal receives no data for about 90 seconds (80 ±20) the terminal goes into hold status (dimmed display). The hold status is reset by the receipt of any printing character, or by pressing the SHIFT key, or by DRBUSY. |
| Storage Time  | Up to 15 minutes in view status or up to one hour in hold status.  |
| Lower Case Characters (ASCII 96-127 <sub>10</sub> ) | Printed as upper case (except  , }, ~, and RUBOUT which do not space or print) when received in Alpha mode. Lower case characters are used for vector addressing bits in Graph mode.   |

|            |  |
|------------|--|
| Erase Time | 770 to 1000 msec (approximately 1 second).   |
| Copy Time  | 10 seconds (minimum display busy -DRBUSY time). The total time to complete the copy operation from initiation to copy out is approximately 18 second. Refer to Hard Copy Unit manual for specific times. |

## OPTIONAL HALF DUPLEX INTERFACE SPECIFICATIONS

With the optional Half Duplex interface installed in the 4006-1 all of the Terminal Interface specifications are applicable with the following exceptions.

|                          |   |
|--------------------------|---|
| Disciplines              | The interface allows the terminal to communicate in either full or half-duplex modes. The interface is designed to be compatible with EIA Standard RS-232-A and C. The interface provides the user with the following switch selectable modes:  |
| Full Duplex              | Both the terminal and the computer are able to transmit and receive simultaneously.   |
| Half Duplex Normal       | Standard half-duplex discipline where only the computer or terminal can transmit (or receive) at one time. Line turn-around is controlled by strap selectable characters. Terminal blanking (during turn-around) may be selected by strap option if desired. The half-duplex interface can buffer one keyboard character (while receiving data from the computer) for transmission to the computer as soon as computer transmission has been completed. |
| Half Duplex Supervisor   | In this mode the computer controls line turn-around. The interface alternates between transmit and receive modes until a data or supervisor carrier is detected. The interface then locks into the appropriate receive or transmit mode.  |
| Line Drivers             | 5 volts (+ and -) at 2 milliamps, increasing to not more than +15 and -12 volts at lesser loads.  |
| Supervisor Search Timing | Search inhibit for data carrier detect is typically 300 ms and search inhibit for Supervisor carrier is typically 1.5 seconds.  |