

4106/4107/4109 COMPUTER DISPLAY TERMINALS



4106/4107/4109

COMPUTER DISPLAY TERMINALS

WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested to comply with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the users at their own expense will be required to take whatever measures may be required to correct the interference.

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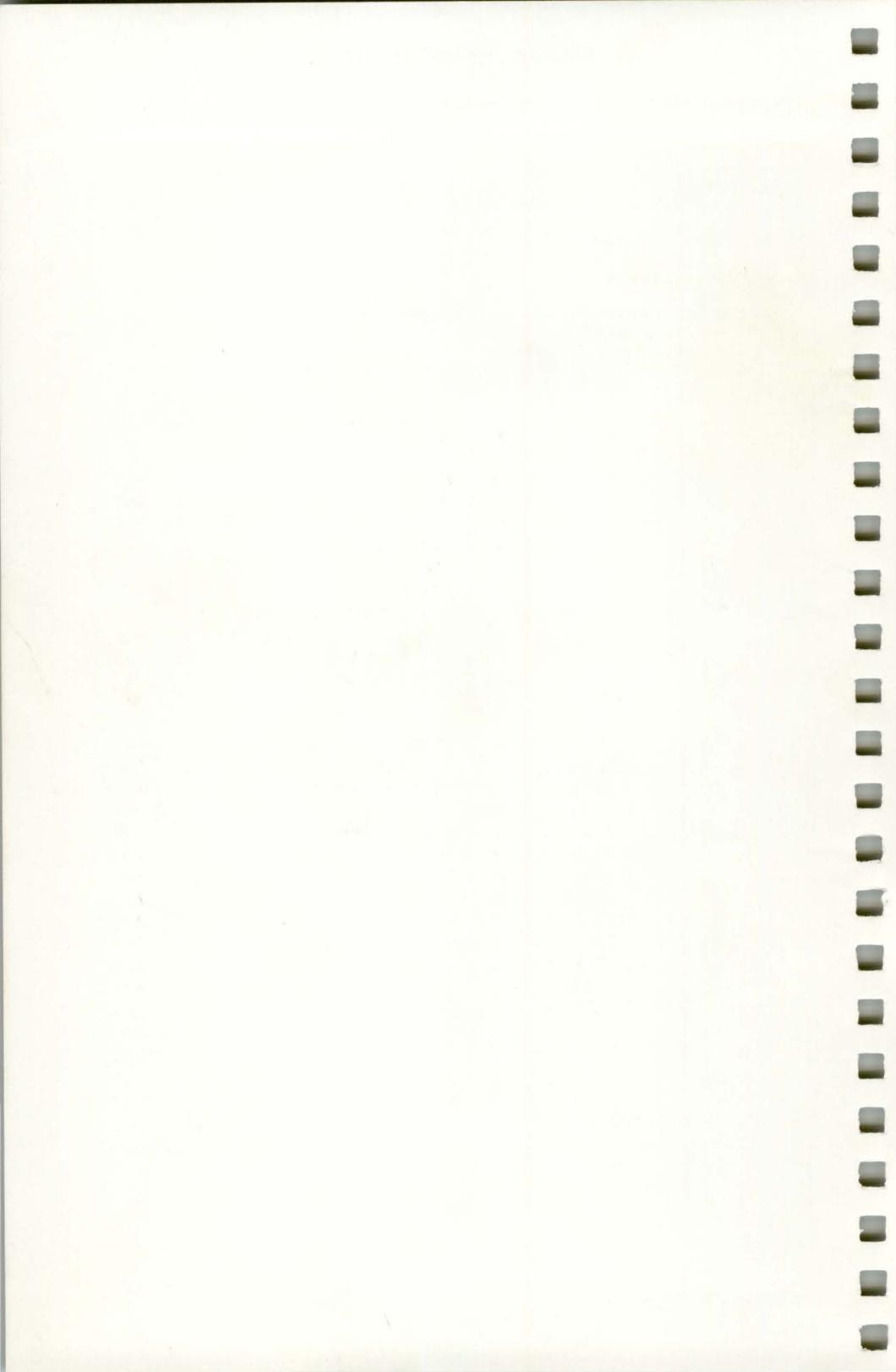
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MANUAL REVISION STATUS

PRODUCT: 4106A/4107A/4109A Computer Display Terminals

This manual supports the following versions of this product: Firmware Version: 1 and up
Current Version: 8

REV DATE	DESCRIPTION
DEC 1983	Original Issue
APR 1984	Revised
JUL 1985	Rewritten to include Version 8 enhancements, including: <ul style="list-style-type: none">• 4510 Rasterizer support• 4691, 4692 support• Monochrome graphics printer support• Segment editing and arcs



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OPERATORS SAFETY SUMMARY

This general safety information is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

TERMS

IN THIS MANUAL

CAUTION statements identify conditions or practices that can result in damage to the equipment or other property.

WARNING statements identify conditions or practices that can result in personal injury or loss of life.

AS MARKED ON EQUIPMENT

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

SYMBOLS

IN THIS MANUAL



This symbol indicates where applicable cautionary or other information is to be found.



Static-Sensitive Devices.

AS MARKED ON EQUIPMENT



DANGER high voltage.



Protective ground (earth) terminal.



ATTENTION — refer to manual.



Refer to manual.

POWER SOURCE

This product is designed to operate from a power source that does not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

GROUNDING THE PRODUCT

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the power input or output terminals. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

DANGER ARISING FROM LOSS OF GROUND

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

USE THE PROPER POWER CORD

Use only the power cord and connector specified for your product.

Use only a power cord that is in good condition.

Refer cord and connector changes to qualified service personnel.

USE THE PROPER FUSE

To avoid fire hazard, use only the fuse specified in the parts list for your product, and which is identical in type, voltage rating, and current rating.

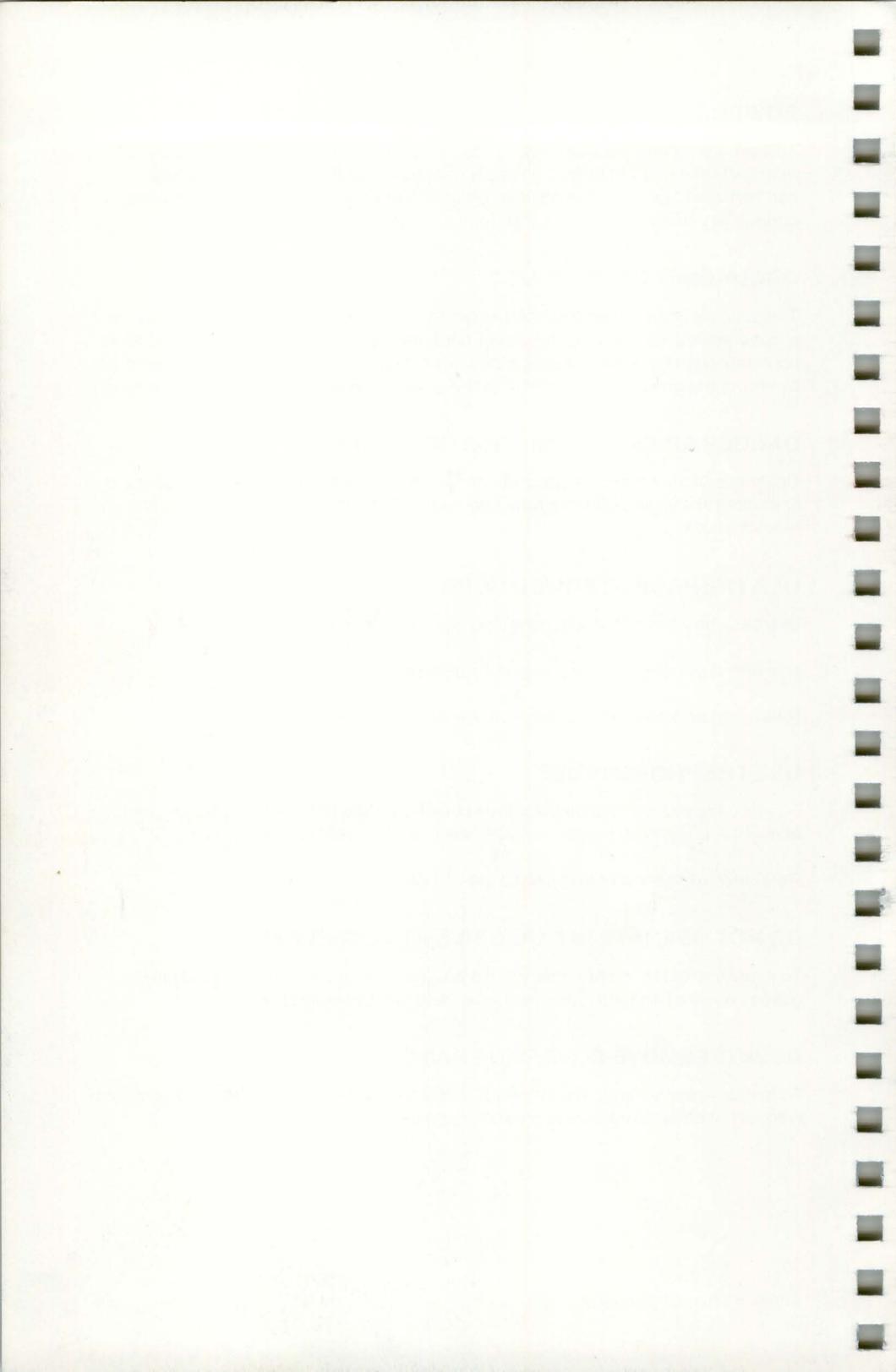
Refer fuse replacement to qualified service personnel.

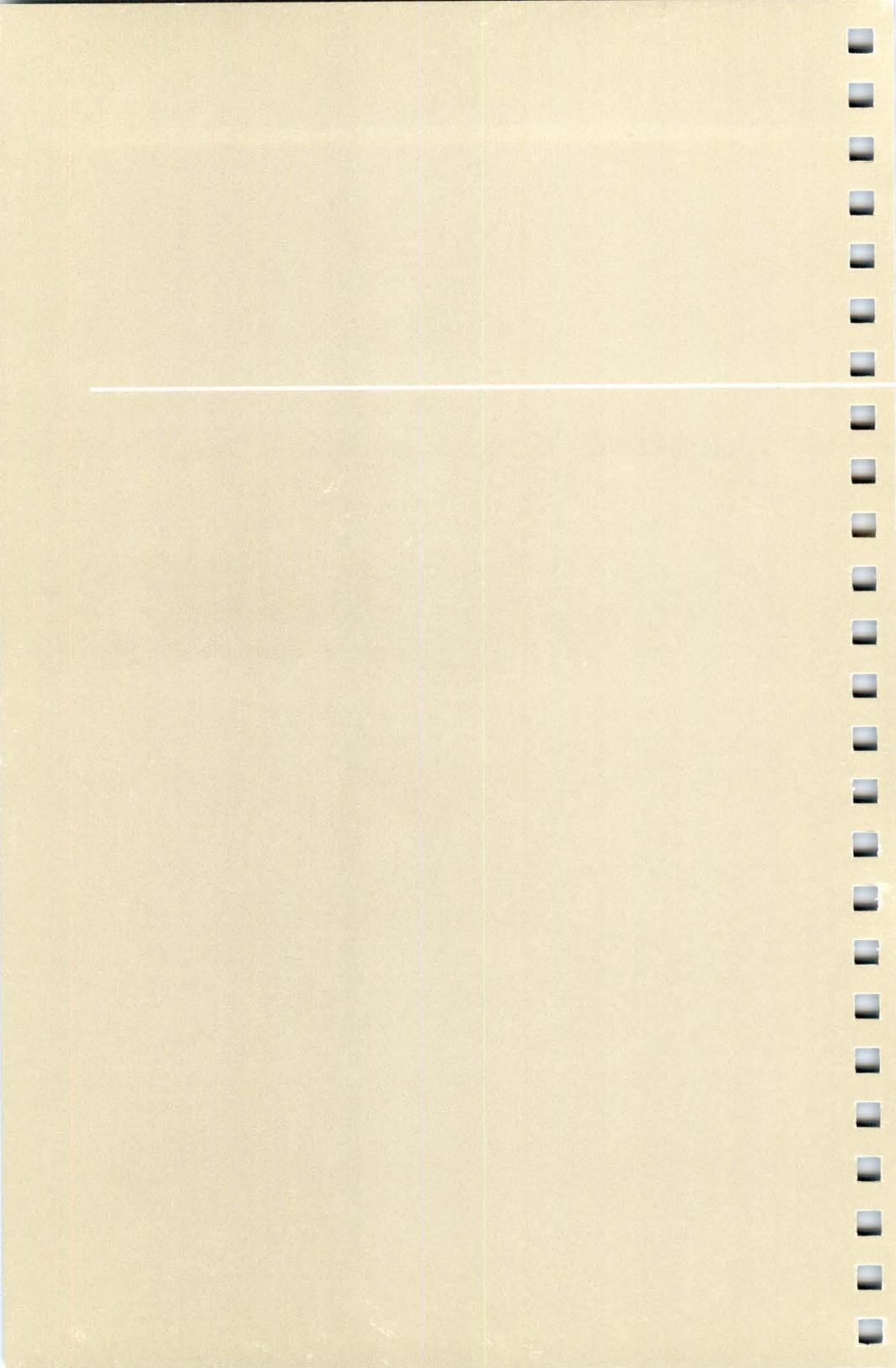
DO NOT OPERATE IN EXPLOSIVE ATMOSPHERES

To avoid explosion, do not operate this product in an atmosphere of explosive gases unless it has been specifically certified for such operation.

DO NOT REMOVE COVERS OR PANELS

To avoid personal injury, do not remove the top covers. Do not operate the product without the covers and panels properly installed.





Section 1

INTRODUCING THE TERMINALS

This manual introduces you to the Tektronix 4106, 4107, and 4109 Computer Display Terminals. It describes the terminals' features and gives you a chance to try some of them out. This manual also tells you how to set up the terminal to communicate with a host computer.

First, let's take a look at how to use this manual. When you see what's in each section, it will be easier for you to find the information you need to use the terminal.

HOW TO USE THIS MANUAL

Section 1 summarizes the terminals' features. Use this section to quickly review the capabilities of the terminal.

The exercises in Section 2 acquaint you with the terminal's features and help you get started with some basic graphics. If you've never used a Tektronix Computer Display Terminal, we suggest that you do these exercises. You don't need to connect the terminal to the host computer to do the exercises.

Section 3 provides cookbook-like procedures for routine tasks you may need to accomplish. It contains detailed instructions for entering and correcting *Setup* commands, and gives handy step-by-step procedures for making hard copies of the display and programming keys.

Appendix A shows you how to unpack and connect the terminal to a host computer and establish the communications link. It also helps you connect copiers and other peripheral devices to the terminal and adjust their settings.

Other appendices of the manual are for reference as needed. Use the Table of Contents or the Index to locate the specific information you require.

After you have used the manual for a while, please fill out one of the reader reply cards (in the front of this manual) and drop it in the mail. Your response will help make future manuals more useful for everyone.

RELATED DOCUMENTATION

The *4106/4107/4109/CX Programmers Reference Guide* accompanying the terminal shows command syntax and condensed descriptions of all commands in a handy pocket-sized guide.

An optional *4106/4107/4109/CX Programmers Reference Manual* contains host programming information and detailed descriptions of all commands. It is intended for programmers who will be writing or maintaining application programs for host computer systems. If you will be programming the terminal, or if you need more information than that contained in this Operators Manual, you will want to order this manual. (See Appendix I for ordering information.)

Service manuals are also available; refer to *Optional Accessories* later in this section.

OVERVIEW OF THE 4106, 4107, AND 4109 TERMINALS

The 4106, 4107, and 4109 Computer Display Terminals are microprocessor-controlled terminals that are specially designed to display color graphics and to edit text. Each terminal consists of two pieces:

- *Display Unit* — The display unit includes the display screen, most of the terminal's electronic circuits, and connectors for the host computer and peripheral devices.
- *Keyboard* — The low-profile keyboard contains ASCII keys, programmable function keys, a numeric keypad, and a multipurpose Joydisk used to scroll text and control the graphics cursor. Snap-down legs on the keyboard adjust its angle.

FEATURES

Briefly, the features of the terminals that help you create, edit, and display color graphics and text are listed here.

User-Friendly Interface

- *Setup* — *Setup* is a special operating mode that lets you enter intelligible English-style commands from the keyboard to control the terminal's operating characteristics.
- *Help* — This easily accessible help facility gives you a quick reference to command names and the kind of parameters they require, all displayed on the terminal screen.
- *Status* — Also easily accessible, the status facility displays the terminal's current settings on the screen; you can check all settings, selected groups of settings, or just one specific setting.
- *Snoopy Mode* — This programming aid for troubleshooting applications programs displays incoming control characters instead of executing them.

High Quality Color

- *Multicolor Palette* — You can display up to 16 colors at a time in your graphics, and up to eight colors in text, chosen from a palette of 64 colors in the 4106 and 4107 terminals, or a palette of 4096 colors in the 4109 terminal.
- *Fill Patterns* — Several dozen predefined patterns that simulate textures and additional colors are available for filling *panels*.
- *Interactive Color Interface* — Special function keys let you enter the Set Color function to select colors and immediately see the affect of your choices in the graphics displayed on the screen.

High Performance

- *Screen Resolution* — 640 × 480 *pixels* (dots of color) on a 13-inch color display screen in the 4106 and 4107 terminals, and 640 × 480 pixels on a 19-inch display screen in the 4109, display graphics with smooth lines and text in sharp focus.
- *Fast Refresh* — A 60-Hz noninterlaced raster-scan display eliminates flicker, resulting in bright colors and a stable image.
- *Addressable Space* — A 4096 × 4096 internal coordinate system provides you with over 16 million addressable data points (specified as xy-coordinates) for defining graphics.
- *Memory* — 256K byte memory in the 4107 and 4109 terminals contains space for *dialog*, *segments*, *fonts*, *macros*, and *views*, including *nonvolatile* memory storage. The 4106 supports all the same features, although it has less memory. You can increase the memory capability of all the terminals by ordering additional memory expansion kits.
- *Pixel Operations* — Control over the color of individual pixels on the screen permits programs to create customized images.
- *Host Communication* — Data transfer rates up to 38.4K baud (bits per per second) display graphics quickly and reduce your communications time.

Versatile Graphics and Text

- *Dual Purpose Display* — A *dialog area* and a *graphics area* let you separate non-graphics text from graphics.
- *Independent Operation* — The separate dialog area lets you edit text without interfering with or obstructing the graphics image. The background of the dialog area can be made transparent, allowing graphics to show through as though the dialog text were printed on a pane of clear glass in front of the graphics.
- *Two Text Column Widths* — Text column widths can be set to either 80 columns or 132 columns. When set to 132 columns, the terminal displays 80 columns at a time, and allows you to scroll the columns horizontally.
- *Scrolling* — Horizontal scrolling permits viewing the entire width of the 132-column text format. Vertical scrolling lets you see parts of the dialog buffer that have been scrolled up out of view.
- *Data Logging* — Dialog text can be automatically sent to both the screen and a printer, providing a hard copy of all dialog between the terminal and the host.
- *Four Graphics Surfaces* — Up to four separate *surfaces* can be used for displaying graphics. Each surface can have its own colors and its own graphics, and can be displayed independently of the others.
- *Programmable Keys* — Most keys can be programmed to generate a sequence of characters (called a *macro*) when pressed.

Powerful Graphics Processing

- *Multiple Views* — Up to 64 separate *views*, each with its own graphics, can be displayed on the screen.
- *Zoom and Pan Keys* — Predefined function keys let you *zoom* in or *pan* across a graphics image to display different portions in more detail.
- *Graphics Input (GIN)* — GIN lets you easily enter graphics data — like locations on a map — required by an applications program. *Gridding*, *inking*, *rubberbanding*, and multiple *GIN windows* aid you in your input task.
- *Segments* — Collections of one or more graphics objects, known as *segments*, can be stored in terminal memory and then copied, moved, scaled, or rotated as a unit, relieving host processing.
- *Graphtext* — Commands allow scaling and rotation of text in the graphics area. *Graphtext font* commands let you define your own font styles for the graphics area.

Graphics Display Support

- *TEK Mode* — This mode of terminal operation lets you run software that uses Tektronix 4100-style and 4010-style escape sequences. Programs written for other Tektronix 4100 and 4110 Series Terminals can be used on a 4106, 4107 or 4109 Terminal with minimal or no modification.

Screen Editing Support

- *ANSI Mode* — This mode of operation supports many common text editing and applications programs using the ANSI 3.64 Standard.
- *EDIT Mode* — This mode of operation supports text editing and applications programs designed for DEC VT100 terminals.
- *VT52 Mode* — This mode of operation supports text editing and applications programs designed for DEC VT52 terminals.

Peripheral Support

- *RS-232-C Ports* — These two ports connect the terminal to several general-purpose devices, including Tektronix 4662 and 4663 Plotters, 4957 and 4958 Graphics Tablets, and the 4510 Color Graphics Rasterizer.
- *COPIER Port* — This port connects the terminal to a Tektronix 4691, 4692, or 4695 Color Graphics Copier for color copying, or for monochrome graphics copying, to a Tektronix 4644 Dot Matrix Printer, a Hewlett-Packard ThinkJet, or other printers that use a Centronics-style parallel interface and Epson FX-80 graphics protocol. You can also make dialog copies on any of these printers or another dot matrix text-only printer that uses a Centronics-style parallel interface.
- *Video Output* — Red, green, and blue signal output on the 4109 permit its use with an external monitor or another compatible imaging device.

Built-In Reliability Checks

- *Self Test* — This built-in program automatically checks the terminal each time you turn it on. In case of a malfunction, the Self Test firmware identifies the defective module.
- *Extended Self Test* — This program, also built into the terminal's firmware, allows you to perform many verification procedures from the keyboard.

Special Features

- *Automatic Screen-Dimming* — The screen automatically dims after five minutes of terminal inactivity to prolong the life of the display screen. You can press any key to restore the display intensity (the Shift key is a good choice, since it does not disturb the display).
- *Nonvolatile Memory* — A special part of terminal memory saves terminal settings and macros, so you don't have to respecify them each time the terminal you turn on the terminal.
- *Answerback* — You can program the terminal to store a password-like string to control access to restricted information. The host uses this this string to verify authorization before releasing information.

STANDARD ACCESSORIES

The following items are delivered with the terminal as standard equipment:

- RS-232-C host port cable (connects the terminal to the host or a modem)
- Power cord¹
- *4106/4107/4109 Computer Display Terminal Operators Manual* (this manual)
- *An Introduction to Computer Color Graphics*
- *4106/4107/4109/CX Programmers Reference Guide*
- Function key overlays (contained in the back of this manual)

OPTIONAL ACCESSORIES

The following optional items can be ordered separately (refer to Appendix I for ordering information):

- *4106/4107/4109/CX Computer Display Terminal Programmers Reference Manual*
- *4106/4107/4109/CX Programmers Reference Supplement* (contains latest enhancements)
- *4106/4107/CX Computer Display Terminal Service Manual*
- *4109/CX Computer Display Terminal Service Manual*
- *13" Display Module Service Manual* (for 4106 and 4107)
- *19" Display Module Service Manual* (for 4109)
- *4106A/4107A/4109A Option 21 Service Manual*
- RS-232 host port loopback connector (used with Self Test)
- COPIER port loopback connector (used with Self Test)
- Alignment graticule (for display unit calibration)

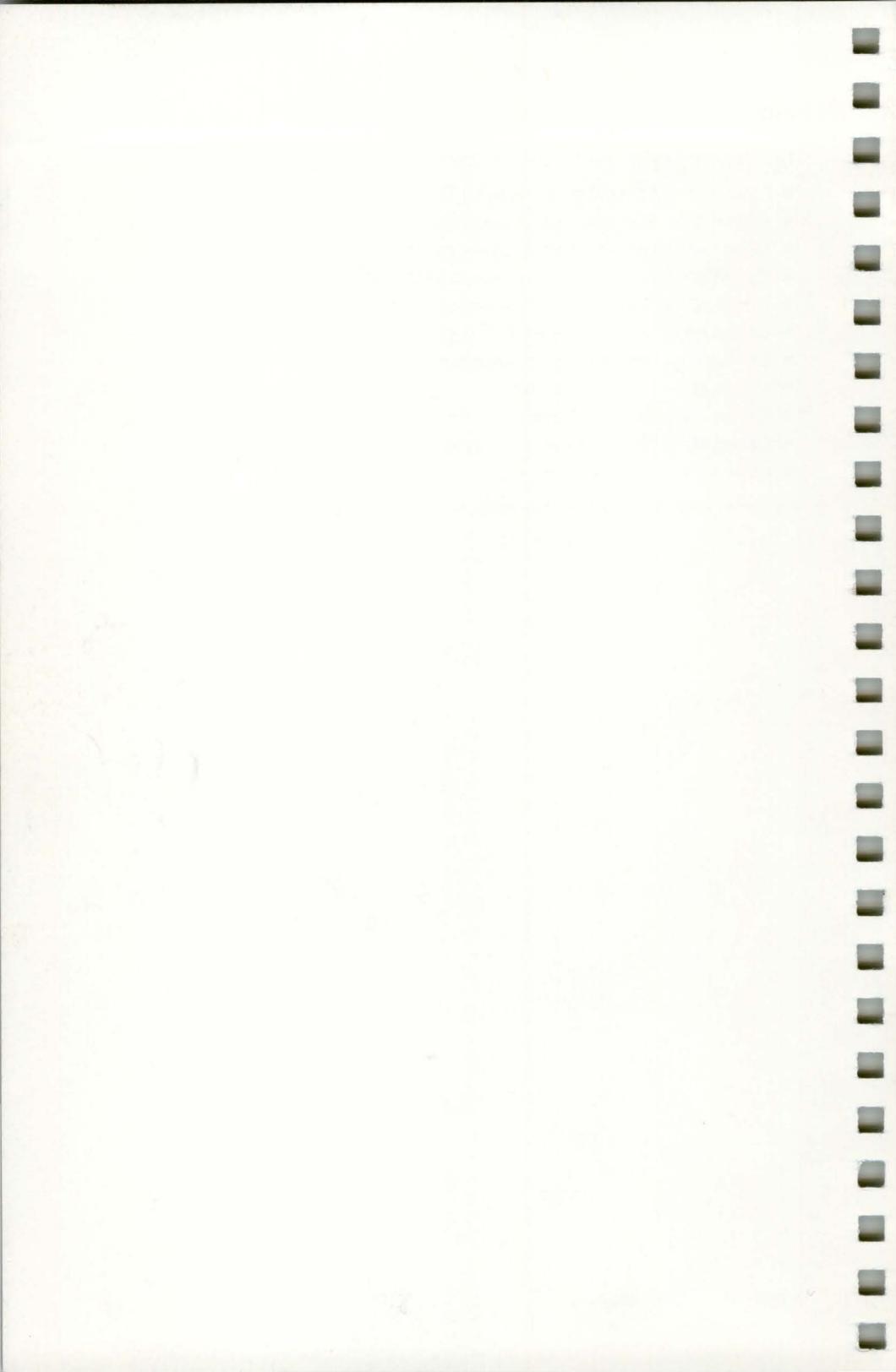
¹ Unless you order an optional power cord or non-USA keyboard, the terminal is shipped with a North American power cord (115 V, 60 Hz) and a North American keyboard. In addition, you can order special European keyboards and power cords.

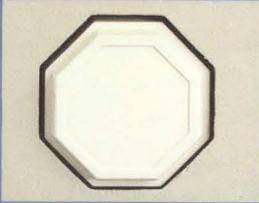
OPTIONS

The terminal can be ordered with the following optional equipment:

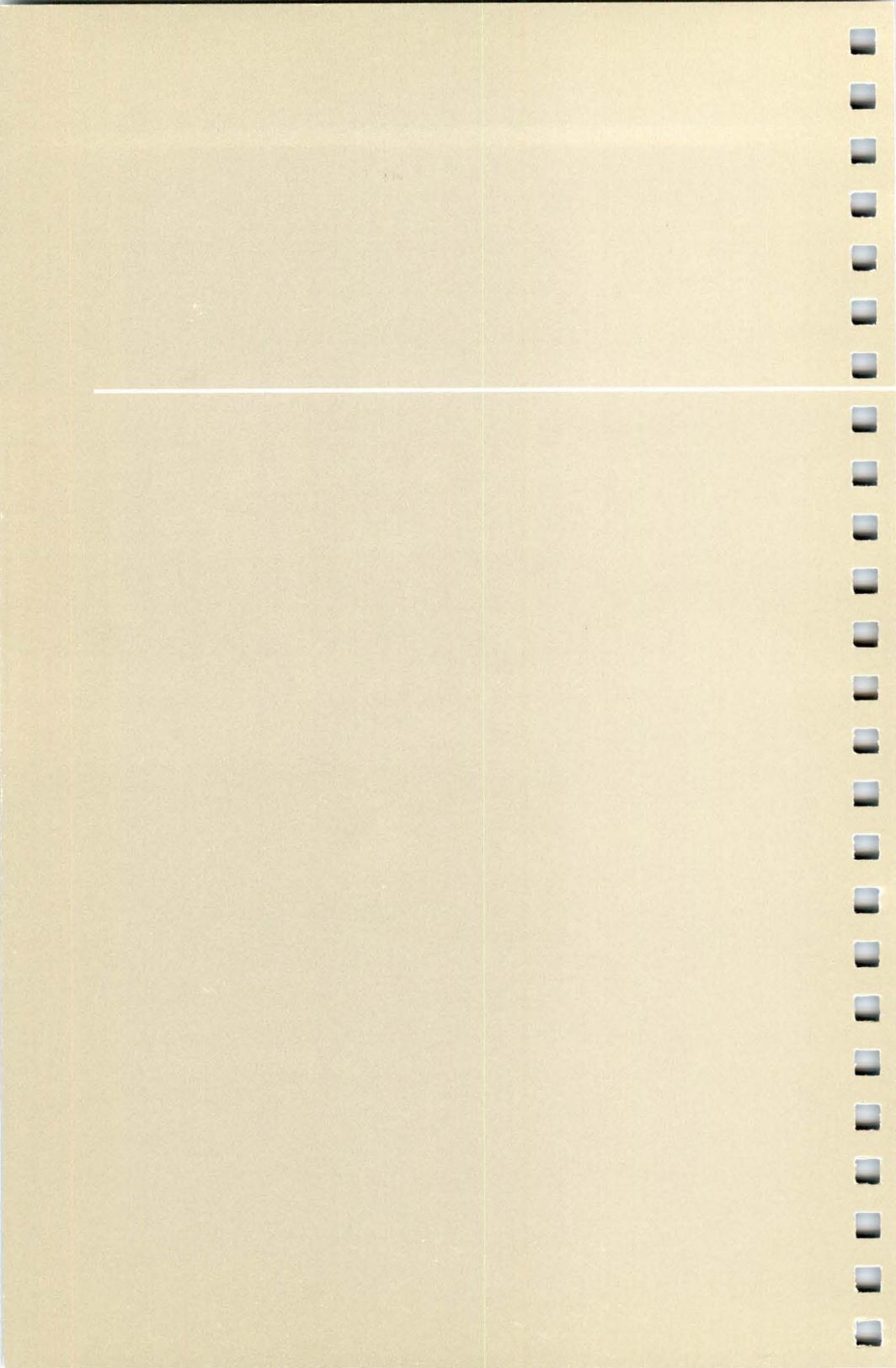
- Option 21 — 1 Megabyte of memory
- Option A1 — European power cord (220 V)
- Option A2 — United Kingdom power cord (240 V)
- Option A3 — Australian power cord (240 V)
- Option A4 — North American power cord (240 V)
- Option A5 — Swiss power cord (240 V)
- Option 4A — United Kingdom keyboard
- Option 4B — French keyboard
- Option 4C — Swedish keyboard
- Option 4F — Danish/Norwegian keyboard
- Option 4G — German keyboard

For information on optional keyboards, refer to Appendix C.





Section 2 GETTING ACQUAINTED WITH YOUR TERMINAL



Section 2

GETTING ACQUAINTED WITH YOUR TERMINAL

This section will help you become familiar with some of the features of your 4106, 4107, or 4109 Computer Display Terminal. You do not need to be connected to a host computer, and if you are, be sure you're not logged in.

Here's what you can expect to learn through these exercises:

- Exercise 1 helps you prepare the terminal to receive commands.
- Exercise 2 teaches you how to enter commands into the terminal.
- Exercise 3 demonstrates the terminal's dialog area and shows you how to get information from the terminal.
- Exercise 4 helps you create graphics on the terminal screen.
- Exercise 5 shows you how to change the colors of the text and graphics on the screen.
- Exercise 6 helps you zoom in on and pan across the graphics displayed on the screen.
- Exercise 7 shows you how to work with graphics input devices if your host program uses *graphics input* (GIN).

Although you can complete the exercises in a single session, it's probably easier to do them in two or more sittings. You should do Exercises 1, 2, and 3 in one sitting; for Exercises 4 through 7, just follow the steps at the beginning of each one, which tell you how to prepare the terminal for that particular exercise. Some exercises will take longer than others, but all seven should require less than two hours of your time.

EXERCISE 1: GETTING READY

This exercise prepares the terminal for use. Always perform these steps if you take more than one session to do the exercises or if you do them out of sequence.

Check to see that the terminal is ready to use. The terminal's power cord should be plugged into a power outlet with the correct voltage, and the keyboard cable should be plugged into the keyboard connector on the rear of the terminal. (If you need help, refer to the *Installation Instructions* in Appendix A.)

One feature you should know about before starting these exercises is the *automatic screen-dimming* feature — when there is no terminal activity for five minutes, the screen automatically dims. This feature prolongs the life of the display surface. To return the screen to normal brightness, press any key (we suggest the *Shift* key because it doesn't disturb the display).

First, turn on and prepare the terminal to receive your commands:

Press the **POWER** button, which is located on the front of the terminal.

(Whenever you must do something in these exercises, the instructions will be highlighted in blue.)

A blinking underline or block, called a *cursor*, will appear on the screen in about fifteen seconds (after the terminal runs its power-up self test — discussed in Appendix A). If you don't see the cursor, adjust the **BRIGHTNESS** knob, located just below the **POWER** button.

Looking at the top row of keys on the keyboard, locate the key labeled *Setup* at the bottom and *Cancel* at the top. When you press this key, it puts the terminal in Setup, or takes it out if it was already in Setup. Setup is a special operating mode that lets you enter intelligible English-style commands from the keyboard — typically to set the terminal's operating characteristics.

Continue by putting the terminal in Setup:

Press the **Setup** key.

Notice that the terminal displays an asterisk (*), immediately followed by the cursor, in the upper-left corner of the screen. The asterisk is the *Setup prompt*, and it tells you that the terminal is ready for your Setup commands.

Locate the Return key on the keyboard:

Press the **Return** key several times.

Notice that each time you press Return, the cursor goes to a new line and redisplay the asterisk, prompting you to enter a command. When you press the Return key, it tells the terminal to execute the command you just entered. Always press the Return key at the end of a command entry.

Now, to make sure these exercises will work as described, put the terminal settings at their *factory default* values. (Factory default values are settings that are predefined in the terminal before it leaves the factory.)

Enter the following command by typing it on the keyboard (you may use uppercase or lowercase letters), and remember to press Return to terminate the command:

FACTORY

The asterisk and the word *FACTORY* disappear from the screen and only the blinking cursor is left in the upper-left corner. This command resets all of the terminal's settings to their factory default values, and takes the terminal out of Setup.

Since the *FACTORY* command took the terminal out of Setup, you'll need to put it back in Setup to continue with the exercise. Go ahead and do that now:

Press the Setup key.

EXERCISE 2: ENTERING COMMANDS

In this exercise, you will learn how to enter commands. But first, we'll look at how to correct mistakes made while entering commands.

CORRECTING COMMAND ENTRY MISTAKES

If you make a typing mistake while entering a command and notice it before pressing the Return key, use the Rub Out key to correct the error, or enter *Ctrl-X* (hold down the Ctrl key while you press and release the X key). Rub Out moves the cursor back while deleting individual characters; Ctrl-X deletes the entire line and returns the cursor to the beginning of the line. Try these two techniques now.

Type in these characters, but *don't press the Return key*:

SATUS DIALOG

Press the Rub Out key to erase each letter in *DIALOG*.

Press the Ctrl-X key combination to erase *SATUS* and return to the beginning of the line.

If you make a mistake and have pressed Return, you may get an error message; don't worry — it's probably just a simple mistake that can be easily corrected. First, enter the command again. Try entering an incorrect command now.

Type in these characters and *press Return*:

STATUS DIALOG

An error message is displayed.

Type in the correct command this time and press Return:

STATUS DIALOG

If you reenter a command and still get an error message, refer to *Correcting Command Entry Errors* in Section 3.

UNDERSTANDING SETUP COMMANDS AND RULES

Each command starts with a *command name* and may include *parameters*. All commands must be terminated by the Return key.

In the command you just entered, *STATUS* is the command name, which describes the command's function — in this case, the function is to obtain the status of the terminal. The word *DIALOG* is a parameter, which is a variable that represents a choice between several options — in this case, the parameter specifies a special group of commands relating to the terminal's dialog area (which you'll learn about later).

Before going on, here are some general guidelines that will help you enter commands during these exercises or at anytime.

- Always end a command entry by pressing the Return key.
- You can enter a command in uppercase, lowercase, or mixed case letters. For example, *STATUS*, *status*, and *Status* are all valid entries. (In this manual, we always use uppercase letters in commands so you can easily distinguish them from the surrounding text.)
- You can shorten command names and parameters to their shortest unambiguous form; for example, *STA* is the same as *STATUS*, but *ST* is not acceptable because other commands start with the letters *ST*. (In this manual, we always use the complete form of a command to avoid confusion.)
- You can use either a comma or a space to separate command parameters. (In this manual, we always use a comma between parameters to make them easier to read.)
- You can omit the parameters from a command if you want to use the *omitted default values* for the parameters. For example, the omitted parameter for *LOCAL* is *YES*; therefore, entering *LOCAL* is the same as entering *LOCAL YES*. The table of Setup commands in Section 4 shows the defaults for all the commands. (The description of 4100-style syntax in your *4106/4107/4109/CX Reference Guide* shows other ways to omit parameters.)

EXERCISE 3: WORKING IN THE DIALOG AREA

In this exercise you will learn about the terminal's dialog area and how to get information from the terminal about its settings.

Think of the terminal's screen as a piece of double-paned glass. On one pane the terminal displays all *dialog* (that is, communication between you and the terminal, such as Setup commands, or between you and an applications program running on a host computer). This "front" pane is called the *dialog area*. (You used the dialog area when you entered the FACTORY and STATUS commands earlier.) The pane behind the dialog area contains the graphics and is called the *graphics area*. (You'll learn about this area in the next exercise.)

The purpose of the dialog area is to keep text that is not part of a graphics image from obscuring the graphics.

CHANGING DIALOG AREA CHARACTERISTICS

You can change several characteristics of the dialog area. For instance one thing you might want to do is make the dialog area invisible so you can see the graphics behind it. Do that now.

Press the Dialog key at the top left of the keyboard.

The text you entered earlier is no longer displayed. If an image were in the graphics area, you could see it without the text interfering.

Now, press the Dialog key again to make the dialog area visible.

You can also decrease or increase the number of lines displayed in the dialog area.

Look at the list displayed on the screen as a result of entering the STATUS command earlier. It occupies a large part of the screen.

To change the size of the dialog area, enter the following commands:

```
DALINES 10  
STATUS DIALOG
```

The first command reduces the number of lines displayed on the screen. The second command gives you dialog area status just as it did before, but this time you can see only ten lines on the screen.

USING THE DIALOG BUFFER AND SCROLLING

The *dialog area buffer*, or simply *dialog buffer*, is a part of the terminal's memory that stores the dialog displayed in the dialog area. After the dialog buffer fills up, the first entries are forced out to make room for subsequent entries.

You can change the size of the dialog buffer to increase or decrease the number of lines it will store. Fewer lines leaves more memory for *segments* (discussed in Exercise 4) and other terminal functions.

Reduce the size of the buffer and fill it by entering:

```
DABUFFER 25  
STATUS
```

The entire list of commands, with their current settings, *scrolls* upward on the screen. The scrolling process is probably too rapid for you to get useful information. So, when the scrolling stops, locate the hexagonal Joydisk in the upper-left corner of the keyboard. Then:

Press the bottom of the Joydisk to scroll some of the previous lines of text back into view.

Notice that you can't scroll all the way back to the beginning of the list. This is because the complete list is too long to fit in the dialog buffer at its current size. Thus, the earliest parts of the status list are not retained, and cannot be redisplayed on the screen.

Now, scroll back to the last line of the buffer:

Press the top of the Joydisk until you see the asterisk prompt.

Now, increase the dialog buffer size to hold more of the status list, and the dialog area to display more lines.

If you have a 4107 or 4109, specify enough buffer lines to hold the entire list by entering:

```
DABUFFER 200
```

If you have a 4106, enter:

```
DABUFFER 49
```

(Because a 4106 has limited memory, you can't set its dialog buffer as large as that of a 4107 or 4109 terminal.)

Now, increase the number of lines displayed and fill the buffer again by entering:

```
DALINES 32  
STATUS
```

Go ahead and use the Joydisk to scroll in both directions through the status list.

When you have finished, scroll to the end of the list so that the asterisk prompt is displayed.

Instead of scrolling, you can stop and start the listing on the screen by using *Ctrl-S* and *Ctrl-Q* after issuing the command. Look at the keyboard and find the *Ctrl* key. (Remember, to enter *Ctrl-S* or *Ctrl-Q*, press the *Ctrl* key and hold it down while you press the *S* or *Q* key — this is similar to holding down *Shift* to enter a capital letter.) Then:

Enter the **STATUS** command once again; but, after you press *Return*, quickly press *Ctrl-S* to halt the listing of the commands. Try it now:

STATUS

To restart the display, press *Ctrl-Q*, but be prepared to halt it once again by quickly pressing *Ctrl-S*.

Press *Ctrl-Q* to finish the display of text.

UNDERSTANDING THE STATUS MESSAGE

You've been using the **STATUS** command to acquaint yourself with some of the basic terminal operations. The **STATUS** command displays the current settings of all the commands that affect the terminal. Take a look at the list the terminal displays when you issue a **STATUS** command:

Ask the terminal for the status of the dialog area:

STATUS DIALOG

Look at the screen and locate the **DALINES** command in the status list. Notice that its setting is **32**, just as you set it in the last **DALINES** command. Any time you need to check the current settings of the dialog area, you can use the **STATUS DIALOG** command as you just did. There are many other commands, however, whose status you may want to check.

Ask for a status list of all Setup commands by entering:

STATUS

Scroll through the list and note how the commands are grouped together.

Getting Status for Specific Groups of Commands

While you were scrolling through the status list you saw that the commands are displayed in groups, called *clusters*. You can get the status of all settings for a specific cluster by using the **STATUS** command with the cluster name as its parameter. That is what you did when you entered **STATUS DIALOG** earlier.

Most commands that share a similar function have the same first two letters. You can also get the status of all these commands by issuing the first two letters as the parameter. For example, if you want to know the status of all hard copy commands, you can use **HC** as the parameter.

Try that now by entering the following command:

STATUS HC

You'll find the **STATUS HC** command useful for checking hard copy settings before you make a copy of the screen. (Section 3 describes how to make copies.)

EXERCISE 4: CREATING GRAPHICS

Normally, you'll create graphics using a host application program, but in this exercise you will create graphics from the keyboard while in Setup. These graphics will then be used in Exercises 5 and 6. (If you are doing this exercise out of sequence, do Exercise 1 first.)

In Exercises 2 and 3 you entered commands in the dialog area and saw the results of your commands in the dialog area. Now, you will enter commands in the dialog area that create color images in the *graphics area*. Remember, the graphics area lies "behind" the dialog area.

PREPARING THE SCREEN FOR GRAPHICS

You'll need to see your commands as you enter them in the dialog area; at the same time, you'll want to see the graphics you are creating in the graphics area. You can see both by decreasing the size of the dialog area so it covers only a small part of the screen.

You can also change the colors of the dialog area to make a more pleasing contrast with the graphics you're going to create.

To accomplish these tasks, enter the following commands:

```
DALINES 5  
DAINDEX 0,3,3
```

The DALINES command reduces the dialog area to five lines, so it now covers less of the graphics area.

The DAINDEX command causes the dialog area to display black text on a green background (you'll learn more about changing dialog area colors in Exercise 5).

UNDERSTANDING PANELS AND SEGMENTS

In working with graphics, you'll see the terms *panel* and *segment*.

- A *panel* is a closed polygon, like a triangle or rectangle, that can be filled with a color or a pattern. A panel normally is used to represent a single unit, such as a piece of furniture or a circuit board element, that is part of a larger graphics display. You will create several panels in this exercise.
- A *segment* is a collection of panels and other elements (including lines, curves, and text) that can be treated as a single object. For example, you could draw a picture of a car's piston as a segment, or you could draw the entire car as a segment.

Even though a segment consists of several distinct elements, you can manipulate it as a complete unit — that is, you can move, copy, rotate, or scale the segment as a whole.

UNDERSTANDING XY-COORDINATES

To enter graphics you will be using *xy-coordinates*. These are locations in the terminal's drawing space, which is 4096 by 4096 points. To create graphics images, you must specify *xy-coordinates* ranging from 0 to 4095 on the horizontal (x) and vertical (y) axes of the screen.

The Graphics Position

The graphics position is the last *xy-coordinate* point specified in a graphics command (in some cases, this point is implied — more on this later). The graphics position becomes the starting point that the terminal uses when executing the next graphics command.

When you turn on the terminal, the graphics position is at the upper-left corner of the screen (0,3071). When drawing an image, the first thing you must do is specify the graphics position — that is, where you want to start drawing. You can do this in a number of different ways, some of which you'll see in this exercise.

CORRECTING ERRORS WHILE DEFINING PANELS AND SEGMENTS

When creating a segment or panel, you might enter a command with parameters that are not what you intended but that are acceptable to the terminal; for example, the color may be wrong or a line draws to the wrong point.

If you notice a wrong parameter before pressing Return, it's easy to correct it using Rub Out or Ctrl-X. But if you have already pressed the Return key, you have two options:

- If the mistake is in a FILLPATTERN command (explained below), and this is the only command you have entered, then simply reenter the command correctly. The latest FILLPATTERN command setting overrides any previous settings.
- If the mistake is in an SGOPEN, BEGINPANEL, DRAW, or CURVE command (explained next), you'll have to delete that segment and begin again. To delete a segment, enter SGDELETE and the number of the segment to be deleted. For example:

SGDELETE 1

In this command, *SGDELETE* with the parameter of *1* deletes Segment 1 and erases it from the screen.

To start over after deleting the segment, you would begin with the *SGOPEN* command (as described next) and reenter the entire sequence of correct commands.

CREATING A PANEL WITHIN A SEGMENT

Begin by creating a segment consisting of a square blue panel, bordered with a white line.

Enter the following sequence of commands exactly as shown:

```
SGOPEN 1  
FILLPATTERN -4  
BEGINPANEL 500,1000,1  
DRAW 2000,1000  
DRAW 2000,2500  
DRAW 500,2500  
SGCLOSE
```

The screen should now look like Figure 2-1.

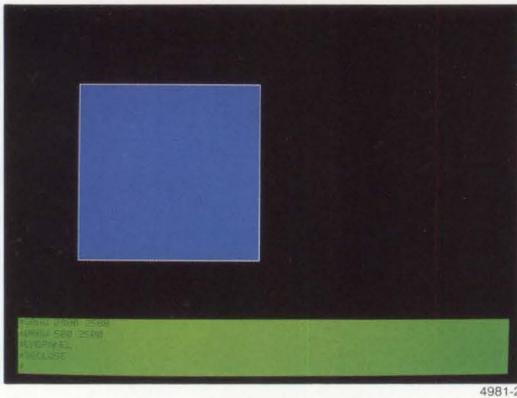


Figure 2-1. Display of One Segment.

Here's what each of these commands did:

- **SGOPEN** begins a segment and labels it with a segment identification number, in this case, Segment 1. All of the commands that follow this **SGOPEN** command continue to define parts of Segment 1 until you enter an **SGCLOSE** command to close the segment definition.
- **FILLPATTERN** selects a predefined pattern or color to fill the interior of each panel you define. This particular command sets the fill pattern to `-4`, specifying a solid blue color. The **FILLPATTERN** command can be issued at any time during a panel definition, but must precede the **ENDPANEL** command.
- **BEGINPANEL** starts a panel definition. The first two parameters specify the graphics position, which is the first corner of the panel — in this case, at xy-coordinate point `500,1000`. The final parameter, `1`, specifies that a border be drawn.
- The three **DRAW** commands continue to outline the panel. **DRAW 2000,1000** draws a line from the first corner (`500,1000`) to the point `2000,1000` on the terminal screen. This point is now the graphics position, and each succeeding **DRAW** command draws a line from the graphics position to the new point specified by the xy-coordinates.
- **SGCLOSE** instructs the terminal to end the panel and close the segment. The terminal draws the last side of the panel and fills it with blue, then closes the segment definition. In this case, because you created a panel, the graphics position is *implied* — the graphics position returns to the point specified in the **BEGINPANEL** command.

CREATING TWO PANELS WITHIN A SEGMENT

Next, you'll draw a red star inside the blue box, using the same sequence of commands for drawing the blue box, but with different parameters. This time, you'll specify that the border not be drawn (by issuing 0 in the third parameter of the `BEGINPANEL` command), so you won't see anything on the screen until you end the panel.

Enter the following sequence of commands:

```
SGOPEN 2
FILLPATTERN - 2
BEGINPANEL 850,1250,0
DRAW 1250,2300
DRAW 1650,1250
DRAW 650,1900
DRAW 1850,1900
ENDPANEL
```

The display should now look like Figure 2-2.

Notice that you did not end the segment being defined, but did issue an `ENDPANEL` command. This closes the panel definition, but leaves the segment open for adding more elements. In the previous sequence of commands, you didn't need an `ENDPANEL` command because the `SGCLOSE` command closed the panel as well as the segment. Once again, the graphics position is implied and returns to the point specified in the `BEGINPANEL` command.

The middle of the star is not filled with red because of the way its boundaries cross. Part of the enclosed space is excluded from the panel definition.



4981-3

Figure 2-2. Box With Star.

Continue defining Segment 2 by adding a rectangle beside the blue square.

Enter the following sequence of commands:

```
FILLPATTERN 6
BEGINPANEL 2500,1000,1
DRAW 3500,1000
DRAW 3500,2500
DRAW 2500,2500
SGCLOSE
```

You've drawn a rectangle and filled it with Pattern 6, a brick-like pattern, as shown in Figure 2-3. (Several dozen fill patterns are available — Appendix H shows each pattern, along with the number used to specify it. You could have used Pattern 15 in the above command by entering *FILLPATTERN 15* instead of *FILLPATTERN 6*.)

Note that the *SGCLOSE* command ends the panel and closes the segment definition. Segment 2 now contains two panels: the star and the rectangle.

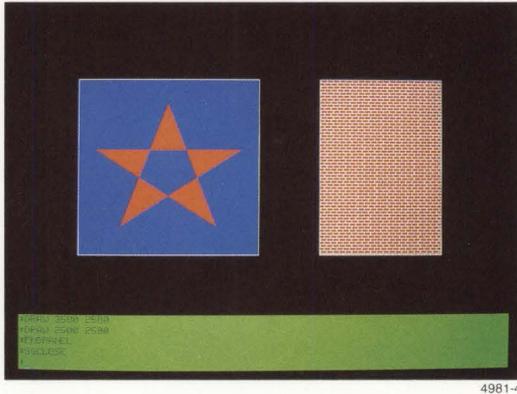


Figure 2-3. Completed Graphics Display.

DRAWING CIRCLES AND CURVES

You can draw simple curves by first specifying the graphics position with the MOVE command, then using the CURVE command with a series of xy-coordinate points.

Watch how the curve is drawn after you enter the CURVE command.

```
MOVE 1000,1000
CURVE ARC,1600,1600,2200,1000,2800,400,3400,1000
```

The MOVE command specified the graphics position. The CURVE command first specified that the type of curve to be drawn is an *arc*, then defined a series of four xy-coordinates through which the curve was drawn.

You can also create full circles using the CURVE command. In this next demonstration, you will create a circle as a panel and fill it with a pattern. This time, the panel will not be part of a segment.

Begin by entering the following command sequence (*without first entering an SGOPE*n command):

```
FILLPATTERN 15
BEGINPANEL 400,2600,1
CURVE ARC,1400,2600,400,2600
ENDPANEL
```

The first two values following *BEGINPANEL* define the graphics position (400,2600). The third parameter (1) specifies that a border be drawn.

The next four values represent two xy-coordinates that the terminal draws through, starting from the graphics position:

- The first two values (1400,2600) specify the first point to draw through — the distance between this first point and the graphics position defines the circle's diameter.
- The next two values (400,2600) specify the same point you specified in the *BEGINPANEL* command — so a circle is drawn.

Since you did not open a segment, this circle is not part of a segment definition.

You can draw other types of curves, which are described in the *4106/4107/4109/CX Programmers Reference Guide*.

UPDATING THE GRAPHICS AREA

Remember that segments are retained in memory. Watch what happens to the curve and circle you just drew when you erase (or, *update*) the graphics area.

Locate the GErAs key (the shifted version of the Dialog key) at the left end of the top row of keys. Now, watch the screen and press GErAs (remember to hold down the Shift key).

The entire display is momentarily erased; then Segments 1 and 2 (the blue panel, star, and bricks) are redrawn. Graphics that are not part of a segment (the circle in this case) are lost, while the graphics that are defined as segments are retained.

CHANGING A SEGMENT'S DISPLAY

Because segments are stored in terminal memory, the terminal can highlight them, make them visible or invisible, and change them in other ways. Because the terminal is unaware of graphics that are not part of segments (like the circular panel), it can't control them once they are displayed.

Segment Visibility

You can remove a segment from the screen without deleting it. By making it invisible, you can redisplay it by just making it visible.

Make a segment invisible by entering:

```
SGVISIBILITY 2,NO
```

Note that the star and brick wall that comprise Segment 2 disappear (Figure 2-4). They are still in the terminal's memory, but are currently invisible.

Now, make the segment visible again by entering:

```
SGVISIBILITY 2,YES
```

Segment 2 is once again displayed on the terminal's screen.

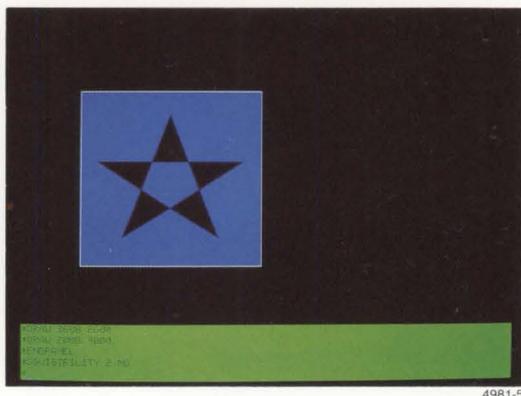


Figure 2-4. Display With Segment 2 Invisible.

Segment Highlighting

You can *highlight* a segment by making it blink on and off. To see the effects of highlighting, first create another segment that is not a panel:

Draw a circle and include it in a segment by entering:

```
SGOPEN 3  
MOVE 400,2600  
CURVE ARC,1400,2600,400,2600  
SGCLOSE
```

This circle is part of a segment because you opened a segment (with *SGOPEN 3*) before you issued the rest of the commands. Since the circle is not a panel, notice that a *MOVE* command rather than a *BEGINPANEL* command specified the graphics position, that is, the circle's beginning point.

Now, highlight Segment 3 by entering:

```
SGHIGHLIGHT 3,YES
```

The circle begins to blink.

Now turn off Segment 3 highlighting and delete Segment 3 by entering:

```
SGHIGHLIGHT 3,NO  
SGDELETE 3
```

The part of the blue square where the circle overlapped was erased when you deleted Segment 3, the circle. To redisplay the square in its entirety, update the screen so the terminal redraws the segments.

Press the *GERas* key.

In Exercise 6, you will see how the terminal can manage segments in other ways. Other terminal segment operations are usually directed by an applications program, so are not described in this manual.

GETTING DIALOG OUT OF THE WAY OF GRAPHICS

Suppose you want to see 22 lines of dialog at a time, but still want to see the graphics behind it. Here's how you can do that:

Increase the size of the dialog area to 22 lines by entering:

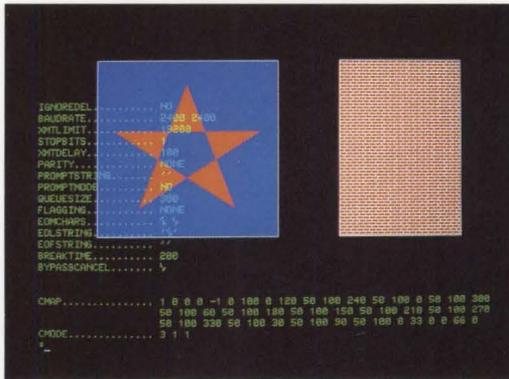
DALINES 22

Notice that the dialog area now covers most of the screen, including the graphics.

Now, change the dialog area text color and make the background transparent, then issue STATUS to see the effect:

DAINDEX 3,0,0
STATUS

As the status list scrolls up, the graphics images show through the dialog area, as though the dialog text were written on a pane of clear glass in the foreground. The display should now look similar to Figure 2-5.



4981-8

Figure 2-5. Display With Transparent Dialog Area.

Another way to get dialog out of the way of graphics is to press the Dialog key, as you did in Exercise 3. Do that again.

Press the Dialog key.

The dialog area disappears and the graphics image is completely visible. This is useful when you want a copy of the graphics that is free of dialog text. (Section 3 tells you how to make a copy.) After the copy is done, you would make the dialog area reappear by pressing the Dialog key again. Go ahead and do that now.

Press the Dialog key.

EXERCISE 5: USING COLOR

In this exercise you will learn to change colors using the terminal's Interactive Color Interface. (If you are doing this exercise out of sequence, do Exercise 1, then do the steps in *Creating a Panel Within a Segment* and *Creating Two Panels Within a Segment* in Exercise 4.)

UNDERSTANDING COLOR INDICES

Every color you can display is identified by a number called a *color index*. To select a color for text or a graphics element, you assign a color index to it.

Before creating your graphics in Exercise 4, you used the command `DAINDEX 0,3,3` to select the color indices for the dialog area. These indices specified black text (Index 0), in green *character cells* (Index 3), on a green background (Index 3). (A character cell is the rectangular area surrounding each character.)

Later, to let your graphics show through the dialog area, you changed the dialog area color indices to display green characters (Index 3), in transparent character cells (Index 0), on a transparent background (Index 0).

In both of these cases, when you changed colors, you specified a new index number. The colors assigned to each index are:

0 — Transparent	3 — Green	6 — Magenta
1 — White	4 — Blue	7 — Yellow
2 — Red	5 — Cyan	

UNDERSTANDING COLOR DEFINITIONS

The *Set Color* function offers another way to change colors. Instead of changing index numbers, you can change the *color definition* assigned to an index. For example, you could change the color definition assigned to Index 2 from red to yellow; then, every part of an image that uses Index 2 would become yellow.

Using the *Set Color* function, you change colors by using special function keys, rather than entering commands.

The *Set Color* function gives you three methods for changing color definitions. In this exercise you will use all three methods so you'll be familiar with the advantages and limitations of each one. Here's what you'll learn in this exercise:

- First, you'll learn how to change a color definition by replacing it with a color definition chosen from a color menu.
- Second, you'll learn how to change a color definition by changing its *hue*, *lightness*, and *saturation* (HLS) values.
- Third, you'll learn how to display the terminal's complete color map and modify any color definition shown there.

You'll see that in all methods the color changes, but the index number remains the same.

ENTERING THE SET COLOR FUNCTION

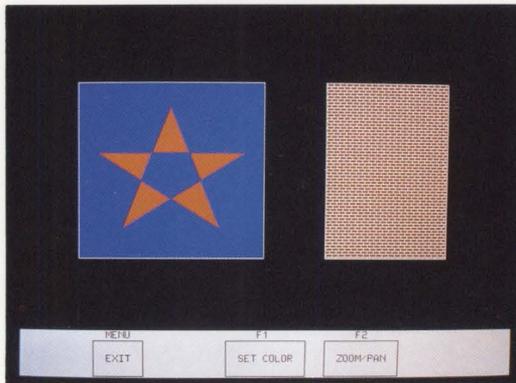
The Menu key gives you access to:

- The *Set Color* function, the terminal's feature that allows you to interactively select colors
- The *Zoom/Pan* function (discussed in Exercise 6)

Locate the Menu key in the middle of the row of function keys along the top of the keyboard. Then:

Press the Menu key.

You'll see a menu displayed on the screen (Figure 2-6). Notice that the dialog area temporarily disappears.



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Figure 2-6. Menu Key Display.

While you're working with the Set Color function, you can't communicate with the host computer. If you exit the Set Color function (by pressing the Menu key again), it will redisplay the text previously displayed in the dialog area and resume communication with the host.

The Set Color Banner

When you press the F1 key it invokes the Set Color function. You will see a flashing message on the screen that says, "**Press S ERas key to erase screen and display current colors.**" However, at this point in the exercise, *do not press S ERas now.*

Go ahead and activate the Set Color function:

Press the F1 key.

Do *not* press S ERas.

(If you inadvertently press another key at this point, simply press the Menu key twice, then the F1 key to access the Set Color function.)

Notice the banner displayed across the bottom of the screen (Figure 2-7).

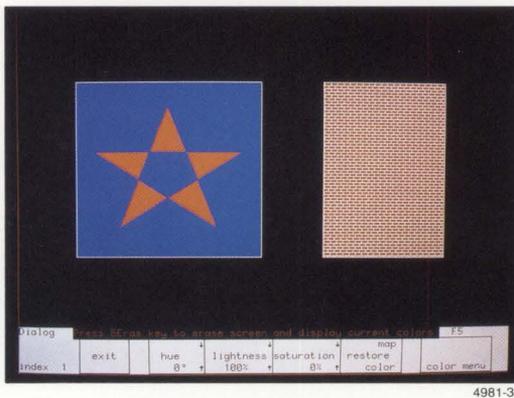


Figure 2-7. Set Color Banner.

Now that you have selected the Set Color function, the terminal responds only to these keyboard keys:

- Function Keys F1, F2, F3, F4, and F5, whose purposes are identified in the banner
- The Joydisk, which you'll use to move the crosshair cursor to select colors
- The Cancel and Menu keys, which you use to exit Set Color
- The SCopy and DCopy keys, which you can use to copy the current colors assigned to indices

Next:

Press the upper-right part of the Joydisk.

The "Press SEras . . ." message disappears and the entire Set Color banner is now visible.

The Crosshair Cursor

At this time, you'll also see a set of perpendicular lines appear on the screen. These form the *crosshair cursor*, which you'll use while working with the Set Color function.

You can use the Joydisk to move the crosshair cursor around on the screen and select items to be changed. Position the intersection over the item you want to select.

Go ahead and try moving the crosshair cursor around now:

Press and hold down different sides of the the Joydisk to see how it controls the motion of the crosshair cursor.

Then, try holding down the Shift key while you press the Joydisk.

Notice that using the Shift key along with the Joydisk slows down the motion of the crosshair cursor for more precise control.

USING THE COLOR MENU

The terminal can display a menu of nine predefined colors. To choose a color from the color menu, you first select the item whose color you want to change, then you select a new color from a list of nine predefined colors. Pressing Function Key F5 displays the colors that you can select. Try it now:

Use the Joydisk to move the crosshair cursor to the red star.

Take a few moments to examine the banner at the bottom of the screen. Notice the word *Graphics* at the left end of the banner. This indicates that the crosshairs are in the graphics area. Below this is a small square of red and the label *index 2*. The small red square is a sample of the color the cursor is on, and the label tells you the color is Index 2.

Continuing on now:

Press the F5 key and hold it down.

The list of nine color names is displayed beside the crosshairs, as shown in Figure 2-8a, and the message, “**Hold F5 down and place crosshairs over the color desired**” appears at the top of the banner.

While holding down F5 with one hand, press the Joydisk with your other hand to move the intersection of the crosshair cursor into the color menu. Then move the cursor up and down within the color menu.

Notice that the color of the star changes to the color selected by the cursor. At the bottom of the screen, the small colored square in the banner also changes to the selected color and informs you of the color's index number. Next:

Move the cursor to the color name *green*, as shown in Figure 2-8b. Then, release the Joydisk and the F5 key.

The star remains green because that is the color name the cursor was on when you released F5. The list of color names disappears.

You have just used the color menu to change the color definition of Index 2 from red to green. Notice that the bricks also changed to green because they also use Index 2. When you change the color definition of a color in the graphics area, all occurrences of that color are changed.

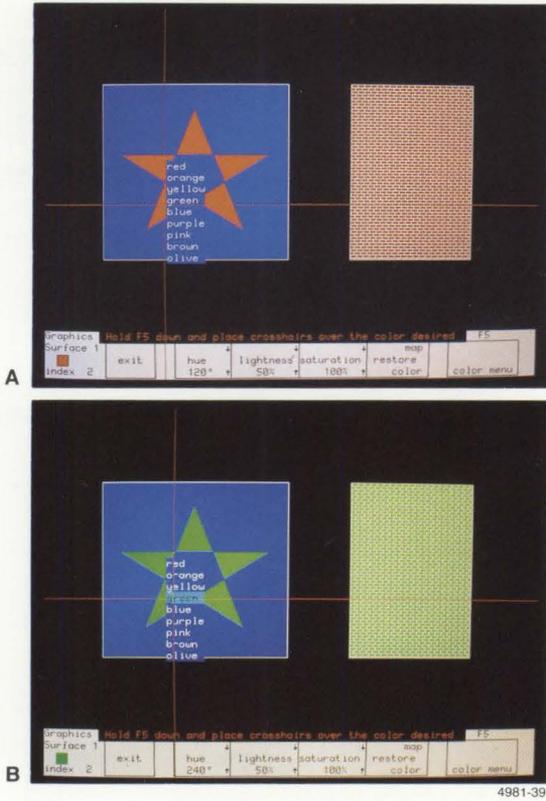


Figure 2-8. Using the Color Menu.

You now have these options:

- Without moving the crosshairs, press F4 to restore the color you just changed to its previous color definition.
- Change more colors by repeating the previous steps.
- Press the Menu key to exit the Set Color function. This automatically saves the new color for Index 2.

For these exercises, use the first option — return the star to its original color:

Press F4.

CHANGING HLS VALUES

Colors are defined by a mixture of *hue*, *lightness*, and *saturation* (HLS) values. (Refer to the *Tektronix Color Standard* in Appendix G for an illustration of the HLS color coordinate system.) This part of the exercise will show you how to change a color by changing its HLS values.

Because you are still in the Set Color function, the crosshairs and banner are already displayed on the screen. If you weren't already in the Set Color function, you would simply press the Menu key followed by F1, which would display the banner and crosshairs.

Continue by selecting an item on the screen:

Move the crosshair cursor to the blue square.

Look at the banner at the bottom of the screen (Figure 2-9). The small blue square shows the color the cursor is on, and the label tells you the color is Index 4.

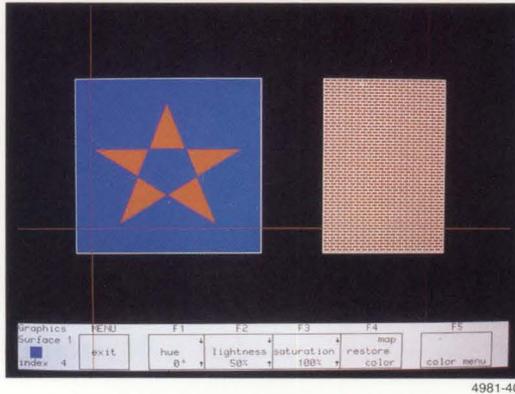


Figure 2-9. Identifying Current Colors.

The rest of the banner tells you what the function keys do. Since the terminal defines each color in terms of HLS values, you can change a color by changing these values. The boxes labeled *hue*, *lightness*, and *saturation* show the values for the color the cursor is on. The labels *F1*, *F2*, and *F3* above the boxes indicate which key to press to change each value.

NOTE

The displays for this exercise were prepared using a 4109 Terminal. Because the 4109 can display a wider range of color, the HLS values for a 4106 or 4107 are different than those for the 4109. We've included the values for the 4106 and 4107 as well as those we used on the 4109.

Try changing the hue:

Press F1 (hue) five or six times.

Notice that each time you press and release the key, the color of the box changes and the hue value changes — by 4° on the 4109, and 10° on the 4106 or 4107. The degrees indicate where you are in the color coordinate system.

Continue changing the hue:

Press and hold F1.

The hue value continues to increase by set increments and wraps around to zero when it passes 360°. You can watch the box on the screen go through the full range of hues in concert with the change in hue values. Now, try this:

Press Shift-F1 (hold down the Shift key and press F1).

Note that pressing F1 increases the hue value and pressing Shift-F1 decreases the hue value. You can change the lightness and saturation values in a similar fashion with the F2 and F3 keys.

Table 2-1 shows what each Set Color function key does when you press it. Experiment with changing HLS values by pressing Keys F1, F2, F3 and their shifted versions.

Table 2-1
SET COLOR FUNCTION KEYS

Key	Action
F1	INCREASE HUE. Increases hue by 10° in the 4106/4107, and by 4° in the 4109.
Shift-F1	DECREASE HUE. Decreases hue by 10° in the 4106 or 4107, and by 4° in the 4109.
F2	INCREASE LIGHTNESS. Increases lightness by 10 units in the 4106 or 4107, and by 3 units in the 4109.
Shift-F2	DECREASE LIGHTNESS. Decreases lightness by 10 units in the 4106 or 4107, and by 3 units in the 4109.
F3	INCREASE SATURATION. Increases saturation by 25 units in the 4106 or 4107, and by 10 units in the 4109.
Shift-F3	DECREASE SATURATION. Decreases saturation by 25 units in the 4106 or 4107, and by 10 units in the 4109.
F4	RESTORE COLOR. Restores the HLS values before the last cursor movement. If the cursor has not moved since the colors have changed, F4 restores the color; if the cursor has moved, there is no effect.
Shift-F4	RESTORE COLOR MAP. Restores all color settings to their values before you entered Set Color function.
F5	COLOR MENU. Displays a menu of nine predefined colors that you can select with the crosshair cursor.

When you started this exercise the box on the screen was blue (hue 0°, lightness 50%, and saturation 100%). Change the box to brown by changing Index 4 to HLS values of 150,30,100:

Use F1 to set the hue to 152° on the 4109, or 150° on the 4106/4107.

Use F2 to change the lightness to 32% on the 4109, or 30% on the 4106/4107.

Leave the saturation at 100%.

You have just changed the color definition of Index 4 in the graphics area to brown, so the terminal screen should now look like Figure 2-10.

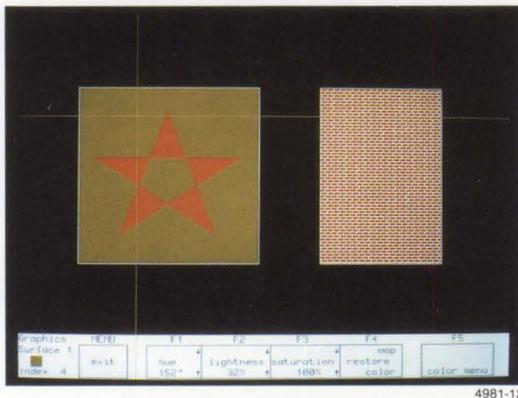


Figure 2-10. Display With Modified Color.

At this point you have several options. Among them, you could:

- Without moving the crosshairs, press F4 to restore the original color.
- Move the crosshairs to another color and modify it by changing the HLS values, or using the color menu (key F5).
- Press the Menu key to exit from the Set Color function, which saves any colors you changed.

For these exercises, use the third option:

Press the key labeled Menu at the top of the keyboard.

This causes the terminal to exit from the Set Color function and save brown (HLS 150,30,100) as the color definition assigned to Index 4. Now, whenever you specify Index 4, it will be brown. (Color definitions are saved until you turn off the terminal or modify the colors again.)

USING THE COLOR MAP

Another way to change colors is to modify the *color map* — the part of terminal memory that stores the color definition for all indices. When you use this method, the terminal displays each index along with its current HLS settings.

The terminal has eight predefined color definitions for the dialog area and 16 for the graphics area. It assigns each of these color definitions to a color index and displays them on the color map.

To use this method you must erase the screen. But first, activate the Set Color function:

Press the Menu key.

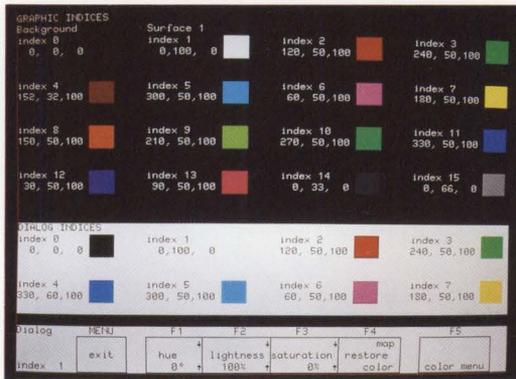
Press the F1 key.

Do not move the crosshairs.

In the first method you moved the crosshairs immediately after activating the Set Color function. In this method, you'll start by erasing the screen to display the color map. Go ahead and do that now:

Press the S ERas key.

The display shown in Figure 2-11 appears on the screen. The screen is divided into three areas: the graphic indices color map, the dialog indices color map, and the Set Color function banner. The color maps show the 16 graphics indices and the eight dialog indices along with the HLS values and color samples for each index.



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Figure 2-11. Complete Color Map.

The rest of this method uses the same procedures you have already learned:

- First, press the joydisk to move the crosshair cursor to the color you want to change.
- Then, use keys F1, F2 and F3 or the color menu to change the color.

As you're selecting colors to change, remember that you can slow down the speed of the crosshairs by pressing Shift while you press the Joydisk.

Go ahead now and change some color definitions by following these steps:

1. Position the crosshair cursor over the square sample of Index 3 in the *DIALOG INDICES* area in the lower part of the screen.
2. Use F1 to change the hue to 132° on a 4109, or 130° on a 4106/4107, which results in red for Color Index 3 in the dialog area.
3. Position the cursor over the square sample of Index 2 in the *GRAPHIC INDICES* in the upper portion of the screen.
4. Use F1 to change the hue value to 180°, which results in yellow for Index 2 in the graphics area.
5. Position the crosshair cursor over the square sample of Index 4 in the *GRAPHIC INDICES* in the upper area of the screen.
6. Press and hold down F5 to display the list of color names, and then use the cursor to select "olive" for Index 4 in the graphics area.
7. Release F5.

You may now do one of the following:

- Press Shift-F4 to restore all colors to the HLS values they had when you activated the Set Color function.
- Without moving the crosshairs, press F4 to restore the color you just changed to its previous color definition.
- Press the Menu key to exit the Set Color function, and save the new colors you just defined.

For these exercises, use the last option:

Press the Menu key to exit the Set Color function and save your colors.

When you define colors, you'll notice that a range of HLS values result in a single color. For example, HLS values of 100°, 30%, and 100% will result in the same red color as the HLS values of 120°, 30%, and 100%. This happens because you can specify a greater number of HLS values than there are colors that the terminal can display.

Remember that how a given color is perceived depends on a number of factors, including how much of the color is displayed and which colors surround it.

After changing colors, you may want to make a hard copy of the color map to show the current color assigned to each index. Use the SCopy key.

EXERCISE 6: USING THE ZOOM/PAN FUNCTION

This exercise introduces the terminal's Zoom/Pan feature. (If you are doing this exercise out of sequence, do Exercise 1, do the steps of *Creating a Graphics Image* in Exercise 4, and do the steps of *Using the Color Map* in Exercise 5.)

To fit on the terminal screen, a large image may have to be reduced so much that you can't see its detail. The Zoom/Pan functions let you select a portion of a displayed image and expand it to reveal more of its detail.

This exercise will help you:

- Use *Zoom* to expand a portion of the graphics image.
- Use *Pan* to move around the graphics image.
- Use general-purpose viewing functions to update or restore the graphics image or to select a view.

ENTERING THE ZOOM/PAN FUNCTION

Remember from Exercise 5 that the Menu key gives you access to both the Set Color function and the Zoom/Pan function. To enter the Zoom/Pan function:

Press the Menu key.

Press the F2 key.

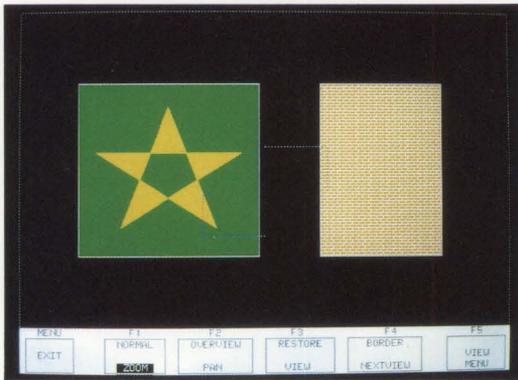
(If you inadvertently press the F1 key, press the Menu key twice, then the F2 key.)

When you enter the Zoom/Pan function, Setup is terminated. You can still work with your host, and all keys except F1 through F5 retain their normal function.

The terminal now displays the Zoom/Pan menu as a banner across the bottom of the screen, as shown in Figure 2-12. This menu shows the unshifted and shifted functions of each of the F1 through F5 keys: the unshifted key function is at the bottom of each box in the menu, and the shifted key function is at the top.

Note the *framing box* (dotted border) displayed around the entire graphics area. This framing box represents a *window* onto your image. When you enter Zoom, the window is at its default size.

Inside the framing box and towards the center of the screen is a pair of dotted brackets that form opposite corners of a rectangle. These brackets and the word **ZOOM** highlighted in the menu indicate that Zoom is active.



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Figure 2-12. Zoom/Pan Menu.

USING THE ZOOM FUNCTION

You can increase or decrease the size of the framing box to select how much of the image you want to be displayed. The larger you make the framing box, the farther away the image appears — more of the image is visible, but with less detail. The smaller you make the framing box, the closer the image appears — less of the image is visible, but with more detail.

Try exploring some of the uses of the framing box to zoom in and zoom out on displayed graphics:

Press on the top or on the right of the Joydisk.

The framing box decreases in size.

Press on the bottom or on the left of the Joydisk.

The framing box increases in size.

Use the Joydisk to decrease the framing box until it includes only part of the box and star.

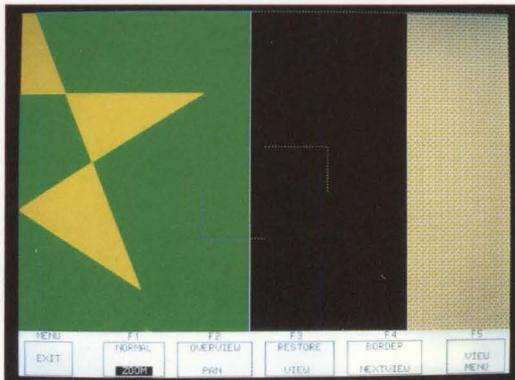
Press F3 to update the view.

The terminal redraws the image that was in the framing box, expanding it to fill the entire graphics area (Figure 2-13). Note that the framing box once again surrounds the entire graphics area. If you can't see the framing box, turn up the brightness (use the BRIGHTNESS knob).

Now, press on the left or bottom of the Joydisk to increase the size of the framing box.

The dotted border disappears, and the pair of dotted brackets expands until most of the screen is included.

Press F3 again to display the image in the zoomed-out larger window.



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Figure 2-13. Display After Zooming and Updating the View.

You can zoom out until you see the entire image on the screen.

Press the top of the Joydisk to reduce the size of the framing box.

Press F3 to update the view.

Now, press the Shift-F2 key combination to display the image in the original window.

Notice that the framing box is reduced to include only the area it encompassed before you restored the original display. This helps you switch back and forth between an expanded image and the original image:

Press the F3 key and you see the expanded image again.

Press the Shift-F2 key combination and you see the original image.

If you want to return to the original image *and* the original framing box, press Shift-F2, then press F1 twice.

Reshaping The Framing Box

During Zoom, you can change the shape of the framing box by simultaneously pressing the Ctrl key and the Joydisk. In the previous examples, when you used the Joydisk to increase or decrease the size of the framing box, the *aspect ratio* (ratio of length to width) of the framing box remained the same.

You can increase or decrease one dimension of the framing box without changing the other dimension. Try it now:

Press and hold down the Ctrl key while you press the top of the Joydisk.

Press F3 to update your view.

You have *decreased* the height of the framing box (which increases the height of the segments in the framing box, as illustrated in Figure 2-14a).

Press Shift-F2 to display the image in the default window; notice the aspect ratio of the framing box.

Press Shift-F1 to restore the original framing box aspect ratio.

Press the Ctrl key and the bottom of the Joydisk to *increase* the height of the framing box.

Press the F3 key to see the results of your changes (illustrated in Figure 2-14b).

Press the Ctrl key and the left side of the Joydisk to *increase* the width, or press the Ctrl key and the right side of the Joydisk to *decrease* the width.

Press the F3 key to see the results of your changes.

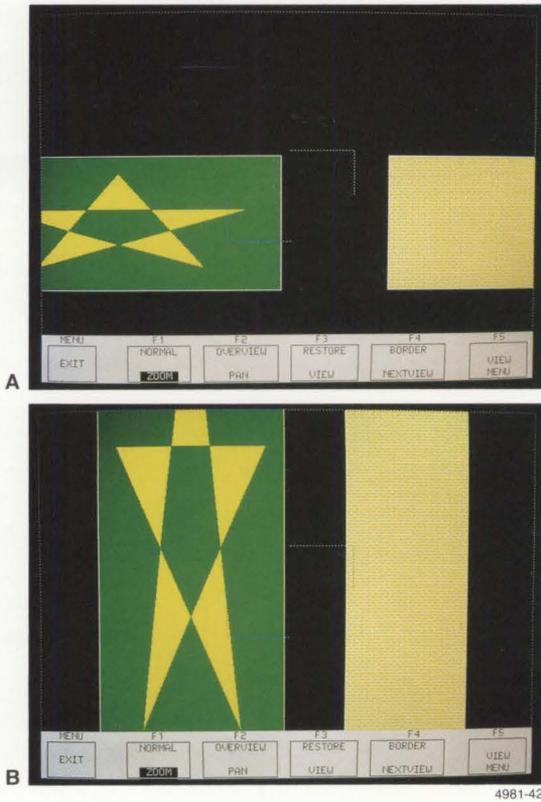


Figure 2-14. Reshaping Displayed Graphics.

Notice that a framing box of shorter height produces a longer graphics image, and a narrower framing box produces a wider graphics image.

When you are through experimenting, return to the original framing box and image:

Press Shift-F1 to restore the original aspect ratio of the framing box.

Press Shift-F2 to return to the original window size.

Press F1 twice to restore the original size of the framing box — the same size as the original window.

Now, reduce the size of the framing box so you can move it around during the Pan function:

Press the top or right of the Joydisk to make the framing box smaller.

USING THE PAN FUNCTION

The Pan function lets you “roam around” in your image and locate the portion you want to display. In contrast to Zoom, which changes the size of the window, Pan changes the location of the window in which your graphics appear.

To change the location of the window, you’ll use the Joydisk to move the location of the framing box. To move the framing box, you must reduce the its size while in Zoom — you just did this.

Now activate Pan:

Press F2.

Note that the dotted brackets displayed during Zoom have been replaced by a cross, and that the word *PAN* in the menu is displayed. Experiment with moving the framing box around:

Press the top of the Joydisk to move the framing box up.

Press the right of the Joydisk to move the framing box to the right.

Press the left of the Joydisk to move the framing box left.

Press the bottom of the Joydisk to move the framing box down.

Now move the framing box and redraw the display:

Press the Joydisk to position the framing box over the star (Figure 2-15a).

Press F3 to redraw the display (Figure 2-15b).

When you pressed F3, the part of the image inside the framing box filled the entire screen (Figure 2-15b). If you move the cross around and press F3 again, you will see a different part of the image, but the framing box and image size do not change.

Move the framing box to the right and press F3 again.

USING OTHER ZOOM/PAN FUNCTIONS

In addition to zooming and panning, the Zoom/Pan function offers other features useful for viewing graphics.

Saving and Restoring Previous Frames

While in Zoom/Pan, the terminal remembers the display of the original image as well as the three most recent displays created by pressing F3 (VIEW). These displays, which include the framing box, are called *frames*. You have already created several frames as you worked with Zoom/Pan in the preceding steps.

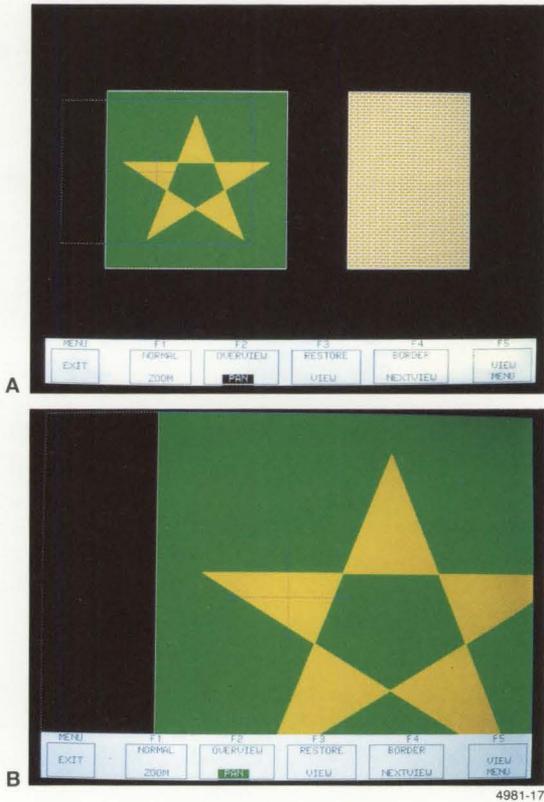


Figure 2-15. Display With Pan.

To look at the previous frames:

Press Shift-F3 to restore the most recent frame (Figure 2-15b).

Press Shift-F3 again to display the next most recent frame (Figure 2-15a).

You can move backward to a limit of three saved frames. Pressing Shift-F3 a fourth time restores the original image (the one displayed on the screen when you entered the Zoom/Pan function). The menu shows you whether the terminal was in Zoom or Pan when each frame was created.

Return to the original image, then restore the original framing box size.

Press Shift-F2.

Press F1 twice.

Displaying a Border

You can create a border around your graphics to complete your display before copying it. Try it now:

Press Shift-F4.

A solid border appears around the edge of the graphics area, framing the entire display. The border remains on the screen even after you exit Zoom/Pan.

The border dimensions remain fixed; altering the size or shape of the framing box has no effect on the border size.

Press Shift-F4 again if you want to delete the border.

Selecting Views

When you are running a host applications program, you can have from one to 64 *views* on the terminal's screen. A view is a snapshot of an image as it is displayed under the control of a host program. Different views can vary the size, shape, and location of the image, as well as which segments make up the image.

Zoom/Pan take place in the *current view*, that is, the view you have selected. In this exercise, you only worked with the current view. If a host program creates multiple views, you can move from one view to another by pressing F4 or Ctrl-F4 (see Table 2-2). Each time you select a view, its border blinks once, indicating that it is now the current view.

Controlling the Zoom/Pan Menu

You can control the visibility of the Zoom/Pan menu just like you can the dialog area's visibility. To make the Zoom/Pan menu invisible, press the Dialog key. Try that now:

Press the Dialog key.

The Zoom/Pan menu disappears.

Press the Dialog key again.

The Zoom/Pan menu is restored.

This is useful if you are making a copy of the screen and don't want the menu to be part of the copy.

Communicating With the Host During Zoom/Pan

Remember that during Zoom/Pan, the terminal can execute host commands, and all keys except F1 through F5 retain their normal function. To see your communication with the host, but still remain in the Zoom/Pan function, you need to redisplay the dialog area. Do that now:

Press the F5 key.

The Zoom/Pan menu disappears, and the dialog area reappears. The framing box remains displayed in the graphics area, indicating that Zoom/Pan is still active.

As the host displays graphics on the screen, you can zoom or pan on those graphics, as well as communicate with the host.

To restore the Zoom/Pan menu, press F5 again.

EXITING ZOOM/PAN

To exit Zoom/Pan, press the keyboard Menu key (not F5). The framing box disappears, but the graphics remain as they were last displayed.

You can also exit from Zoom/Pan by pressing the Setup key, since entering Setup automatically cancels Zoom/Pan.

ZOOM/PAN FUNCTION KEYS

Table 2-2 lists the functions of keys F1 through F5.

Table 2-2
ZOOM/PAN FUNCTION KEYS

Key	Action
F1	ZOOM. Activates Zoom and displays the framing box. Joydisk changes size of framing box. Pressing F1 again cancels Zoom.
Shift-F1	NORMAL. Returns the framing box aspect ratio to match original window of the current view.
Ctrl-F1	FIXED ZOOM. Equivalent to pressing ZOOM (F1), decreasing the size of the framing box, then pressing VIEW (F3).
F2	PAN. Activates Pan and displays framing box. Joydisk changes location of framing box. Pressing F2 again cancels Pan.
Shift-F2	OVERVIEW. Selects default window of entire screen (4095x3130) for current view and renews current view.
Ctrl-Shift-F2	SUPER OVERVIEW. Selects "super window" that includes all of the 4096x4096 terminal space.
F3	VIEW. Sets window for the current view to match the framing box and renews the current view.
Shift-F3	RESTORE. Displays the previous frame (of the four frames that the terminal retains in memory).
Ctrl-F3	UPDATE NEXT VIEW. Equivalent to pressing NEXT VIEW (F4), VIEW (F3), then LAST VIEW (Ctrl-F4), in that order.
F4	NEXT VIEW. Saves the status of the current view and makes the next higher numbered view the current one.
Shift-F4	BORDER. Toggles the visibility of the border around the current view.
Ctrl-F4	LAST VIEW. Similar to NEXT VIEW (F4), but selects the next lower numbered view.
F5	VIEW MENU. Turns display of the ZOOM/PAN menu on or off. When the menu is turned off, the dialog area reappears.

EXERCISE 7: GRAPHICS INPUT (GIN)

Graphics input (GIN) allows you to send graphics coordinates from the terminal to the host computer. This exercise gives you a brief introduction to GIN and two of the GIN features your application program may use: *inking* and *rubberbanding*.

(If you are doing this exercise out of sequence, do Exercise 1, do the steps of *Creating a Graphics Image* in Exercise 4, and do the steps of *Using the Color Map* in Exercise 5.) Before starting this exercise, **be sure the terminal is not logged in to a host computer.**

ENABLING GIN

Normally, a host program enables the keyboard or a tablet to perform specific GIN functions, and prompts you for the data. To do the exercise, however, you'll first enable one of these devices for GIN, then enter graphics coordinates.

If you have a tablet, follow the instructions for enabling it. Otherwise, follow the instructions for enabling the keyboard. Then, follow the instructions for entering points.

Enabling the Keyboard

If you have a graphics tablet, skip these instructions and go directly to *Enabling the Tablet*. If you don't have a tablet, follow these instructions to enable the terminal keyboard for GIN.

Put the terminal in Setup (if it isn't already) and enter:

GINENABLE 0,5

Notice that when you pressed the Return key, the *GIN cursor* (a pair of crosshairs) appeared on the terminal screen.

In the GINENABLE command, the 0 specified that you'll be using the keyboard, and the 5 means that the terminal will accept five points.

Now enable GIN inking and rubberbanding:

GININKING 0,2
GINRUBBERBAND 0,2

Press the Setup key to remove the terminal from Setup.

The terminal leaves Setup and begins responding to your GIN operations.

You will be controlling the GIN cursor's movement around the screen by pressing the Joydisk. Try it now:

Press different sides of the Joydisk to move the crosshair cursor around.

If the cursor moves too quickly, try slowing down the cursor by holding down the Shift key while pressing the Joydisk. (You can also use the GSPEED command to change the speed — see your Reference Guide for information on the GSPEED command.)

Now, proceed to the instructions under *Entering Points*.

Enabling the Tablet

The Tektronix 4957 and 4958 Graphics Tablets consist of a tablet surface and an attached puck or stylus.

Make sure the tablet is connected either to PORT 0 or PORT 1 at the rear panel of the terminal. If it is not, refer to the installation instructions in Appendix A of this manual and connect the cable.

Put the terminal in Setup (if it isn't already) and enter:

GINENABLE 8,5

Notice that when you pressed the Return key, the *GIN cursor* (a pair of crosshairs) appeared on the terminal screen.

In the GINENABLE command, the 8 specified that you'll be using the tablet, and the 5 means that the terminal will accept five points.

Now enable GIN inking and rubberbanding:

GININKING 8,2
GINRUBBERBAND 8,2

Press the Setup key again.

The terminal leaves Setup and begins responding to your GIN operations.

When you use the stylus, hold it as you would a ballpoint pen, with the tip resting on the tablet. The tablet can keep track of the stylus and send its location to the terminal as long as the stylus is within 1/2" of the tablet surface.

When you use the puck, lay it flat on the tablet surface with the buttons facing up.

Try it now:

Use the stylus or puck to move the crosshair cursor around.

ENTERING POINTS

When you move the cursor around, notice the elastic line that tracks the GIN cursor as it moves from the original point — this is *rubberbanding*. After moving the cursor around some:

Enter a graphics point by pressing any keyboard key, or pressing down on the stylus, or pressing any of the buttons on the puck.

The GIN cursor blinks momentarily as the terminal accepts the point.

Move the crosshair to a new location and again enter a point.

Since you have enabled inking, the terminal draws a line on the terminal screen from the first point to the second point (see Figure 2-16a).

Each time you enter a point, another line is drawn from the previous location to the current one (see Figure 2-16b).

Go ahead and enter three more points.

After you enter the fifth point, the terminal exits from GIN and the GIN cursor disappears from the screen. Remember that in the GINENABLE command you specified that GIN was to be enabled for only five points.

To finish:

Press the GErAs key.

Since the inked lines displayed on the screen are not part of a segment definition, they are erased.

Normally, the graphics coordinates are processed by the host application program. The lines you drew and displayed on the screen were simply to acquaint you with GIN.

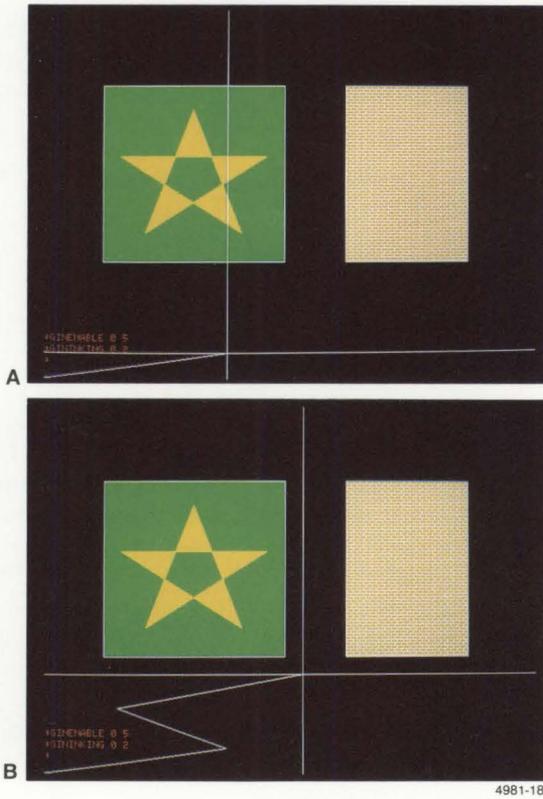


Figure 2-16. Graphics Input With Inking.

YOUR NEXT STEP . . .

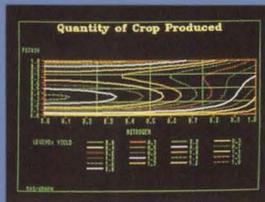
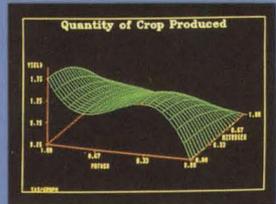
You have now completed your introduction to using the terminal for routine graphics operations. By this time, you should have a basic understanding of how to:

- Enter commands
- Use the dialog and graphics areas
- Create graphics
- Change color definitions
- Use the Zoom/Pan function
- Enter graphics points for graphics input (GIN)

At this point you may want to:

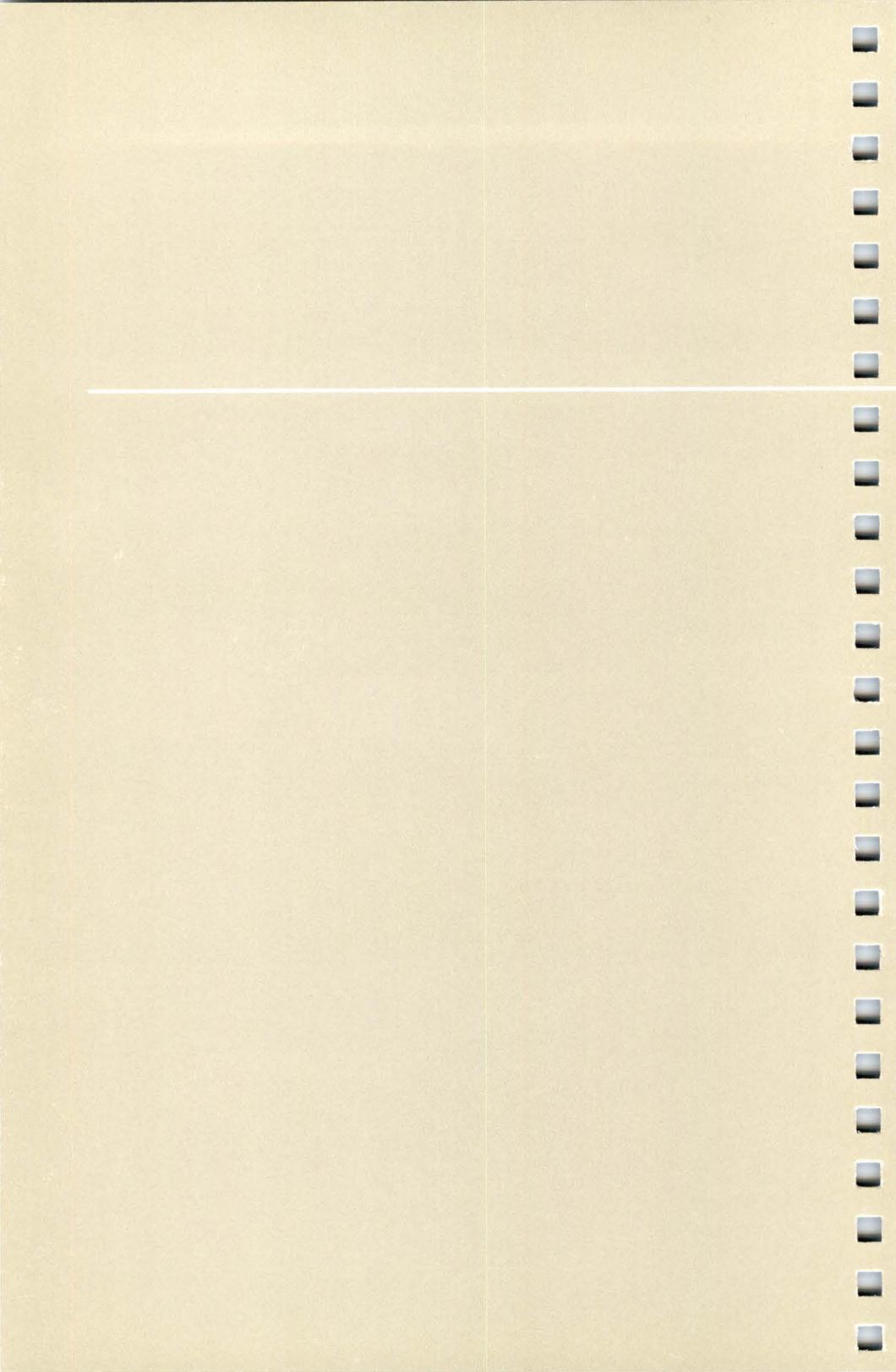
- Go on to Section 3 and try some of the specific tasks that are explained there.
- Continue entering Setup commands. For reference you can use the *Setup Command Table* in Section 4 of this manual. Or you might look through the *4106/4107/4109/CX Reference Guide*. If you have the optional *4106/4107/4109/CX Programmers Reference Manual*, you may want to review it.
- Log on to your host computer and run an application program. Before you do so, however, make sure the terminal's communications parameters have been set to the requirements of your host computer (refer to Appendix A for connecting the terminal to a host).

When you're finished, turn the terminal off or reset it for the convenience of the next user. (To reset the terminal, enter a RESET command or press the RESET button on the rear panel of the display unit.)



Section 3

HOW-TO PROCEDURES



Section 3

HOW-TO PROCEDURES

Use this section like recipes in a cookbook — just locate the heading that covers the task you need to accomplish, then follow the step-by-step procedures.

We've included procedures for these groups of tasks:

- How to Use Setup Commands
- How to Reset the Terminal
- How to Select a Terminal Operating Mode
- How to Make Copies
- How to Use the 4510 Rasterizer
- How to Use a 4662 or 4663 Plotter
- How to Copy From a Host to a Peripheral Device
- How to Use a Graphics Tablet
- How to Use Data Logging
- How to Assign an Answerback Message
- How to Create Macros

The following procedures rely on your understanding of terms and terminal functions described in the exercises in Section 2.

HOW TO USE SETUP COMMANDS

When the terminal is in Setup, you can enter commands to change terminal settings, display status or help messages, and make copies of the display — in other words, you can use any command that has Setup syntax. These commands have English-style names that describe their purpose, such as *DALINES*, which sets the number of lines displayed in the dialog area.

ENTERING SETUP

Press the Setup key to enter Setup. When you see the asterisk prompt followed by the blinking underline or block cursor, you know you're in Setup.

NOTE

If your host also uses the asterisk as a prompt, it may be difficult to tell whether you are in Setup or communicating with your host. Press the Setup key again — if the cursor moves to a new line and displays the asterisk, you're in Setup. If a new asterisk is not displayed, press the Setup key again to enter Setup.

During Setup, control characters that don't have editing functions in Setup are displayed rather than executed. For example, pressing the Escape key would display ^c , but pressing the Return key would execute a Carriage Return, one of the terminal's editing characters.

If you enter Setup from the Zoom/Pan function, Zoom/Pan is terminated. Any other terminal operation (such as host communication) will be suspended when you enter Setup and resumed when you exit.

ENTERING COMMANDS

You enter a command by typing it on the keyboard and pressing the Return key. (Section 2, *Getting Acquainted With Your Terminal*, gives you experience in entering commands.)

Most Setup commands consist of three parts:

- The *command name*, which is the part of the command that specifies the operation you want the terminal to perform or the type of setting you want to change.
- One or more *parameters*, which are words or integers that define the exact action of a command; parameters always follow the command name.

A parameter can be a keyword, such as *YES* or *NO*, or an integer value, such as 1, 2, or 3.

- The *command terminator*, which is the ^R control character entered by pressing the Return key.

Some Setup commands perform a particular action in the terminal, like drawing a line. Other Setup commands establish the terminal's *settings*, like the maximum number of lines the terminal can display in its dialog area. (Section 4 describes the function of each Setup command).

When all the settings have been established, they determine the terminal's *operating characteristics*, that is, how the terminal responds to commands and displays information.

Here's an example of a typical Setup command:

DAINDEX 1,3,0

DAINDEX is the command name. Its function is to set the color indices of the dialog area. *1*, *3*, and *0* are parameters. Each parameter in this command is a number that corresponds to a specific color index.

To specify more than one parameter in a command, use one or more spaces or a comma to separate the parameters. For example, the following commands both correctly specify the same settings:

DAINDEX 1,3,0

DAINDEX 1 3 0

(For clarity in this manual, we've used commas to separate parameters.)

If you don't enter all the required parameter values, the omitted parameters assume their *omitted* default values:

- If the parameter is the only one in the command, or is the last of two or more parameters, you simply omit it. For instance, since 0 is the omitted default for the third parameter in the *DAINDEX* command, these two entries specify exactly the same settings:

DAINDEX 1,3,0

DAINDEX 1,3

- To omit a parameter other than the last one, use commas to separate the location of the omitted parameter from adjacent parameters. For example, to omit the first parameter of the *DAINDEX* command, you would enter:

DAINDEX ,3,0

To omit the second parameter, you would enter:

DAINDEX 1,,0

Section 4, *Setup Command Summary*, shows the defaults for all Setup commands.

Each time you press the Return key to end a command, the terminal executes the command, goes to a new line, and displays an asterisk to prompt for the next command.

CORRECTING COMMAND ENTRY ERRORS

If you notice a mistake in a Setup command before you press the Return key, press the Rub Out key to back up and erase the error. You can also enter Ctrl-X to erase the entire command line, and then reenter the command. To enter Ctrl-X, hold down the Ctrl key and press the X key — don't type the hyphen.

If you make a mistake and you've already pressed the Return key, just reenter the command correctly. For instance, if you discover that you entered the wrong parameters for a command, simply enter the command again with the correct parameters. The last entry overrides any previous entry for the same command (unless it is a DRAW or BEGINPANEL command — see *Correcting Segment and Panel Definition Errors* in Section 2).

UNDERSTANDING ERROR MESSAGES

When you enter a Setup command incorrectly, the terminal displays an error message that helps you identify the type of error. In many cases, the terminal displays a string of asterisks below the incorrect portion of the command to help you locate the error.

For example, suppose you want to change the size of the dialog area and you accidentally enter *DALANES* instead of *DALINES*. The terminal would display the following error message:

```
*DALANES 6
*****
>> Terminal Detects Error : Nonexistent Command
*
```

Should you make an error entering the parameters of a command, the terminal may display asterisks below the parameter that caused the error. For example, say you enter a *DALINES* command with two parameters instead of one. *DALINES* requires only one parameter, so the error message appears as follows:

```
*DALINES 20,8
**
>> Terminal Detects Error : Extraneous Input
*
```

The message tells you that you entered too many parameters for the command; the asterisks locate the extraneous input — the comma and the 8.

Now, suppose you accidentally enter a parameter value that is out of the range for the command. To illustrate, assume you want to set the size of the dialog area to 20 lines, and you enter 200 for the parameter value instead of 20. The following error message would appear:

```
*DALINES 200
>> Terminal Detects Error LL11:
>> Invalid Value in Parameter 1 of (ESC)(L)(L) Command.
*
```

In this case, the terminal displays an error code (LL11) instead of asterisks to identify the parameter error. If you need more information about valid values for a parameter, refer to your *4106/4107/4109/CX Programmers Reference Guide*.

GETTING HELP FOR SETUP COMMANDS

The terminal can display a one-line help message for each Setup command. This message can help you recall Setup command names and the kind of parameters you need to enter. (The HELP message also gives the command's opcode, which is used for host syntax.)

The HELP command has several variations (the terminal must be in Setup):

- You can ask for all help messages by entering just:

HELP

Since the complete help message is rather lengthy, you can use Ctrl-S to temporarily stop scrolling of the help message, and Ctrl-Q to resume scrolling.

- If you want the help message for a specific Setup command, you can either:
 - Enter *HELP* followed by the command name — for example:

HELP FILLPATTERN

- Enter enough characters to uniquely identify the command — for example:

HELP FIL

- Most commands that share a similar function have the same first two letters. When you want help for all commands that begin with the same two letters, enter the HELP command followed by the first two letters of the commands — for example:

HELP DA

This example would display the status of all *dialog area* commands. Other combinations include *HC* for hard copy commands, *SG* for segment commands, *GI* for graphics input commands, *GT* for graphtext commands, and *PX* for pixel commands.

- Cluster names identify specific categories of commands. To display messages for these related commands, enter one of the *cluster names* that appear in the complete help message. The cluster names are:

- | | |
|------------------|----------------|
| • ANSI | • Pixels |
| • Communications | • Report/Input |
| • Dialog | • Segments |
| • General | • Surfaces |
| • Graphics | • Views |
| • Hardcopy | • 2PPI |
| • Keyboard | |

For example, to get help for all commands affecting the keyboard, you would enter:

HELP KEYBOARD

GETTING STATUS FOR SETUP COMMANDS

You can display the settings of commands that control the terminal by using the STATUS command. This command displays the Setup command name, and the current settings of that command.

The STATUS command works just like the HELP command. See the previous discussion for the various ways you can query the terminal for its status.

SAVING COMMANDS

Nonvolatile commands are commands whose settings you can save in the terminal's *nonvolatile memory* — memory that is retained even when you turn off the terminal. Saved commands are automatically in effect whenever you turn on or *reset* the terminal. (You can reset the terminal by pressing the RESET button on the back of the terminal, by issuing a RESET command, or by turning the terminal off and on again. See the next discussion, *Resetting the Terminal*.)

During installation, you usually save all the communications commands that establish the communications link between the terminal and the host computer and between the terminal and peripheral devices (see Appendix A).

You can save additional nonvolatile commands during installation or at some later date. To save commands in nonvolatile memory, enter an NVSAVE command after issuing the commands you want to save. Entering an NVSAVE command at the end of the following command sequence would store the three commands above it in nonvolatile memory:

```
ACURSOR 3,6
DAINDEX 0,3,3
DIM NO
NVSAVE
```

The settings established by the three saved commands — the dialog area cursor color, the dialog area colors, and whether the screen automatically dims after five minutes — would be in effect whenever you turn on or reset the terminal.

You can temporarily change the settings of any of these commands by entering the command with different parameters, but not issuing NVSAVE. Suppose you are working with an application where there is little terminal activity, so you want to activate automatic screen-dimming — you would simply enter the command:

```
DIM YES
```

Screen dimming would be in effect until you change it again with another DIM command or turn off or reset the terminal.

Whenever you issue an NVSAVE command, it saves the most recent settings of *all* commands that can be saved in nonvolatile memory and that have changed since the last NVSAVE. Therefore, before issuing NVSAVE, consider *all* the commands you used during a session. Keep in mind that if you issue NVSAVE after running a host application program, you may be saving some commands that the application issues, making the terminal incompatible with other applications. Further, you may inadvertently override some of your saved commands as well.

The NVSAVE command also saves any nonvolatile *macros* that have been defined since the last NVSAVE. (Macros are discussed later in this section.)

CAUTION

*After you enter an NVSAVE command, wait for the * to appear before taking any further action. If you turn off or reset the terminal while NVSAVE is working, all parameters will be reset to their factory default values.*

The terminal's nonvolatile memory can be changed approximately 10,000 times with the NVSAVE command. This should be sufficient for many years of normal terminal operation. However, to prolong the life of the memory, it's best to use NVSAVE only when necessary.

There are many settings that cannot be saved with an NVSAVE command. Turning the terminal off or resetting it causes these commands to return to their factory default values. Section 4 shows which commands can be saved in nonvolatile memory.

HOW TO RESET THE TERMINAL

You can use the **FACTORY** or **RESET** command or the **RESET** button to restore terminal settings to their default values. Here are a few considerations to keep in mind when using these commands:

- When you issue a **RESET** command, the terminal assumes its *power-up condition*, which is a combination of the factory default settings and the settings that have been saved in nonvolatile memory. So, the next time you turn on or reset the terminal, commands that were previously saved in nonvolatile memory are again in effect.
- Pushing the **RESET** button performs the same function as issuing a **RESET** command. Use the **RESET** button when the terminal won't respond to the **RESET** command.
- When you issue a **FACTORY** command, *all* settings revert to their *factory* default values. (Section 4 shows the factory default value for each command.) The next time you turn on or reset the terminal, it will assume its power-up condition, using settings saved in nonvolatile memory and using factory defaults for all other settings.

NOTE

*Using the **FACTORY** command could change your communications parameters and prevent communication with the host until you reset them.*

- When you enter a **FACTORY** command and follow it immediately with an **NVSAVE** command, *all* commands revert to their factory default settings, and any commands that have been saved in nonvolatile memory are lost.

HOW TO SELECT A TERMINAL OPERATING MODE

The terminal has four modes of operation that are compatible with a variety of host applications programs. These modes are:

- TEK — For programs that use Tektronix 4100-style graphics and terminal control commands.
- ANSI — For programs that use ANSI Standard X3.64 text editing commands.
- EDIT — For DEC VT100 applications programs.
- VT52 — For DEC VT52 applications programs.

The terminal must be in the proper mode to understand the host program's commands. Follow these steps to set the terminal to the proper mode:

1. Check with your computer center staff or your systems programmer to determine which mode you should use to communicate with your host application.
2. Put the terminal in Setup (press the Setup key) and select the operating mode with the CODE command.
 - To select TEK mode, enter:
CODE TEK
 - To select ANSI mode, enter:
CODE ANSI
 - To select EDIT mode, enter:
CODE EDIT
 - To select VT52 mode, enter:
CODE VT52
3. Remove the terminal from Setup (press the Setup key again).

NOTE

Regardless of which mode the terminal is in, it can understand and execute all Setup commands.

HOW TO MAKE COPIES

The following procedures show you how to make both color and monochrome hard copies of the display. (If you are using a host program that selects copier attributes or initiates copies for you, you should follow the host program's procedures instead of these.)

You can make color copies on these copiers:

- Tektronix 4691 Color Graphics Copier
- Tektronix 4692 Color Graphics Copier
- Tektronix 4695 Color Graphics Copier

You can make monochrome (black-and-white) copies on these copiers:

- Tektronix 4644 Dot Matrix Printer
- Hewlett-Packard ThinkJet
- Centronics-style printers that use Epson FX-80 graphics protocol

Additionally, you can make copies of just the text in the dialog buffer on most Centronics-style printers that don't have graphics capability (that is, without Epson-style graphics).

Copies of the dialog buffer are called *dialog copies* and copies of the graphics area are called *graphics copies*.

INITIATING A COPY OPERATION

To make a copy, follow these steps:

1. Be sure that the copier is installed and that both it and the terminal are powered up (Appendix A tells how to connect and set up all the peripherals).
2. Put the terminal in Setup.
3. At this point you can customize your copy by changing the terminal's default settings. Table 3-1 shows which commands you can use with your copier; these commands are described in detail later in this section. Be sure to enter Setup before issuing these commands.

Table 3-1
COMMANDS FOR CUSTOMIZING COPIES

4691	4692	4695	Monochrome Graphics Printer	Monochrome Text Printer
HCDAATTRIBUTES	HCDAATTRIBUTES	HCDAATTRIBUTES	HCDAATTRIBUTES	HCDAATTRIBUTES
HCSIZE	HCSIZE	HCSIZE	HCMAP	
HCORIENT	HCORIENT			
	HCDATARES			
	HCDENSITY			
	HCREPAINT			

4. Display on the terminal screen the information you want to copy.
5. Follow the instructions for copying:
 - To copy the entire screen — both the dialog and graphics — press the SCopy key. Host communications are suspended during a full screen copy.
 - To copy the graphics area:
 - a. Press the Dialog key to make any text in the dialog area invisible.
 - b. Press the SCopy key (reversing black and white).
 - To copy the dialog area:
 - a. Be sure the first line of the text you want to copy is displayed in the dialog area. The terminal will send up to one page of text to the copier, starting with the first line displayed in the dialog area.
 - b. Press the DCopy (Shift-SCopy) key combination.

The dialog area copy is always made with a white background.

- To copy the contents of the dialog buffer:
 - a. Issue the HCDAATTRIBUTES command, which controls how much of dialog buffer is copied and how the pages break (see the discussion *HCDAATTRIBUTES — Multi-Page Dialog Buffer Copy* later in this section).
 - b. Press the DCopy (Shift-SCopy) key combination.

The copy will have a white background.

If you're using a monochrome text-only printer, the only valid key to press for a copy is the DCopy key. (Since you can make only dialog copies, pressing SCopy generates an error message.)

Making Multiple Copies

To make multiple copies of the image or text, just press the key (or key combination) once for each copy you need. For instance, to make four copies of the entire screen display, press the SCopy key four times. Or, if you want two copies of all the pages in the dialog buffer, press DCopy twice after issuing the HCDAATTRIBUTES command (see *HCDAATTRIBUTES — Multi-Page Dialog Buffer Copy* later in this section).

You can queue up to 32 requests.

Reversing Black and White

You can reverse black and white on a full screen or graphics area copy. When you press one of the Copy keys (SCopy or DCopy) black and white on the screen are reversed. That is, black on the screen is not inked on the paper, and white on the screen is inked in black — like normal typewriter copy. This saves black ink.

Be aware, however, that all black and white in the screen image — not just the text — will be reversed. Other colors are not affected.

To override the black and white reversal, hold down the Ctrl key while you press the SCopy key. This should be done when you have black areas of an image that must appear black on the copy.

Host Communication During Graphics Copy

You can continue communication with the host computer during a graphics copy operation by following these steps:

1. Be sure the dialog area is enabled before making a graphics copy:
 - a. Put the terminal in Setup
 - b. Enable the dialog area by entering:

DAENABLE YES

2. Press the Dialog key to make any text in the dialog area invisible.
3. Press the appropriate key to begin the graphics copy.
4. Press the Dialog key again to redisplay dialog area text.
5. Press the Setup key to remove the terminal from Setup and continue host communications.

Host Communication During Dialog Copy

You can continue communication with the host computer during a dialog copy operation by following these steps:

1. Disable the dialog area by entering:

DAENABLE NO

2. Press the Dialog key to make the dialog area invisible.
3. Press the DCopy key (Shift-SCopy) to begin the dialog area copy.
4. Press the Setup key to leave Setup so you can resume working with the host in the graphics area.
5. To use the dialog area when the copy is complete, return to Setup and enable it:

DAENABLE YES

6. Press the Dialog key to make the dialog area visible.

STOPPING A COPY OPERATION

To stop a copy operation in process, press the Cancel key (Shift-Setup) located in the top row of keys on the terminal's keyboard.

You can also stop a copy operation by pressing the RESET button or turning off the terminal, but these methods erase your graphics and text from memory and the screen.

CUSTOMIZING YOUR COPIES

You can use the terminal's default settings to make copies, or you can change the settings to fit your copy needs. The next few pages describe the commands you can use; Table 3-1 shows what commands apply to which copiers.

You can save the settings made with these commands (see *Saving Commands* earlier in this section), or you can reissue them whenever you make a copy. If you need to switch frequently from one kind of copy to another, you can program keys to select the different settings you need. (See *Creating Macros* later in this section.)

If your text or graphics are displayed before you've issued commands to control copy attributes, you may want to avoid writing in the area you intend to copy. By enabling or disabling the dialog area, you can control where your commands are written:

- To avoid cluttering the dialog area, before entering the commands, disable the dialog buffer:

DAENABLE NO

- To avoid cluttering the graphics area, before entering the commands, be sure the dialog buffer is enabled:

DAENABLE YES

NOTE

Since a command to disable or enable the dialog area is displayed before it is executed, it will appear in the area you are trying to keep free of text. To avoid this, see Dialog Area Disabling and Enabling Macros later in this section.

HCSIZE — Image Size on a 4691, 4692, or 4695 Copier

The HCSIZE command lets you select the size of the copied image sent to a color copier. If you are copying to a Tektronix 4695 Color Copier, this command controls both graphics and dialog copy size. If you are copying to a 4691 or 4692 Copier, it controls only dialog copy size.

You can select either standard (the default setting) or small copies. Small-size copies are placed on the paper in *portrait format*, that is, long axis of the image with short axis of the copier paper. Small copies from a 4695 copier are one-half standard size (standard size is 8x10 $\frac{1}{8}$ "). Small dialog copies from a 4691 or 4692 Copier are slightly larger than one-half standard size.

One benefit of choosing the small copy is speed; since a smaller copy area on the paper is used, the copy takes less time. A standard-sized copy provides greater resolution and color range, but takes longer.

The small copy also allows you to copy 132 columns on the same line. By contrast, in a default copy of text with a 132-character line, approximately 80 characters appear on one line and the remaining characters wrap to the next line (the actual number that wrap depends on the copier attached).

Here's how to set the copy size:

- To select the small copy size, enter:

HCSIZE 1

- To produce the default copy size, enter:

HCSIZE 0

HCORIENT — Image Orientation on a 4691 or 4692 Copier

When you are using a 4691 or 4692 Color Graphics Copier, you can select from four image positions, as illustrated in Figure 3-1.

- To align the long axis of the image on the long axis of the paper (*landscape format* — the default), enter:

HCORIENT HORIZONTAL

- To align the long axis of the image on the short axis of the paper (*portrait format*), enter one of the following:

HCORIENT VTOP

HCORIENT VCENTER

HCORIENT VBOTTOM

The three preceding commands place the image at the top, center, or bottom of the paper, respectively.

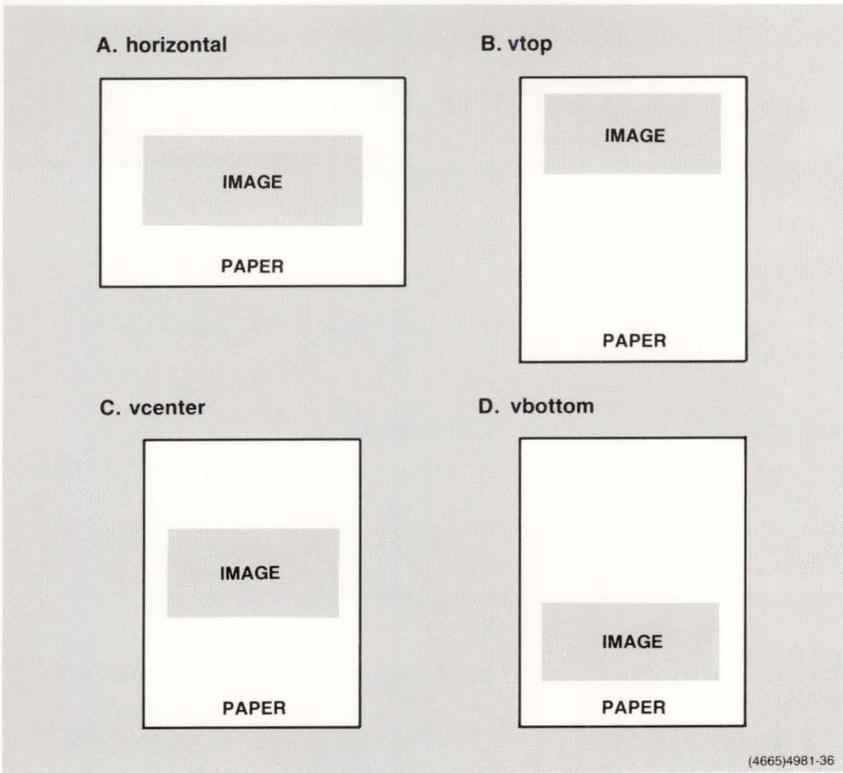


Figure 3-1. Orientation of Copier Images.

NOTE

When you specify any HCORIENT setting other than HORIZONTAL (the factory default), the copy is automatically reduced to fit the screen image to the narrower width of the paper.

HCDENSITY — Resolution on a 4692 Copier

If you are copying to a 4692 Copier, you can select the dot density (resolution) of the copy.

- To produce higher density copies (the default), enter:

HCDENSITY HIGH

- To produce lower density copies, enter:

HCDENSITY LOW

NOTE

When you select high density, the copied image will be slightly smaller than a normal-density copy.

HCREPAINT — Overwriting on a 4692 Copier

On the 4692 Copier, you can choose how many times (from one to four) the copier overwrites the image in a single copy. Writing the same image several times in the same copy adds a heavier concentration of ink. You'll find this useful when you create transparencies, since more ink produces intense colors.

Here's an example of how to issue the HCREPAINT command:

HCREPAINT 3

This example paints the image three times, producing a saturated copy of the image.

HCDATARES — Color Matching on a 4692 Copier

The factory default setting specifies that screen colors will be sent to a 4692 Color Copier for maximum color matching. This command allows you to change that default — and is provided for compatibility with terminals from other Tektronix product lines.

For this terminal, the only recommended setting is:

HCDATARES 2

Making Transparencies on a 4692 Copier

To make high quality transparencies on a 4692 Copier, use these settings:

```
HCORIENT HORIZONTAL  
HCDENSITY HIGH  
HCREPAINT 2  
HCDATARES 2
```

HCMAP — Converting Colors for Monochrome Graphics Printing

On a monochrome graphics printer, all colors except the background color (Index 0) print in black ink. If this makes your graphics copy hard to read, you can use the HCMAP command to suppress the printing of selected indices.

To suppress printing of an index, issue *HCMAP* followed by an index and a 0 or 1 — 0 specifies “no print” and 1 specifies “print.” You can continue specifying index numbers and 1’s or 0’s until you’ve specified all the indices you need to.

For example, to suppress printing of Color Indices 5, 6, and 7, you would enter:

```
HCMAP 5,0,6,0,7,0
```

Now, everything displayed in Indices 1, 2, 3, and 4 will appear as black in your copy, and images displayed in Indices 0, 5, 6, and 7 will not be printed in your copy.

HCDAATTRIBUTES — Multi-Page Dialog Buffer Copy

The HCDAATTRIBUTES command lets you copy to a color copier or monochrome printer more of the dialog buffer text than just that displayed on the terminal's screen.

The HCDAATTRIBUTES command has three parameters:

1. Number of pages to be copied (you can copy as many pages as you wish).
2. Starting page to begin the copy (the starting page can begin at either the beginning or end of the dialog buffer, or at the beginning of the text displayed on the screen).

Your options are:

- 0 — to start copying from the first line on the screen
 - 1 — to start copying from the top of the dialog buffer
 - 2 — to copy from the bottom of the dialog buffer
3. When to begin a new page (a new page can begin after each 60 lines of text, wherever a Form Feed character occurs, or both).

Your options are:

- 0 — to page after each 60 lines of text (the terminal inserts three blank lines at the beginning and end of a page)
- 1 — to page after 66 lines of text or at Form Feed characters
- 2 — to page at only Form Feed Characters

The following examples show how the HCDAATTRIBUTES command works:

- To copy the three most recent pages, ignoring Form Feed characters, enter:

HCDAATTRIBUTES 3,2,0

The first parameter (3) specifies three pages to be copied. The second parameter (2) causes the page count to start from the bottom (most recent) line of the dialog buffer. The third parameter (0) causes a new page to begin every 60 lines of text (66 lines total — text plus 3 lines each at the top and bottom of a page).

- To copy two pages starting from the first line displayed on the screen and to start a new page every 60 lines of text or wherever a Form Feed occurs, enter:

HCDAATTRIBUTES 2,0,1

- To copy the five oldest pages and start a new page at every Form Feed character, enter:

HCDAATTRIBUTES 5,1,2

Keep in mind that the first setting (the number of pages) and the last setting (whether Form Feeds are ignored) interact with each other. If the dialog buffer begins with four Form Feeds, and you specify that the copier or printer should print four pages, paging only at Form Feeds, you would get four blank pages.

Or, assume you set the terminal to page only on Form Feeds and you set the number of pages to 1. If there are no Form Feeds in the text, the entire dialog buffer will be copied without page breaks, regardless of the number of lines.

HOW TO USE THE RASTERIZER

Using the Tektronix 4510 Rasterizer, you can copy the graphics area to a 4691 or 4692 Copier with greater resolution than when copying directly from the screen to the copier. The Rasterizer also gives you a wider color selection.

You can use the Rasterizer only on images that were created as segments. If you aren't sure of what a segment is, you may want to refer to *Exercise 4: Creating Graphics* in Section 2. If the image was not created as segments, you can use Setup commands to display the image as a segment (explained below).

Follow these steps for making a rasterized copy:

1. Be sure the Rasterizer is connected to the terminal, the color copier is connected to the Rasterizer, and all are powered on. (Appendix A tells you how to connect the Rasterizer and a color copier.)

These procedures assume the Rasterizer is connected to PORT 0. If it is connected to PORT 1, substitute *P1*: wherever *P0*: is shown in a command.

2. Put the terminal in Setup, if it isn't already.
3. Be sure the dialog area is enabled so your commands won't clutter the graphics:

DAENABLE YES

4. Display your image and be sure it is comprised of segments.

If your host program does not display graphics as segments, you can make a segment out of the entire display by opening a segment before the host displays the graphics, then closing the segment after the graphics are drawn. Like this:

- a. Open a segment (in this case, Segment 1) by entering:

SGOPEN 1

- b. Take the terminal out of Setup.
- c. Enter the commands required by your host to display graphics on the terminal.
- d. After the image is on the screen, return the terminal to Setup.
- e. Close the segment by entering:

SGCLOSE

5. Make sure your image is in the current view.

If you have more than one view on the screen, the image in the current view will be sent to the Rasterizer. Refer to *Exercise 6: Using the Zoom/Pan Function* in Section 2 of this manual for instructions on entering the Zoom and Pan function, selecting views, and returning to Setup.

- Specify the number of copies. For example, if you want three copies, enter:

PCOPIES P0:,3

- Start the copy process by entering:

PLOT TO,P0:

The preceding steps use existing settings for copy orientation and appearance, but you can change these settings to fit your copy needs. The commands to do so are discussed under *Customizing Rasterized Copies*.

Copying From a Host to the Rasterizer

You can use the COPY command to send graphics from a host directly to the Rasterizer without displaying the graphics on the screen.

NOTE

Because the data will not be processed by the terminal's device driver, the host must send it in the proper format for the Rasterizer.

Use the method described under *Copying From a Host to a Peripheral* later in this section as a guide.

CUSTOMIZING RASTERIZED COPIES

You can control how your rasterized copy is oriented on the paper (or other media) and whether black and white are reversed. The commands to change the default settings are described next.

You can save the settings made with these commands (see *Saving Commands* earlier in this section), or you can reissue them whenever you make a copy. If you need to switch frequently from one type of copy to another, you can program keys to select the different settings you need. (See *Creating Macros* later in this section.)

Because the Rasterizer takes care of other copier details, such as resolution, color matching, and so forth, you don't need to adjust these settings as you do when you send copies directly to the color copiers.

PORIENT — Image Orientation for Rasterized Copies

You can select the orientation of the screen image on the copier paper using one of the following commands.

- To align the long axis of the image with the long axis of the media, enter:

PORIENT P0:,HORIZONTAL

- To align the long axis of the image on the short axis of the paper, enter one of these commands:

PORIENT P0:,VTOP

PORIENT P0:,VCENTER

PORIENT P0:,VBOTTOM

The three preceding commands place the image at the top, center, or bottom of the copier paper, respectively.

PINVERSION — Reversing Black and White on Rasterized Copies

You can select how black and white colors in the image will be copied by entering one of these commands. Reversing black and white may be useful when your screen text is white on a black background. The text will print as black on a white background, like normal typewriter or printer copies, and it will save black ink. Be aware, however, that all black and white colors in the screen image will be reversed. Other colors are not affected.

- To make a copy with black and white reversed, enter:

PINVERSION P0:,NEGATIVE

- To keep the image's blacks and whites as displayed on the screen, enter:

PINVERSION P0:,POSITIVE

HOW TO USE A PLOTTER

You can use a Tektronix 4662 or 4663 Interactive Digital Plotter to create a plot of all graphics segments that are currently visible and in the current view. (Refer to the discussion on segments and the current view at the beginning of the previous Rasterizer section.)

1. Be sure the plotter is connected and configured for the terminal and both are powered on. (Appendix A tells you how to install and prepare your plotter for use.)

These procedures assume the plotter is connected to PORT 0. If it is connected to PORT 1, substitute *P1*: wherever *P0*: is shown in a command.

2. Install the plotter pen or pens, and place your paper or transparency on the plotter's surface.
3. If your plotter has multiple pens, you can assign color indices to particular pens. Here are three examples:

- To map all displayed color indices (-1) to a single pen (Pen 1), enter:

PMAP P0:,-1,1

- To map graphics displayed in Index 3 to Pen 2, enter:

PMAP P0:,3,2

Reissue this command for each index you want to map.

- To suppress plotting graphics displayed in a particular color, map that index to Pen 0 — that is, no pen.

This is useful when you want a multicolored plot but have a plotter with only one or two pens. The following commands illustrate how you can plot one color at a time.

First, map all color indices to Pen 0:

PMAP P0:,-1,0

Then, select a pen color, install the pen, and map one index to that pen. For example:

PMAP P0:,8,1

After plotting (Step 4) the graphics displayed in Index 8, install a pen with another color. Then map another index to that pen and remap the index just plotted so that it won't plot. For example:

PMAP P0:,5,1

PMAP P0:,8,0

Replot the image for each index you want to show.

4. Plot your screen image by entering:

PLOT TO,P0:

HOW TO COPY FROM A HOST TO A PERIPHERAL DEVICE

You can send text or graphics directly from the host to a peripheral device, without displaying the image on the terminal screen. This is convenient for sending program listings from the host to a monochrome copier or sending graphics from the host to the Rasterizer.

To route a copy from the host directly to a peripheral device, follow these steps.

1. Make sure the terminal is connected to the host and to the peripheral, and both are powered on. (Appendix A tells you how to install and prepare your peripherals for use.)
2. Before entering Setup, type whatever command the host requires to send text to the terminal, but do not type the key the host needs to terminate the command — usually the Return key.
3. Enter Setup.
4. Type in the COPY command and the desired destination. For example, this command would send data from the host to a device connected to the COPIER port:

COPY HO:,TO,HC:

(Be sure to press the Return key to terminate this command.)

If you are sending the host data to a device connected to PORT 0 or PORT 1, substitute *P0:* or *P1:* for *HC:* in the command.

4. Exit Setup.
5. Now terminate the host command you entered in Step 2.

NOTE

Because the terminal does not process the data, it is the responsibility of the host to send it in a format acceptable to the receiving peripheral.

To avoid switching in and out of Setup to enter the commands for copying directly from the host, you can program a key to simplify the process. Refer to *Host Copy Macro* later in this section for the procedure.

HOW TO USE A GRAPHICS TABLET

Connecting the terminal to a Tektronix 4957 or 4958 Graphics Tablet provides a method for you to conveniently transfer drawings from paper to a computer data base. Using a stylus or puck, you simply trace your drawing; the tablet and terminal automatically send the graphics coordinates to the host computer. You can also use the stylus or puck to select from a menu of items or send other graphics choices to your host program.

This section will tell you only how to use the stylus or puck. Any other instructions should come from your host program. The program will probably tell you to choose a certain item or part of the picture, to enter a certain number of points on the screen, or to enter points continuously.

To use a stylus:

- Hold it as you would a ballpoint pen, with the tip resting on the tablet. The tablet can keep track of the stylus and send its location to the terminal as long as the stylus is within $\frac{1}{2}$ " of the tablet surface.
- To pick an item or enter individual points, press down on the stylus tip (or press the button on the barrel, if it has one). The screen cursor will blink momentarily as the location is transmitted.
- To enter continuous points, press down on the stylus tip (or hold down the button on the barrel), and move it across the tablet surface as if you were drawing on the tablet. A steady stream of points is entered as you move the stylus until you lift the tip or release the button.

To use the puck:

- Lay the puck flat on the tablet surface with the buttons facing up.
- To pick an item or enter individual points, press one of the buttons on a puck. The screen cursor will blink momentarily as the location is transmitted.
- To enter continuous points, hold down a puck button and move the puck across the tablet surface. A steady stream of points is entered as you move the puck until you release the button.

HOW TO USE DATA LOGGING

You can create a hard copy log of all text in the dialog area — this is known as *data logging*. The AUTOPRINT command simultaneously copies text in the dialog area to a hard copier as it's being displayed on the screen. You can use data logging with a monochrome printer or a 4695 Copier.

To turn on data logging, follow these steps:

1. Be sure the printer or copier is connected to the terminal's COPIER port and both are turned on. (Appendix A tells you how to install your printer or copier.)
2. Put the terminal in Setup.
3. Activate data logging by entering:

AUTOPRINT YES

4. Now when you use the dialog area, all text will be logged. You can exit Setup and communicate with your host — this text will also be logged.
5. To turn data logging off, be sure the terminal is in Setup and enter:

AUTOPRINT NO

When the terminal is in ANSI mode, you can toggle data logging without entering Setup by programming a key to send *host syntax* commands. See *Data Logging Macro* later in this section.

HOW TO ASSIGN AN ANSWERBACK MESSAGE

The terminal can store a password-like message that a host can verify before releasing restricted information. The message has to be entered from the terminal's keyboard (it can't be sent from the host). *Before assigning an answerback message to your terminal, consult your systems programmer.*

To assign the message to your terminal, follow these steps.

1. Put the terminal in Setup.
2. Enter the ANSWERBACK command, a beginning delimiter, the message, and an ending delimiter. For example:

ANSWERBACK /PASSWORD/

HOW TO CREATE MACROS

A *macro* is a sequence of characters stored in the terminal as a single group. By assigning these characters to a key (known as *programming a key* or *creating a key macro*), you can recall them by simply pressing that key (known as *expanding a macro*).

Macros provide a shortcut for entering commands and text that you use frequently. When you need to enter a particular set of commands or block of text repeatedly, you can create a key macro that contains the commands or text. The terminal saves the macro in its memory so that whenever you need it all you need to do is press the programmed key.

All keys except Shift, Ctrl, and Caps Lock can be programmed.

NOTE

Avoid programming keys that you normally use to enter commands. For example, if you program the Return key, you cannot use it to terminate a command.

The following overview describes the methods for creating macros. Next, we've provided several macros that perform functions you may find useful to have programmed into your terminal keyboard. By programming one or two of these macros into your keyboard, you'll also learn the sequence for creating your own macros.

USING MACRO NUMBERS

Key macros are identified by *macro numbers* that correspond to keys on the keyboard. Each key has four numbers assigned to it:

- One number for the key pressed by itself
- One number for the key pressed in combination with the Shift key
- One number for the key pressed in combination with the Ctrl key
- One number for the key pressed in combination with the Ctrl and Shift keys

These macro numbers range from -150 through 143. (Appendix C shows the macro numbers assigned to individual keys.)

USING MACRO COMMANDS

There are four different commands you can use to create a macro:

- *LEARN* helps you program keys (identified by macro numbers –150 through 143). When you enter the *LEARN* command, the terminal prompts you for your subsequent entries to define the macro. Macros defined with *LEARN* are lost when the terminal is turned off or reset, or when you issue a *FACTORY* command.
- *NVLEARN* works like *LEARN*, except that *NVLEARN* macros can be saved in nonvolatile memory by issuing *NVSAVE* following the macro definition.
- *DEFINE* lets you define a macro for any key or macro number (including macros 144 and up, which do not correspond to any keys). A macro created with *DEFINE* is lost when you turn off or reset the terminal, or when you issue a *FACTORY* command. The *DEFINE* command is primarily for defining macros from the host and is not further described in this manual — for more information about the *DEFINE* command, refer to the *4106/4107/4109/CX Programmers Reference Manual*.
- *NVDEFINE* works just like *DEFINE* except that *NVDEFINE* macro can be saved in nonvolatile memory by issuing *NVSAVE* following the macro definition. The *NVDEFINE* command is primarily for defining macros from the host and is not further described in this manual — for more information about the *NVDEFINE* command, refer to the *4106/4107/4109/CX Programmers Reference Manual*.

CAUTION

A macro created by NVLEARN or NVDEFINE is not automatically saved in nonvolatile memory. If you want to save the macro, you must enter an NVSAVE command before turning off the power, issuing a RESET command, or issuing a FACTORY command. A limited amount of memory is available to save nonvolatile macros.

SELECTING MACRO COMMAND SYNTAX

Commands within a macro are usually in *host syntax*, rather than in *Setup syntax* (your *4106/4107/4109/CX Programmers Reference Guide* explains host syntax). This allows you to use the macro while you are communicating with the host — remember that the terminal only understands *Setup syntax* when it is in *Setup*. When you use host syntax commands in a macro, be sure the terminal is not in *Setup* when you press the programmed key.

Commands to the terminal in a macro can be *Setup* commands. This, however, requires the terminal to be in *Setup* before you press the programmed key. (Remember that you cannot communicate with the host while in *Setup*.)

SELECTING LOCAL OR HOST MACROS

Normally, when you press a programmed key, the macro defined for that key is sent to the host computer — just as if you had entered that sequence of characters on the keyboard. This allows you to avoid typing a sequence of commands you frequently use with your host.

However, you might want a macro to be interpreted as a sequence of commands to the terminal (rather than the host). For instance, if you frequently use a particular sequence of commands to change a terminal characteristic — like, the size of the dialog area or size of your hard copies — you could program a key to execute that sequence of commands. In a case like this, you do not want the macro sent to the host, but you do want it executed by the terminal.

To construct a macro to be executed by the terminal, you must include a pair of *key-execute characters* at the beginning and at the end of the macro. The default key-execute character is ρ_L , which you type as *Ctrl-P*. (If you need to use the ρ_L character within a macro, you'll need to change the default key-execute character — see the SET KEY EXECUTE CHARACTER command description in your *4106/4107/4109/CX Programmers Reference Guide*.)

The key-execute character acts like a switch that sends the contents of the macro either to the terminal or to the host. The first time the key-execute character appears in the macro, it switches to the terminal. The next time it appears in the macro, it switches back to the host.

DELETING A MACRO DEFINITION

You can delete a macro and return a key to its default meaning by reissuing the command you issued to create the macro — either LEARN or NVLEARN. In response to the prompt, press the key that contains the macro you want to delete, then press F1. If the macro has been saved in nonvolatile memory (that is, created with the NVLEARN command and followed by an NVSAVE), you would also reissue the NVSAVE command.

For example, to delete a macro that was assigned to the F6 key and was saved in nonvolatile memory, put the terminal in Setup and enter:

NVLEARN

The terminal responds with its prompt:

Press the key to be defined :

Press the F6 key, then press the F1 key. The F6 key is now back to its default meaning. (With the exception of the function keys, the keycap label of a key identifies its default meaning.)

Finally, issue:

NVSAVE

MACRO EXAMPLES

Here are several macros you might find helpful in your day-to-day work with your terminal. By following the step-by-step procedures for one or two of these examples, you'll also learn the sequence for creating your own macros.

The macros shown here are:

- *Hard Copy Size* — This macro lets you specify one of two different size copies.
- *Dialog Area Enabling and Disabling* — This macro allows you to disable the dialog area so that you can make clean dialog copies, then reenable it.
- *Host Copy Macro* — This macro allows you to easily queue a copy from the host directly to a copier, without displaying the file on the terminal screen.
- *Data Logging Macro* — This macro allows you to turn data logging on and off without going into Setup.

These examples use the NVLEARN command rather than the LEARN command so that you can save these macros in nonvolatile memory. You could substitute LEARN wherever you see NVLEARN.

Hard Copy Size Macro

Assume you frequently need to change the setting of the HCSIZE command. You can program two keys — one to specify the smaller size copy and one to specify the larger size — so that you can easily switch between them. Here's how to set up the macro that selects the smaller size:

1. Put the terminal in Setup.
2. To start the programming process for a nonvolatile macro, enter this command:

NVLEARN

The terminal displays the following prompt:

Press the key to be defined :

3. Press the F5 function key, located in the top-right row of keys. The screen displays the number 132 (the macro number for the F5 key) after the colon, and the following message appears on the next line:

Enter definition. (F1 terminates definition, F2 deletes last character)

- Now you can enter the contents of the macro. Assuming that the key-execute character is ρ_L (the default key-execute character), you'll enter it by holding down the Ctrl key and pressing the P key; this is shown in this manual as *Ctrl-P*. Use the F2 key to correct any errors you make while entering the macro.

Since this example uses the host syntax of the HCSIZE command, be sure to enter the command in uppercase letters (as shown) and without any spaces between characters.

Ctrl-P **Esc** **QA1** **Ctrl-P**

As you enter the macro, it is displayed on the screen like this:

ρ_L E_cQA1 ρ_L

- Press the F1 key to end the macro definition.
- If you want to save the macro in the terminal's nonvolatile memory, put the terminal in Setup and enter:

NVSAVE

Now, verify that the macro is correct:

- Check the contents of the macro by entering the following command:

MACROSTATUS 132

The value 132 is the macro number for the F5 key that was displayed earlier (in Step 3 of this procedure). If you entered the macro definition correctly, the following message appears:

132 " ρ_L E_cQA1 ρ_L "

- Press the Setup key again to take the terminal out of Setup.
- Press the F5 function key.
- To see the effect of the macro, press the Setup key and enter:

STATUS HCSIZE

The terminal should display:

HCSIZE 1

Now, simply follow the same steps to program another key to select the larger size.

You could add other commands to this simple macro so that pressing a single key sets up all your copy specifications.

Dialog Area Disabling and Enabling Macros

When copying the dialog buffer, you can avoid cluttering up the copy with the commands that set the copy format by disabling the dialog area and making it invisible. Then, when you issue your commands, they'll appear in the graphics area, and won't appear on your hard copy.

Here's how to set up the macro:

1. Put the terminal in Setup.
2. Since you may want to save this macro in nonvolatile memory, start the programming process by entering this command:

NVLEARN

The terminal displays the following prompt:

Press the key to be defined :

3. Press the F3 function key. The screen displays the macro number for the F3 key (130), and the following message appears on the next line:

Enter definition. (F1 terminates definition, F2 deletes last character)

4. Assuming the key-execute character is ρ_L (entered as *Ctrl-P*), type in this macro definition (using uppercase letters as shown, and without any spaces between characters):

```
Ctrl-P Esc KA0 Esc LV0 Ctrl-P
```

Your command appears like this on the screen:

```
 $\rho_L$ EscKA0EscLV0 $\rho_L$ 
```

5. Press the F1 key to end the macro definition.
6. If you want to save the macro in the terminal's nonvolatile memory, put the terminal in Setup and enter:

NVSAVE

Now you can disable the dialog area and make it invisible without the command appearing on the screen:

1. Take the terminal out of Setup.
2. Press F3.

To create a macro to enable the dialog area and make it visible again, follow the previous steps, but assign the macro to a different function key (consider Shift-F3), and substitute *KA1* for *KA0* and *LV1* for *LV0* when you type in the macro definition:

```
Ctrl-P Esc KA1 Esc LV1 Ctrl-P
```

Host Copy Macro

You can route text from the host directly to a printer or copier attached to the COPIER port. In this case, you must use the COPY command instead of the SCopy or DCopy key. (During this type of copy, the terminal does not process or change the text in any way; so if the printer requires initialization commands, such as page size, the host must send them.)

To program the F6 key to issue a COPY command, follow these steps:

1. Put the terminal in Setup.
2. Enter this command:

NVLEARN

The terminal displays the following prompt:

Press the key to be defined :

3. Press the F6 function key. The screen displays the number 133 (the macro number for the F6 key) after the colon, and the following message appears on the next line:

Enter definition. (F1 terminates definition, F2 deletes last character)

4. Assuming that the key-execute character is ρ_L (entered as *Ctrl-P*), enter the macro definition using the host syntax for the COPY command:

Ctrl-P **Esc** **JC3HO:2TO3HC:** **Ctrl-P**

As you enter it, the macro string is displayed on the screen like this:

ρ_L Esc**JC3HO:2TO3HC:** ρ_L

5. To end the macro definition, press the F1 key.
6. If you want to save the macro in nonvolatile memory, enter:

NVSAVE

Now, whenever you want to make a hard copy of a file without displaying it on the screen, you can just follow these steps:

1. Press the Setup key again to take the terminal out of Setup.
2. Enter a command that instructs your host to send text to the terminal, but do not press Return to terminate the command.
3. Press the F6 function key — this causes the terminal to execute the macro — then press Return to terminate the command to the host.

The printer should begin to print whatever the host sent to the terminal. If you do not have a printer connected to the terminal, it will display an error message.

4. When the copy is done, press the Cancel key to end the copy process.

You can also use these steps to send data directly from the host to one of the peripheral ports, for instance, to the Rasterizer or a plotter. Substitute either *P0:* or *P1:* (depending on which port the device is connected to) for *HC:* in the macro.

Be sure that the file you're sending is formatted for the device connected to the COPIER port — see your systems programmer.

Data Logging Macro

You can program a single key to turn data logging on or off (that is, *toggle* data logging) rather than having to enter Setup and explicitly issue the `AUTOPRINT` command.

Here's how:

1. Put the terminal in Setup.
2. Enter this command:

NVLEARN

The terminal displays the following prompt:

Press the key to be defined :

3. Press the F8 function key. The screen displays the number 135 (the macro number for the F8 key) after the colon, and the following message appears on the next line:

Enter definition. (F1 terminates definition, F2 deletes last character)

4. Assuming the key-execute character is `␣` (entered as *Ctrl-P*), enter this macro definition using the host syntax for data logging:

`Ctrl-P Esc [?3i Ctrl-P`

Your command appears on the screen like this:

`␣Esc[?3i␣`

5. To end the macro definition, press the F1 key.
6. If you want to save the macro in nonvolatile memory, enter:

NVSAVE

You can test this macro without a host, but be sure a printer is connected to the terminal and turned on, then:

1. Check that your terminal is in Setup, then put the terminal in ANSI mode by entering:

CODE ANSI

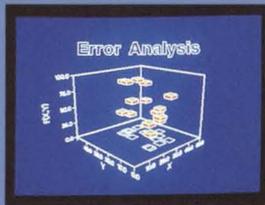
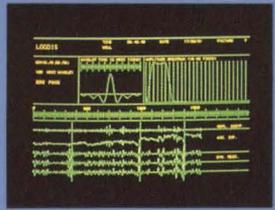
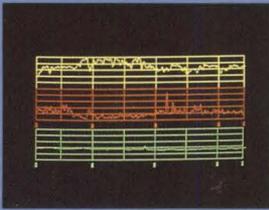
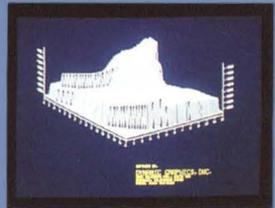
2. Then check the data logging status by entering:

STATUS AUTOPRINT

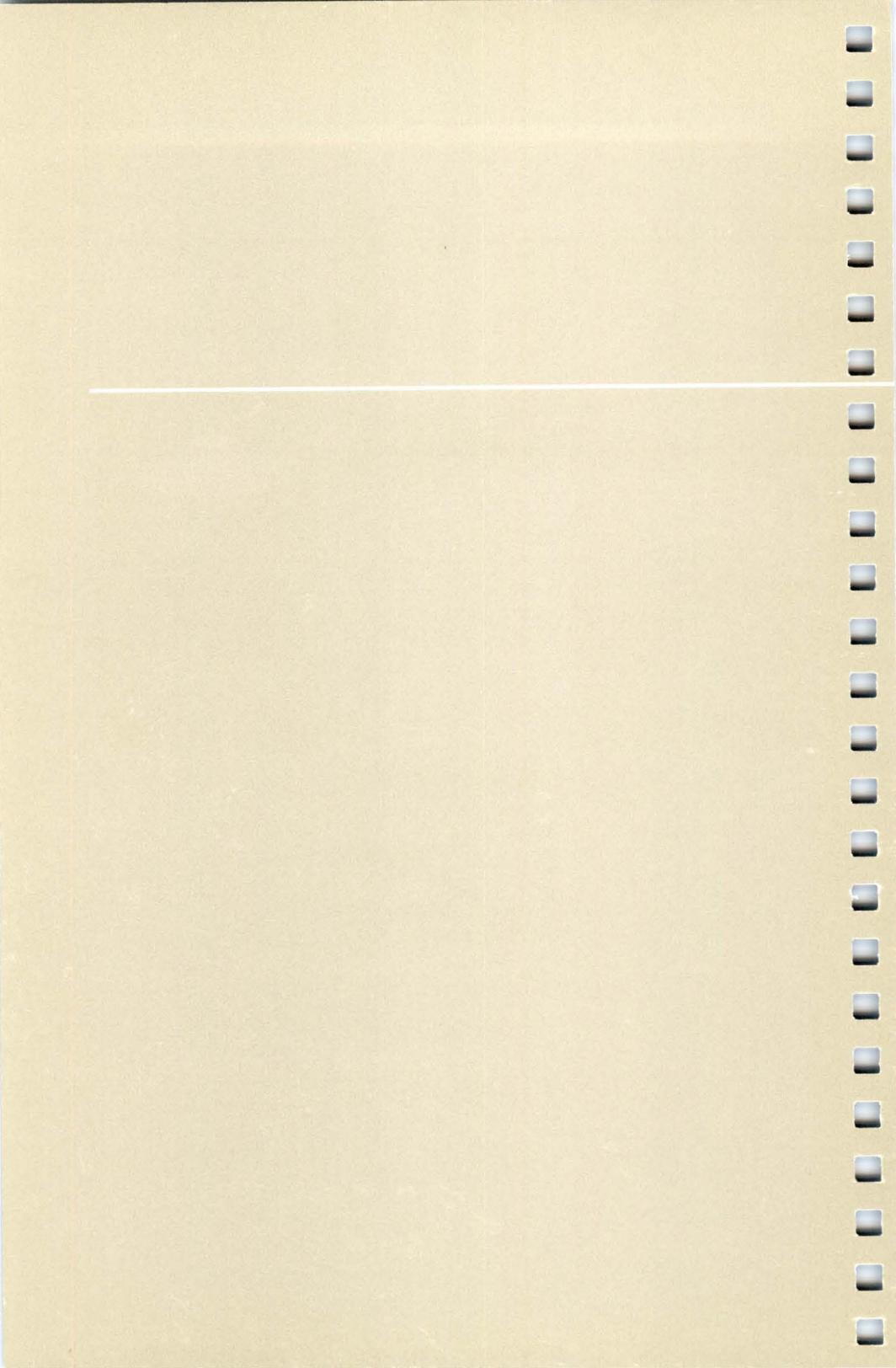
3. Noting whether the status message says *AUTOPRINT . . . NO* or *AUTOPRINT . . . YES*, take the terminal out of Setup.
4. Press F8.
5. Enter Setup again and check the data logging status:

STATUS AUTOPRINT

The data logging status should be the reverse of what it was in Step 2. When data logging is active, all text and dialog in the dialog area will be printed on the printer.



Section 4 SETUP COMMAND SUMMARY



Section 4

SETUP COMMAND SUMMARY

Table 4-1 on the following pages shows all of the terminal's Setup commands. The table is arranged by function, listing all commands that affect that function. You'll find Table 4-1 convenient for verifying a Setup command's syntax, identifying its function, checking its defaults, or determining if it can be saved in nonvolatile memory.

See Section 3 for how to enter Setup commands, correct entry errors, and understand error messages.

The column headings and subheadings in Table 4-1 have the following meanings:

- **Setup Name** — Specifies the Setup command name as you actually type it.
- **Parameters** — Defines parameter functions. Although the complete range of parameters for each command is not shown, all permissible keywords are listed (in bold type). Just enter the keyword that describes the setting you want. For commands that do not have keywords, the example (in the righthand column) gives you an idea of the kind of parameter entry the command requires. You can find all parameter values for each command in your Reference Guide.
- **Defaults** — Specifies the parameter setting the terminal assumes when a value or keyword is not explicitly entered. There are two kinds of defaults:
 - *Factory* — Refers to the setting made when the terminal is manufactured.
 - *Omitted* — Refers to the setting assumed when you enter a command but do not specify a keyword or value for the parameter.

Blank entries under the *Defaults* column indicate that there is no default value for the parameter.

- **Saved** — Specifies whether or not a command's parameters can be saved with an NVSAVE command. Those not saved either revert to the factory default or have no power-up value.
- **Description** — Provides a brief summary description of the command's function. Where appropriate, examples (in bold type) show how you would enter the command.

FUNCTIONAL CATEGORIES

The commands are listed under these terminal functions:

Alphatext

Color

- Dialog Area
- Graphics Area

Command Settings

- Reporting
- Resetting
- Saving

Communications

- Host
- COPIER Port
- PORT 0 and PORT 1

Copies

- Making Copies
- Setting Attributes for PORT 0 and PORT 1
- Setting Color Copy Attributes for COPIER Port
- Setting Monochrome Copy Attributes for COPIER Port

Curves

Dialog Area

- Controlling Attributes
- Controlling Text

Graphics Input (GIN)

- Enabling and Disabling
- Setting Display Characteristics
- Controlling Reports

Graphics Primitives

- Alphatext
- Curves
- Graphtext
- Lines
- Markers
- Panels

Graphtext

Help

Keyboard

Lines

Macros

Markers

Modes

Panels

Pixel Operations

- Initializing
- Transferring Data

Reports

Screen Dimming

Security

Segments

- Defining
- Saving
- Displaying
- Transforming
- Setting Attributes
- Assigning Classes
- Editing

Surfaces

Text

- Displaying Alphatext
- Displaying Graphtext

Views

- Controlling Multiple Views
- Zoom and Pan

Table 4-1
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)																		
		Factory	If Omitted																				
ALPHATEXT																							
BACKINDEX	text-background-index	-1	0	No	Specifies color indices for the character backgrounds of string precision graphtext and alpha text in the graphics area; also specifies the index for the gaps in dashed lines BACKINDEX 0,-1																		
	dash-gap-index	-1	0																				
DAENABLE	mode no yes	yes	yes	Yes	Enables or disables the dialog area																		
GAMODE	writing-mode replace overstrike	overstrike	replace	Yes	Specifies whether the terminal overwrites or replaces characters in the graphics area																		
GTINDEX	text-index	1	0	No	Specifies the color index for graphtext and alphatext in the graphics area GTINDEX 2																		
COLOR: Dialog Area																							
ACCURSOR	first-index	0	0	Yes	Assigns color indices to the alpha cursor ACCURSOR 3,6																		
	second-index	1	0																				
DACMAP	color-mixture	<table border="1"> <tr><td>Index</td><td>Color</td></tr> <tr><td>0</td><td>Black</td></tr> <tr><td>1</td><td>White</td></tr> <tr><td>2</td><td>Red</td></tr> <tr><td>3</td><td>Green</td></tr> <tr><td>4</td><td>Blue</td></tr> <tr><td>5</td><td>Cyan</td></tr> <tr><td>6</td><td>Magenta</td></tr> <tr><td>7</td><td>Yellow</td></tr> </table>	Index	Color	0	Black	1	White	2	Red	3	Green	4	Blue	5	Cyan	6	Magenta	7	Yellow	Unchanged	Yes	Specifies the color assigned to color indices in the dialog area DACMAP 3,0,100,0
Index	Color																						
0	Black																						
1	White																						
2	Red																						
3	Green																						
4	Blue																						
5	Cyan																						
6	Magenta																						
7	Yellow																						

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
COLOR: Dialog Area (continued)					
DAINDEX	character-index	1	0	Yes	Specifies the color index for alphanumerical characters, character-cell background, and dialog area background DAINDEX 3,4,5
	character-background-index	0	0		
	dialog-background-index	0	0		
SCREENMODE	mode normal reverse	normal	normal	Yes	Reverses the hues in the graphics area and changes Index 0 to opaque
TEXTRENDITION	graphic-rendition	0	0	No	Selects character color, cell background color, blink, bold, underscore, etc.
COLOR: Graphics Area					
ACURSOR	first-index	0	0	Yes	Assigns color indices to the alpha cursor ACURSOR 3,6
	second-index	1			
BACKINDEX	text-background-index	-1	0	No	Specifies color indices for the character backgrounds of string precision graphtext and alpha text in the graphics area; also specifies the index for the gaps in dashed lines BACKINDEX 0,-1
	dash-gap-index	-1	0		
CBACKGROUND	first-color-coordinate	0	0	No	Sets the color of the background surface CBACKGROUND 120,50,100
	second-color-coordinate	0	0		
	third-color-coordinate	0	0		

CMAP	surface-number		Error TG11	No	Defines the color map for a graphics writing surface CMAP 1,3,0,100,0
	color-mixture	<u>Index</u> <u>Color</u> 0 Black 1 White 2 Red 3 Green 4 Blue 5 Cyan 6 Magenta 7 Yellow 8 Orange 9 Grn-Ylw 10 Grn-Cyan 11 Blue-Cyan 12 Blu-Mgnta 13 Rd-Mgnta 14 Dk Gray 15 Lt Gray	Error TG21		
CMODE	color-specifying-mode	3	0	No	Specifies which color coordinate system to use for color graphics: HLS, RGB, or CMY CMODE 1,3,0
	color-overlay-mode	1	0		
	gray-mode	1	0		
FILLPATTERN	fill-pattern-number	-1	0	No	Specifies the fill pattern for panel definitions FILLPATTERN 16
GCURSOR	first-color-coordinate	0	0	Yes	Specifies the color mixture for the GIN crosshair cursor GCURSOR 150,50,90
	second-color-coordinate	100	0		
	third-color-coordinate	0	0		
GTINDEX	text-index	1	0	No	Specifies the color index for graphtext and alphanetext in the graphics area GTINDEX 2
LINEINDEX	line-index	1	0	No	Specifies the color index for all subsequent lines, panel boundaries, and markers LINEINDEX 4
VATTRIBUTES	surface-number	1	0	No	Sets the surface, wipe index, and border index for the current view VATTRIBUTES 0,0,2
	wipe-index	0	0		
	border-index	1	0		

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
COMMAND SETTINGS: Reporting					
STATUS	name ANSI communications dialog general graphics hardcopy keyboard level memoryblocks pixels pmemoryblocks report/input segments surfaces terminal version views 2PPI		All commands	No	Displays the current parameter values for a command or a cluster of commands (cluster names and special inquiry names are listed as keywords under the <i>Parameters</i> column)
COMMAND SETTINGS: Resetting					
FACTORY				No	Sets all parameters to their factory default values and takes the terminal out of Setup
RESET				No	Resets the terminal to its power-up condition
COMMAND SETTINGS: Saving					
NVSAVE				Yes	Saves the parameter values of those commands whose settings can be saved in nonvolatile memory; also saves all nonvolatile macros

COMMUNICATIONS: Host

ANSWERBACK	answerback-string			Yes	Assigns the terminal's answerback string ANSWERBACK /PASSKEY/
BAUDRATE	transmit-data-rate	2400	Error NR11	Yes	Sets the terminal's transmit and receive baud rates BAUDRATE 600,300
	receive-data-rate	2400	Same as <i>transmit- baud-rate</i>		
BREAKTIME	break-time	200	0	Yes	Sets the duration (in milliseconds) of the break signal that the terminal sends when a user presses the terminal's Break key BREAKTIME 25
BYPASSCANCEL	bypass-cancel-character	^L F (ADE 10)	^N u (ADE 0)	Yes	Specifies the character that causes the terminal to terminate Bypass mode BYPASSCANCEL 10
ECHO	echo-mode no yes	no	yes	Yes	Specifies whether the terminal echoes characters it transmits to the host
EOFSTRING	EOF-string			Yes	Specifies the terminal's end-of-file string EOFSTRING /XYZ/
EOLSTRING	EOL-string	^C R (ADE 13)		Yes	Specifies the terminal's end-of-line string EOLSTRING / ~ ^CR/
EOMCHARS	first-EOM-indicator	^C R (ADE 13)	^N u (ADE 0)	Yes	Specifies two characters that the terminal can use to mark the end of a line of data sent to the host EOMCHARS 13,10
	second-EOM-indicator	^L F (ADE 10)	^N u (ADE 0)		
ERRORLEVEL	error-threshold-level	2	0	No	Specifies the levels of error messages the terminal displays ERRORLEVEL 3

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
COMMUNICATIONS: Host (continued)					
FLAGGING	flagging-mode none input output in/out dtr/cts	none	none	Yes	Specifies the kind of flagging the terminal uses
IGNOREDEL	ignore-deletes-mode no yes	no	yes	Yes	Determines whether the terminal ignores the Δ T (Delete) character
PARITY	parity-mode none odd even high data	none	none	Yes	Specifies the kind of parity the terminal uses when it transmits to the host
PCOPY	source-device HO: P0: P1:		Error PC11	No	Establishes two-way communications between the host and a 2PPI port or between two 2PPI ports PCOPY HO:,TO,P0:
	separator TO		Error PC21		
	destination-device HO: P0: P1:		Error PC31		

PROMPTMODE	prompt-mode no yes	no	yes	No	Turns Prompt mode on or off
PROMPTSTRING	prompt-string			Yes	Specifies the string that initiates the terminal's Prompt mode PROMPTSTRING /ABC/
QUEUESIZE	queue-size	300	Error NQ11	Yes	Specifies the size (in bytes) of the terminal's input queue QUEUESIZE 900
REOM	EOM-frequency	1	1	Yes	Specifies how often the terminal sends an EOL string to the host REOM 0
RLINELENGTH	maximum-line-length	0	0	No	Specifies the maximum number of characters per line the terminal sends to the host RLINELENGTH 100
STOPBITS	number-of-stop-bits ^a	1	Error NB11	Yes	Specifies number of stop bits appended to each character the terminal transmits STOPBITS 2
XMTDELAY	transmit-delay	100	0	Yes	Specifies the terminal's delay between transmitting lines of text XMTDELAY 200
XMTLIMIT	rate-limit	19200	Error NL11	Yes	Specifies the effective transmit baud rate limit XMTLIMIT 900

COMMUNICATIONS: COPIER Port

HCINTERFACE	copier-type	2	0	Yes	Identifies the copier connected to the COPIER port HCINTERFACE 2
HCMONOCHROME	monochrome-attributes	1	0	Yes	Specifies the line termination (C_R or $C_{R^L F}$) that the terminal sends to a monochrome printer HCMONOCHROME 0

^a For commands that require keywords, we've listed the keywords below the parameter.^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
COMMUNICATIONS: PORT 0 and PORT 1					
PASSIGN	port-identifier P0: P1:		Error PA11	Yes	Assigns a device protocol to PORT 0 or PORT 1 PASSIGN P0:,4510
	protocol-identifier PPOINT 4510 4662 4662/MP 4663	PPOINT	Error PA21		
PBAUD	port-identifier P0: P1:		Error PR11	Yes	Specifies the baud rate for PORT 0 or PORT 1 PBAUD P0:,2400
	baud-rate	2400	Error PR21		
PBITS	port-identifier P0: P1:		Error PB11	Yes	Sets the number of stop bits and the number of data bits in characters sent to the specified port PBITS P0:,2,7
	number-of-stop-bits	1	Error PB21		
	number-of-data-bits	8	Error PB31		
PCOPY	source-device HO: P0: P1:		Error PC11	No	Establishes two-way communications between the host and a 2PPI port or between two 2PPI ports PCOPY P0:,TO,P1:
	separator TO		Error PC21		

	destination-device HO: P0: P1:		Error PC31		
PEOF	port-identifier P0: P1:		Error PE11	Yes	Sets the end-of-file string for PORT 0 or PORT 1 PEOF P0:,"/*"
	EOF-string				
PFLAG	port-identifier P0: P1:		Error PF11	Yes	Sets the flagging mode for PORT 0 or PORT 1 PFLAG P0:;CHAR, Ctrl-Q, Ctrl-S
	flagging-mode none char DTR/CTS	none	char		
	go-character		P ₁ (ADE 17)		
	stop-character		P ₃ (ADE 19)		
PPARITY	port-identifier P0: P1:		Error PP11	Yes	Specifies the parity scheme for output to PORT 0 or PORT 1 PPARITY P1:;ODD
	parity-mode low odd even high none	none	low		

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
COPIES: Making Copies					
AUTOPRINT	copy-option no yes toggle	no	yes	No	Sends dialog to the printer at the same time it is written to the screen
COPY	source HO: P0: P1:		Error JC11	No	Sends data from the host to the COPIER port COPY HO:,TO,HC:
	separator TO		Error JC21		
	destination HC: HO: P0: P1:		Error JC31		
PLOT	separator TO		Error PL11	No	Sends all visible segments to a 2PPI port PLOT TO,P0:
	port HO: P0: P1:		Error PL21		
SAVE	object-saved SEG		Error JV11	No	Sends a segment definition to the host port or to one of the 2PPI ports SAVE SEG,1,TO,P0:
	segment-number		Error JV21		
	separator TO		Error JV31		

destination-device HO: P0: P1:	Error JV41
--	------------

COPIES: Setting Attributes for PORT 0 and PORT 1

PCOPIES	port-identifier P0: P1:		Error PN11	Yes	Selects the number of copies produced on the 4510 Rasterizer PCOPIES P1:,5
	number-of-copies	1	0		
PINVERSION	port-identifier P0: P1:		Error PJ11	Yes	Instructs the rasterizer to reverse the black and white colors in a copy image PINVERSION P0:;NEGATIVE
	image-polarity negative positive	negative	negative		
PMAP	port-identifier P0: P1:		Error PI11	No	Assigns a color index to a plotter pen PMAP P0:;,5,2
	index	1	0		
	pen-ID-number	1	0		
PORIENT	port-identifier P0: P1:		Error PO11	Yes	Specifies whether the long axis of an image aligns with the long or short axis of a hard copy on the 4510 Rasterizer PORIENT P0:;VCENTER
	orientation horizontal vbottom vcenter vtop	horizontal			

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
COPIES: Setting Color Copy Attributes for the COPIER Port					
HCDAATTRIBUTES	number-of-pages	1	Unchanged	Yes	Specifies the number of pages to be copied, the starting page, and how Form Feed is interpreted HCDAATTRIBUTES 2,1,1
	page-origin	0	0		
	F _F -interpretation	0	0		
HCDATARES	number-of-bytes	2	Error QB11	Yes	Selects the color resolution of data sent from the terminal to a 4691 and 4692 Color Copier HCDATARES 2
HCDENSITY	density-code low high	high	high	Yes	Selects either low-density or high-density copies
HCINTERFACE	copier-type	2	0	Yes	Identifies the copier connected to the COPIER port HCINTERFACE 2
HCORIENT	orientation horizontal vbottom vcenter vtop	horizontal	horizontal	Yes	Specifies whether the long axis of an image aligns with the long or short axis of a hard copy on a 4691 or 4692 Copier
HCREPAINT	repaint-count	1	1	Yes	Sets the number of times the 4692 Color Copier will repaint an image HCREPAINT 4
HCSIZE	size	0	0	Yes	Selects a standard-size or small-size copy image HCSIZE 1

COPIES: Setting Monochrome Copy Attributes for the COPIER Port

HCDAATTRIBUTES	number-of-pages	1	Unchanged	Yes	Specifies the number of pages to be copied, the starting page, and how Form Feed is interpreted HCDAATTRIBUTES 2,1,1
	page-origin	0	0		
	F _F -interpretation	0	0		

HCMAP	monochrome-values	All indices print except Index 0	Error QI11	No	Specifies which graphics color indices print and which do not print on monochrome printers HCMAP 2,0,3,0,4,0
HCMONOCHROME	monochrome-attributes	0	1	Yes	Specifies the line termination (C_R or C_{R-F}) that the terminal sends to a monochrome printer

CURVES

CURVE	curve-type arc chord pie		Error UC11	No	Draws a curve through a list of points, starting at the current graphics position CURVE ARC,500,1500,2000,3000
	list-of-points		Error UC21		
CSMOOTH	smoothness ^c	0.0909 . . . (5° per vector)	0.0	No	Determines the smoothness of curves drawn with the CURVE command CSMOOTH 1,0

DIALOG AREA: Controlling Attributes

ACURSOR	first-index	1	0	Yes	Assigns color indices to the alpha cursor ACURSOR 3,6
	second-index	0	0		
AUTOWRAP	mode no yes	yes	yes	Yes	Specifies whether newly entered characters in the rightmost column overwrite existing characters or wrap around to next line
CLEARDIALOG				No	Erases the dialog buffer
COLUMNMODE	mode 80 132	80	80	Yes	Specifies a dialog area buffer width of 80 or 132 columns
CURSORTYPE	cursor-mode underline block	underline	Unchanged	Yes	Selects a block or an underscore as the alpha cursor

^a For commands that require keywords, we've listed the keywords below the parameter.^b Examples of command syntax appear in bold type following some descriptions.^c This parameter must be encoded as a *real* parameter — see the 4106/4107/4109/CX *Programmers Reference Guide*.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ¹)	Defaults		Saved	Description (Examples ²)																		
		Factory	If Omitted																				
DIALOG AREA: Controlling Attributes (continued)																							
DABUFFER	number-of-lines	49	Error LB11	Yes	Specifies the number of lines available for storing text in the dialog area buffer DABUFFER 30																		
DACMAP	color-mixture	<table border="0"> <tr><td><u>Index</u></td><td><u>Color</u></td></tr> <tr><td>0</td><td>Black</td></tr> <tr><td>1</td><td>White</td></tr> <tr><td>2</td><td>Red</td></tr> <tr><td>3</td><td>Green</td></tr> <tr><td>4</td><td>Blue</td></tr> <tr><td>5</td><td>Cyan</td></tr> <tr><td>6</td><td>Magenta</td></tr> <tr><td>7</td><td>Yellow</td></tr> </table>	<u>Index</u>	<u>Color</u>	0	Black	1	White	2	Red	3	Green	4	Blue	5	Cyan	6	Magenta	7	Yellow	Unchanged	Yes	Specifies the colors assigned to color indices in the dialog area DACMAP 3,0,100,0
<u>Index</u>	<u>Color</u>																						
0	Black																						
1	White																						
2	Red																						
3	Green																						
4	Blue																						
5	Cyan																						
6	Magenta																						
7	Yellow																						
DAENABLE	mode no yes	yes	yes	Yes	Enables or disables the dialog area																		
DAINDEX	character-index	1	0	Yes	Specifies the color index for alphanumerical characters, character-cell background, and dialog area background DAINDEX 3,4,5																		
	character-background-index	0	0																				
	dialog-background-index	0	0																				
DALINES	number-of-lines	32	Error LL11	Yes	Specifies the number of lines visible in the dialog area DALINES 15																		
DAMODE	writing-mode replace overstrike	replace	replace	Yes	Specifies whether the Space and Underscore characters can be used to add and delete underscoring in existing text or are to be treated as ordinary characters																		
DAVISIBILITY	visibility-mode no yes	yes	yes	Yes	Specifies whether the dialog area is visible																		
HCDAATTRIBUTES	number-of-pages	1	Unchanged	Yes	Specifies the number of pages to be copied, the starting page, and how Form Feed is interpreted HCDAATTRIBUTES 2,1,1																		
	page-origin	0	0																				
	Ff-interpretation	0	0																				

DIALOG AREA: Controlling Text

CRLF	crlf-mode no yes	no	yes	Yes	Specifies whether a C_R character sent to the terminal also implies a L_F
ECHO	echo-mode no yes	no	yes	Yes	Specifies whether the terminal echoes characters it transmits to the host
EDITCHARS	character-delete	D_T (ADE 127)	Unchanged	Yes	Specifies characters used for character-delete, line-delete, and take-literally EDITCHARS <input type="text" value="Back Space"/> ,?,#
	line-delete	C_N (ADE 24)	Unchanged		
	literal	~ (ADE 126)	Unchanged		
EDITMARGIN	top-margin	1	1	No	Sets the dialog area's edit margins EDITMARGIN 5,25
	bottom-margin	32	Same as DALINES		
INSERTREPLACE	mode replace insert	replace	replace	No	Specifies whether newly entered characters overwrite or replace existing characters
LFCR	lfcrl-mode no yes	no	yes	Yes	Specifies whether an L_F character sent to the terminal also implies a C_R
ORIGINMODE	mode absolute relative	relative	relative	Yes	When edit margins are set, specifies whether cursor origin is first line of buffer or first line of scrolling region

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
DIALOG AREA: Controlling Text (continued)					
SELECTCHARSET	set-selector G0 G1		Error	No	Assigns a character set as the G0 or G1 set (invoked by S ₁ or S ₀ respectively) (No effect when terminal in Setup) SELECTCHARSET G0,G
	character-set A United Kingdom B ASCII/North American G Swedish K German f French ∩ Danish/Norwegian 0 Rulings 3 Supplementary	Depends on keyboard	Error		
SNOOPY	snoopy-mode no yes	no	yes	No	Specifies whether the terminal displays ANSI control characters or treats them as commands
TABS	tab-positions	Every eighth column (1,9,17...)	0	Yes	Sets tab stops at the specified positions. TABS 5,10,15
TEXTRENDITION	graphic-rendition	0	0	No	Selects character color, background color, erase color, blink, bold, underscore, etc.
GRAPHICS INPUT (GIN): Enabling and Disabling					
GINDISABLE	GIN-code		0	No	Disables graphics input (GIN) GINDISABLE 0
GINENABLE	device-function-code		0	No	Enables the terminal for graphics input (GIN) GINENABLE 0,5
	number-of-GIN-reports	0 (same as 65536)	65536		

GRAPHICS INPUT (GIN): Setting Display Characteristics

GCURSOR	first-color-coordinate	0	0	Yes	Specifies the color mixture for the GIN crosshair cursor GCURSOR 150,50,90
	second-color-coordinate	100	0		
	third-color-coordinate	0	0		
GINAREA	device-function-code	All devices	0	No	Defines GIN area on the graphics tablet and maps the GIN area into terminal space GINAREA 8,50,50,200,200
	window-specifier	-1	0		
	GIN-lower-left-corner	0,0	0,0		
	GIN-upper-right-corner	4095,4095	4095,4095		
GINCURSOR	device-function-code	0	Error IC20	No	Selects a segment for use as the GIN cursor GINCURSOR 0,15
	segment-number	0	Error IC20		
GINGRIDDING	device-function-code		0	No	Restricts the set of possible GIN positions for Locate or Pick functions GINGRIDDING 0,25,25
	x-grid-spacing	0	0		
	y-grid-spacing	0	0		
GININKING	device-function-code		0	No	Turns inking on or off for subsequent Locate or Stroke operations GININKING 0,2
	inking-mode	0	0		
GINPICKAPERTURE	aperture-width	8	0	No	Sets the size of a square aperture in terminal space used to Pick graphics segments GINPICKAPERTURE 8
GINRUBBERBAND	device-function-code		0	No	Turns rubberbanding on or off for subsequent GIN Stroke operations GINRUBBERBAND 0,1
	rubberband-mode	0	0		
GINSTARTPOINT	device-function-code		0	No	Specifies an initial point for GIN inking or rubberbanding GINSTARTPOINT 0,53,1000
	start-point		0,0		

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
GRAPHICS INPUT (GIN): Setting Display Characteristics (continued)					
GINWINDOW	lower-left-corner	0,0	0,0	No	Creates a window in terminal space for use by the SET GIN AREA command GINWINDOW 359,479
	upper-right-corner	4095,4095	4095,4095		
GSPEED	normal-speed	8	1	Yes	Specifies how fast the GIN cursor moves across the screen when the Joydisk is pressed GSPEED 12,2
	shifted speed	4	1		
GRAPHICS INPUT (GIN): Controlling Reports					
BYPASSCANCEL	bypass-cancel-character	L _F (ADE 10)	N _U (ADE 0)	Yes	Specifies the character that causes the terminal to terminate Bypass mode BYPASSCANCEL 10
EOFSTRING	EOF-string			Yes	Specifies the terminal's end-of-file string EOFSTRING /XYZ/
EOLSTRING	EOL-string	C _R (ADE 13)		Yes	Specifies the terminal's end-of-line string EOLSTRING / ~ C_R/
EOMCHARS	first-EOM-indicator	C _R (ADE 13)	N _U (ADE 0)	Yes	Specifies two characters that the terminal can use to mark the end of a line of data sent to the host EOMCHARS 13,10
	second-EOM-indicator	L _F (ADE 10)	N _U (ADE 0)		
ERRORLEVEL	error-threshold-level	2	0	No	Specifies the levels of error messages the terminal displays
GINFILTERING	device-function-code		Error IF10	No	Restricts the number of GIN Stroke Reports sent to the host GINFILTERING 10,24,2
	distance-filter	0	0		
	time-filter	0	0		
GINREPORT	report-format	0	0	No	Specifies the amount of information returned to the host in each GIN report GINREPORT 4

GINSHADERCHARS	key-characters letters control	letters	letters	Yes	Selects the key characters used in GIN Stroke Reports
REOM	EOM-frequency	1	1	Yes	Specifies how often the terminal sends an EOL string to the host REOM 0
RLINELENGTH	maximum-line-length	0 (no maximum)	0 (no maximum)	No	Specifies the maximum number of characters per line the terminal sends to the host RLINELENGTH 100
RSIGCHARS	report-type-code		0	No	Assigns signature characters used in reports RSIGCHARS 8,X,Y
	signature-character	0	0		
	terminating-signature-character	0	0		

GRAPHICS PRIMITIVES: Alphatext

BACKINDEX	text-background-index	-1	0	No	Specifies color indices for the character backgrounds of string precision graphtext and alpha text in the graphics area; also specifies the index for the gaps in dashed lines BACKINDEX 0,-1
	dash-gap-index	-1	0		
DAENABLE	mode no yes	yes	yes	Yes	Enables or disables the dialog area
GAMODE	writing-mode replace overstrike	overstrike	replace	Yes	Specifies whether the terminal overwrites or replaces characters in the graphics area
GTINDEX	text-index	1	0	No	Specifies the color index for graphtext and alphetext in the graphics area GTINDEX 2

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
GRAPHICS PRIMITIVES: Curves					
CURVE	curve-type arc chord pie		Error UC11	No	Draws a curve through a list of points, starting at the current graphics position CURVE ARC,500,1500,2000,3000
	list-of-points		Error UC21		
CSMOOTH	smoothness ^c	0.0909 . . . (5° per vector)	0.0	No	Determines the smoothness of curves drawn with the CURVE command CSMOOTH 1,0
GRAPHICS PRIMITIVES: Graphtext					
GAMODE	writing-mode replace overstrike	overstrike	replace	Yes	Specifies whether the terminal overwrites or replaces a character in the graphics area
GTBEGIN	font-number		0	No	Starts the definition of a graphtext character GTBEGIN 4,65
	character-number		Error ST21		
GTDELETE	font-number		0	No	Deletes a user-defined character from a graphtext font GTDELETE 4,65
	character-number		Error SZ21		
GTEND				No	Concludes a graphtext character definition
GTEXT	text			No	Writes a string of graphtext starting at the current graphics position GTEXT /UNICORN/
GTFONT	font-number 0 ASCII/North American 1 Swedish 2 German 3 United Kingdom 9 Danish/Norwegian 12 French	Depends on keyboard	0	No	Selects a character font displaying stroke-precision graphtext GTFONT 12

GTGRID	font-number		0	No	Creates a graphtext font and specifies the dimensions of the invisible grid used for defining characters in the font GTGRID 4,30,40
	grid-width		Error SG21		
	grid-height		Error SG31		
GTINDEX	text-index	1	0	No	Specifies the color index for graphtext and alphatext in the graphics area GTINDEX 2
GTPATH	direction right left up down	right	right	No	Selects a direction (right, left, up, down) to move after writing a graphtext character
GTPRECISION	precision string stroke	stroke	stroke	No	Selects string-precision or stroke-precision to draw graphtext characters
GTROTATION	angle ^c	0.0	0.0	No	Specifies the rotation angle (in degrees) for all subsequent graphtext strings GTROTATION -77,-1
GTSIZE	width	39	39	No	Sets the size of subsequent graphtext strings GTSIZE 30,40,10
	height	59	59		
	spacing	12	12		
GTSLANT	slant-angle ^c	0.0	0.0	No	Specifies how much each stroke-precision graphtext character slants from the vertical GTSLANT 10,0

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

^c This parameter must be encoded as a *real* parameter — see the *4106/4107/4109/CX Programmers Reference Guide*.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
GRAPHICS PRIMITIVES: Lines					
DRAW	position		0,0	No	Draws a vector from the current graphics position to a new position DRAW 52,1000
LINEINDEX	line-index	1	0	No	Specifies the color index for all subsequent lines, panel boundaries, and markers LINEINDEX 4
LINestyle	line-style	0	0	No	Specifies the line style for subsequent lines and panel boundaries LINestyle 1
MOVE	position		0,0	No	Moves the graphics position without drawing a vector MOVE 52,1000
GRAPHICS PRIMITIVES: Markers					
GAMODE	writing-mode replace overstrike	overstrike	replace	Yes	Specifies whether the terminal overwrites or replaces a character in the graphics area
MARKER	position		0,0	No	Draws a marker at a specified location MARKER 52,1000
MARKERTYPE	marker-number	0	0	No	Specifies a marker type MARKERTYPE 10
GRAPHICS PRIMITIVES: Panels					
BEGINPANEL	first-point		0,0	No	Starts a panel boundary definition BEGINPANEL 52,1000,1
	draw-boundary		0		
ENDPANEL				No	Ends a panel definition
FILLPATTERN	fill-pattern-number	-1	0	No	Specifies the fill pattern for panel definitions FILLPATTERN 16

GRAPHTEXT

GAMODE	writing-mode replace overstrike	overstrike	replace	Yes	Specifies whether the terminal overwrites or replaces a character in the graphics area
GTBEGIN	font-number		0	No	Starts the definition of a graphtext character GTBEGIN 4,65
	character-number		Error ST21		
GTDELETE	font-number		0	No	Deletes a user-defined character from a graphtext font GTDELETE 4,65
	character-number		Error SZ11		
GTEND				No	Concludes a graphtext character definition
GTGRID	font-number		0	No	Creates a graphtext font and specifies the dimensions of the invisible grid used for defining characters in the font GTGRID 4,30,40
	grid-width		Error SG21		
	grid-height		Error SG31		
GTEXT	text			No	Writes a string of graphtext starting at the current graphics position GTEXT /UNICORN/
GTFONT	font-number 0 ASCII/North American 1 Swedish 2 German 3 United Kingdom 9 Danish/Norwegian 12 French	Depends on keyboard	0	No	Selects a character font displaying stroke-precision graphtext GTFONT 12
GTINDEX	text-index	1	0	No	Specifies the color index for graphtext and alphanetx in the graphics area GTINDEX 2
GTPATH	direction right left up down	right	right	No	Selects a direction (right,left,up, down) to move after writing a graphtext character

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
GRAPHTEXT (continued)					
GTPRECISION	precision string stroke	stroke	stroke	No	Selects string-precision or stroke-precision to draw graphtext characters
GTROTATION	angle ^c	0.0	0.0	No	Specifies the rotation angle (in degrees) for all subsequent graphtext strings GTROTATION -77,-1
GTSIZE	width	39	39	No	Sets the size of subsequent graphtext strings GTSIZE 30,40,10
	height	59	59		
	spacing	12	12		
GTSBLANT	slant-angle ^c	0.0	0.0	No	Specifies how much each stroke-precision graphtext character slants from the vertical GTSBLANT 10,0
HELP					
HELP	name ANSI communications dialog general graphics hardcopy keyboard pixels report/input segments surfaces views 2PPI		All commands	No	Displays the host escape sequence, Setup name, and command or cluster of commands (cluster names are listed as keywords under the <i>Parameters</i> column), and parameter types for each command

STATUS	name ANSI communications dialog general graphics hardcopy keyboard level memoryblocks pixels pmemoryblocks report/input segments surfaces terminal version views 2PPI		All commands	No	Displays the current parameter values for a (cluster names and special inquiry codes are listed as keywords under the <i>Parameters</i> column)
--------	---	--	-----------------	----	---

KEYBOARD

CURSORKYMODE	mode no yes	no	yes	No	Specifies whether Function Keys F1 — F4 transmit cursor movement commands or programmed values
KEYEXPAND	mode no yes	yes	yes	Yes	Enables or disables key macros
KEYPADMODE	keypad-mode application numeric	numeric	numeric	No	Specifies whether the numeric keypad sends numeric values or application codes
LOCAL	local-mode no yes	no	yes	No	Specifies whether the terminal responds to commands from the host or to commands from its own keyboard

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

^c This parameter must be encoded as a *real* parameter — see the 4106/4107/4109/CX *Programmers Reference Guide*.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
KEYBOARD (continued)					
LOCKVIEWINGKEYS	locking-mode no yes	no	no	No	Locks or unlocks the viewing keys used for Zoom and Pan modes
TABS	tab-positions	Every eighth column (1,9,17 . . .)	0	Yes	Sets tab stops at the specified positions. TABS 5,10,15
LINES					
DRAW	position		0,0	No	Draws a vector from the current graphics position to a new position DRAW 52,1000
LINEINDEX	line-index	1	0	No	Specifies the color index for all subsequent lines, panel boundaries, and markers LINEINDEX 4
LINestyle	line-style	0	0	No	Specifies the line style for subsequent lines and panel boundaries LINestyle 1
MOVE	position		0,0	No	Moves the graphics position without drawing a vector MOVE 52,1000
MACROS					
DEFINE	macro-number		0	No	Creates or deletes a macro DEFINE F1,/XYZ/
	string				
EXPAND	macro-number		0	No	Expands a macro EXPAND 128
KEYEXCHAR	key-execute-character	␣ (ADE 16)	␣ (ADE 0)	Yes	Specifies the character used in macro definitions to switch between sending characters to the host and processing them at the terminal KEYEXCHAR 24

KEYEXPAND	mode no yes	yes	yes	Yes	Enables or disables key macros
LEARN				No	Programs a key from the keyboard
MACROSTATUS	macro-number		0	No	Displays a macro definition
NVDEFINE	macro-number		0	Yes	Creates or deletes both the volatile and nonvolatile version of a macro NVDEFINE F1,/XYZ/
	macro-contents				
	string				
NVLEARN				Yes	Programs a key from the keyboard so that the definition can be stored
NVSAVE				Yes	Saves the parameter values of those commands whose settings can be saved in nonvolatile memory; also saves all nonvolatile macros

MARKERS

GAMODE	writing-mode replace overstrike	overstrike	replace	Yes	Specifies whether the terminal overwrites or replaces a character in the graphics area
MARKER	position		0,0	No	Draws a marker at a specified location MARKER 52,1000
MARKERTYPE	marker-number	0	0	No	Specifies a marker type MARKERTYPE 10

MODES

CODE	syntax TEK ANSI EDIT VT52	TEK	TEK	Yes	Causes the terminal to recognize ANSI, EDIT, TEK, or VT52 mode command syntax
------	---	-----	-----	-----	---

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
PANELS					
BEGINPANEL	first-point		0,0	No	Starts a panel boundary definition BEGINPANEL 52,1000,1
	draw-boundary		0		
ENDPANEL				No	Concludes a panel definition
FILLPATTERN	fill-pattern-number	-1	0	No	Specifies the fill pattern for panel definitions FILLPATTERN 16
PIXEL OPERATIONS: Initializing					
PXBEGIN	surface-number	1	0	No	Specifies surface number, ALU mode, and bits per pixel for use by subsequent pixel operations PXBEGIN 1,12,6
	ALU-mode	11	0		
	bits-per-pixel	6	0		
PXPOSITION	beam-position	0,479	0,0	No	Sets the position of the pixel beam in the pixel viewport for use by subsequent pixel commands PXPOSITION 0,0
PXVIEWPORT	lower-left	0,0	0,0	No	Sets the pixel viewport position in the graphics area PXVIEWPORT 0,0,200,200
	upper-right	639,479	0,0		
PIXEL OPERATIONS: Transferring Data					
PXCOPY	destination-surface		0	No	Copies pixels from one region of the graphics area to another PXCOPY 10,10,50,50,80,80
	destination-lower-left-corner		0,0		
	first-source-corner		0,0		
	second-source-corner		0,0		
PXRASTERWRITE	number-of-pixels		Error RP11	No	Specifies a color index for each of a specified number of pixels in the pixel viewport PXRASTERWRITE 4,/2233/
	color-index-codes		0,0		

PXRECTANGLE	lower-left-corner		0,0	No	Sets all the pixels in a rectangle to the same color PXRECTANGLE 10,10,90,90
	upper-right-corner		0,0		
	fill-index		0		
PXRUNLENGTHWRITE	runcode-array			No	Loads color indices into the pixel viewport PXRUNLENGTHWRITE 84

REPORTS

BYPASSCANCEL	bypass-cancel-character	L _F (ADE 10)	Empty string (ADE 0)	Yes	Specifies the character that causes the terminal to terminate Bypass mode BYPASSCANCEL 10
EOLSTRING	EOL-string	C _R (ADE 13)		Yes	Specifies the terminal's end-of-line string EOLSTRING / ~ C_R/
EOMCHARS	first-EOM-indicator	C _R (ADE 13)	Empty string (ADE 0)	No	Specifies the characters used to terminate messages EOMCHARS 13,10
ERRORLEVEL	error-threshold-level	2	0	No	Specifies the levels of error messages the terminal displays ERRORLEVEL 3
GINFILTERING	device-function-code		Error IF10	No	Restricts the number of GIN Stroke Reports sent to the host GINFILTERING 10,24,2
	distance-filter	0	0		
	time-filler	0			
GINREPORT	report-format	0	0	No	Specifies the amount of information returned to the host in each GIN report GINREPORT 4
GINHEADERCHARS	key-characters letters control	letters	letters	Yes	Selects the key characters used in GIN Stroke Reports
REOM	EOM-frequency	1	1	Yes	Specifies how often the terminal sends an EOL string to the host REOM 0

^a For commands that require keywords, we've listed the keywords below the parameter.^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
REPORTS (continued)					
RLINELENGTH	maximum-line-length	0 (no maximum)	0 (no maximum)	No	Specifies the maximum number of characters per line the terminal sends to the host RLINELENGTH 100
RSIGCHARS	report-type-code		0	No	Assigns signature characters used in reports RSIGCHARS 8,X,Y
	signature-character	0	0		
	terminating-signature-character	0	0		
SCREEN DIMMING					
DIM	dim-code no yes	yes	no	Yes	Turns the automatic screen-dimming feature on or off
SECURITY					
ANSWERBACK	answerback-string			Yes	Assigns the terminal's answerback string ANSWERBACK /PASSKEY/
ECHO	echo-mode no yes	no	yes	Yes	Specifies whether the terminal echoes characters it transmits to the host
SEGMENTS: Defining					
SGCALL	segment-number		Error SF11	No	Calls a segment as a subroutine SGCALL 16,500,500,NONE
	position		0,0		
	attributes none modify reset both	0 (none)	0 (none)		

SGCLOSE				No	Concludes a segment definition
SGDOWN				No	Ends the current segment definition and begins a new segment. The pivot point of the new segment is at the current graphics position, and the segment number is one lower than the segment just ended.
SGINCLUDE	segment-number		Error LK11	No	Copies another segment into the segment currently being defined SGINCLUDE 16
SGNEW	segment-number		Error SE11	No	Starts a new segment definition, closing the current segment definition if one is open; the pivot point is set to the current graphics position SGNEW 16
SGOPEN	segment-number		Error SO11	No	Starts definition of a new segment, setting the pivot point at the location set by the most recent SET PIVOT POINT command SGOPEN 32
SGPICKID	pick-ID-number	1	0	No	Assigns an identification number to subsequent graphics primitives drawn in a currently open segment for GIN Pick operations
SGPIVOT	pivot-point	0,0	0,0	No	Specifies the pivot point used for segments defined with BEGIN SEGMENT commands and for user-defined graphtext characters SGPIVOT 2841,412
SGUP				No	Ends the current segment definition and begins a new segment definition; the pivot point is set to the current graphics position and the segment number becomes the next higher sequential number

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
SEGMENTS: Saving					
PLOT	separator TO		Error PL11	No	Sends all visible segments to a 2PPI port PLOT TO,P0:
	port H0: P0: P1:		Error PL21		
SAVE	object-saved SEG		Error JV11	No	Sends a segment definition to the host port or to one of the 2PPI ports SAVE SEG,2,TO,H0:
	segment-number		Error JV21		
	separator TO		Error JV31		
	destination-device H0: P0: P1:		Error JV41		
SEGMENTS: Displaying					
FIXUP	fixup-level	6	0	No	Specifies how often to update the screen display when changes are made to the current view FIXUP 2
RENEW	view-number		0	No	Erases a view and redraws all segments visible in that view RENEW 32
SGMODE	segment-number		0	No	Selects the writing mode used to display a segment SGMODE 16,SET
	writing-mode and or set xor	set	Error SM21		

SGVISIBILITY	segment-number		0	No	Sets the visibility of a segment SGVISIBILITY 16,YES
	visibility no yes	yes	no		

SEGMENTS: Transforming

SGPOSITION	segment-number		00,0	No	Moves a segment's pivot point to a specified location in terminal space SGPOSITION 1000,1500
	position	0,0			
SGSCALEROTATE	segment-number		Error SJ11		Scales or rotates a segment SGSCALE -5,1,0,2,0,1000,1500
	x-scale-factor ^c	1.0	0.0		
	y-scale-factor ^c	1.0	0.0		
	rotation-angle ^c	0.0	0.0		
SGTRANSFORM	segment-number		Error SI11	No	Scales, rotates, and positions a segment SGTRANSFORM 1,2,0,7,-1,45,0,500,500
	x-scale-factor ^c	1.0	0.0		
	v-scale-factor ^c	1.0	0.0		
	rotation-angle ^c	0.0	0.0		
	position				

SEGMENTS: Setting Attributes

SGDETECT	segment-number		Error SD11	No	Specifies whether a segment is detectable in a GIN Pick operation SGDETECT 16,YES
	detectability no yes		no		
SGHIGHLIGHT	segment-number		Error SH11	No	Turns highlighting (blinking) on or off for one or more segments SGHIGHLIGHT 16,NO
	highlighting no yes		no		

^a For commands that require keywords, we've listed the keywords below the parameter.^b Examples of command syntax appear in bold type following some descriptions.^c This parameter must be encoded as a real parameter — see the 4106/4107/4109/CX Programmers Reference Guide.

(continued)

**Table 4-1 (cont)
SETUP COMMAND SUMMARY**

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
SEGMENTS: Setting Attributes (continued)					
SGPIVOT	pivot-point	0,0	0,0	No	Specifies the pivot point used for segments defined with BEGIN SEGMENT commands and for user-defined graphtext characters SGPIVOT 2841,412
SGPRIORITY	segment-number		Error SS11	No	Sets a segment's display and GIN pick priority SGPRIORITY 32,4
	priority-number		0		
SGVISIBILITY	segment-number		0	No	Sets the visibility of a segment SGVISIBILITY 16,YES
	visibility no yes		no		
SEGMENTS: Assigning Classes					
SGCLASS	segment-class		Error SA11	No	Assigns a segment to one or more classes for use in segment class matching operations SGCLASS 2, <13,14>, <3,4,5>
	removal-array				
	addition-array				
SGMATCHINGCLASS	inclusion-set			No	Defines inclusion and exclusion sets used in matching operations SGMATCHINGCLASS <13,14>, <3,4,5>
	exclusion-set				
SEGMENTS: Editing					
SGEDIT	edit-mode none position attribute both	none	none	No	Specifies how segment editing affects the rest of the segment
SGDELETE	segment-number		Error SK11	No	Deletes a segment from memory SGDELETE 16

SGINSERT	segment-number		Error UI11	No	Opens an existing segment so you can insert new primitives and primitive attributes SGINSERT 16,3,BEFORE
	Pick-ID		Error UI21		
	sequence before end after	before	before		
SGREMOVE	segment-number		Error UD11	No	Deletes Pick groups from segment SGREMOVE 16,3,4
	first-Pick-ID		Error UD21		
	last-Pick-ID		Error UD31		
SGRENAME	old-segment-number		Error SR11	No	Assigns a new segment number to an existing segment SGRENAME 16,39
	new-segment-number		Error SR21		
SGREPLACE	segment-number		Error UE11	No	Deletes Pick groups from an existing segment and leaves the segment open SGREPLACE 3,7,7
	first-Pick-ID		Error UE21		
	last-Pick-ID		Error UE31		

SURFACES

CBACKGROUND	first-color-coordinate	0	0	No	Sets the color of the background surface CBACKGROUND 120,50,100
	second-color-character	0	0		
	third-color-character	0	0		

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)																																
		Factory	If Omitted																																		
SURFACES (continued)																																					
CMAP	surface-number		Error TG11	No	Defines the color map for the graphics region CMAP 1,3,0,100,0																																
	color-mixtures	<table border="1"> <thead> <tr> <th>Index</th> <th>Color</th> </tr> </thead> <tbody> <tr><td>0</td><td>Black</td></tr> <tr><td>1</td><td>White</td></tr> <tr><td>2</td><td>Red</td></tr> <tr><td>3</td><td>Green</td></tr> <tr><td>4</td><td>Blue</td></tr> <tr><td>5</td><td>Cyan</td></tr> <tr><td>6</td><td>Magenta</td></tr> <tr><td>7</td><td>Yellow</td></tr> <tr><td>8</td><td>Orange</td></tr> <tr><td>9</td><td>Grn-Ylw</td></tr> <tr><td>10</td><td>Grn-Cyan</td></tr> <tr><td>11</td><td>Blue-Cyan</td></tr> <tr><td>12</td><td>Blu-Magenta</td></tr> <tr><td>13</td><td>Rd-Magenta</td></tr> <tr><td>14</td><td>Dk Gray</td></tr> <tr><td>15</td><td>Lt Gray</td></tr> </tbody> </table>	Index	Color		0	Black	1	White	2	Red	3	Green	4	Blue	5	Cyan	6	Magenta	7	Yellow	8	Orange	9	Grn-Ylw	10	Grn-Cyan	11	Blue-Cyan	12	Blu-Magenta	13	Rd-Magenta	14	Dk Gray	15	Lt Gray
Index	Color																																				
0	Black																																				
1	White																																				
2	Red																																				
3	Green																																				
4	Blue																																				
5	Cyan																																				
6	Magenta																																				
7	Yellow																																				
8	Orange																																				
9	Grn-Ylw																																				
10	Grn-Cyan																																				
11	Blue-Cyan																																				
12	Blu-Magenta																																				
13	Rd-Magenta																																				
14	Dk Gray																																				
15	Lt Gray																																				
SDEFINITIONS	surface-definitions	4	Error RD11	No	Erases the screen and sets the number of surfaces and the number of bit planes in each surface SDEFINITIONS 2,1,1																																
SPRIORITIES	priorities	1,1	Error RN11	No	Sets the priority of one or surfaces SPRIORITIES 1,4,2,3,3,2,4,1																																
SVISIBILITY	surface-numbers-and-visibilitys	1,1	Error RI11	No	Sets the visibility of one or more surfaces without affecting surface priorities SVISIBILITY 1,0,2,1,3,2,4,1																																
VATTRIBUTES	surface-number	1	0	No	Sets the surface, wipe index, and border index for the current view VATTRIBUTES 0,0,2																																
	wipe-index	0	0																																		
	border-index	1	0																																		
VSELECT	view-number	1	0	No	Specifies which view will be the current view VSELECT 48																																

TEXT: Displaying Alphatext

BACKINDEX	text-background-index	-1	0	No	Specifies color indices for the character backgrounds of string-precision graphtext and alphatext in the graphics area; also specifies the index for the gaps in dashed lines BACKINDEX 0,-1
	dash-gap-index	-1	0		
DAENABLE	mode no yes	yes	yes	Yes	Enables or disables the dialog area
GAMODE	writing-mode replace overstrike	overstrike	replace	Yes	Specifies whether the terminal overwrites or replaces characters in the graphics area
GTINDEX	text-index	1	0	No	Specifies the color index for graphtext and alphatext in the graphics area GTINDEX 2

TEXT: Defining Graphtext Characters

GTBEGIN	font-number		0	No	Starts the definition of a graphtext character GTBEGIN 4,65
	character-number		Error ST21		
GTDELETE	font-number		0	No	Deletes a user-defined character from a graphtext font GTDELETE 4,65
	character-number		Error SZ11		
GTEND				No	Concludes a graphtext character definition
GTGRID	font-number		0	No	Creates a graphtext font and specifies the dimensions of the invisible grid used for defining characters in the font GTGRID 4,30,40
	grid-width		Error SG21		
	grid-height		Error SG31		

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.

(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
TEXT: Displaying Graphtext					
BACKINDEX	text-background-index	-1	0	No	Specifies color indices for the character backgrounds of string-precision graphtext and alphanumtext in the graphics area; also specifies the index for the gaps in dashed lines BACKINDEX 0,-1
	dash-gap-index	-1	0		
GAMODE	writing-mode replace overstrike	overstrike	replace	Yes	Specifies whether the terminal overwrites or replaces a character in the graphics area
GTEXT	text			No	Writes a string of graphtext starting at the current graphics position GTEXT /UNICORN/
GTFONT	font-number 0 ASCII/North American 1 Swedish 2 German 3 United Kingdom 9 Danish/Norwegian 12 French	Depends on keyboard	0	No	Selects a character font displaying stroke-precision graphtext GTFONT 12
GTINDEX	text-index	1	0	No	Specifies the color index for graphtext and alphanumtext in the graphics area GTINDEX 2
GTPATH	direction right left up down	right	right	No	Selects a direction (right,left,up, down) to move after writing a graphtext character

GTPRECISION	precision string stroke	stroke	stroke	No	Selects string-precision or stroke-precision to draw graphtext characters
GTROTATION	angle ^c	0.0	0.0	No	Specifies the rotation angle (in degrees) for all subsequent graphtext strings GTROTATION -77,-1
GTSIZE	width	39	39	No	Sets the size of subsequent graphtext strings GTSIZE 30,40,10
	height	59	59		
	spacing	12	12		
GTSLANT	slant-angle ^c	0.0	0.0	No	Specifies how much each stroke-precision graphtext character slants from the vertical GTSLANT 10,0

IEWS: Controlling Multiple Views

BORDER	border-visibility-mode no yes toggle	no	no	No	Controls the visibility of a the current viewport's border
RENEW	view-number		0	No	Erases a view and redraws all segments visible in that view RENEW 32
VATTRIBUTES	surface-number	1	0	No	Sets the surface, wipe index, and border index for the current view VATTRIBUTES 0,0,2
	wipe-index	0	0		
	border-index	1	0		
VCLUSTER	view-numbers		Remove all views from all clusters	No	Defines a group of views that are to have identical windows VCLUSTER 2,8,16
VDELETE	view-number		0	No	Deletes a view VDELETE 16

^a For commands that require keywords, we've listed the keywords below the parameter.^b Examples of command syntax appear in bold type following some descriptions.^c This parameter must be encoded as a real parameter — see the 4106/4107/4109/CX Programmers Reference Guide.

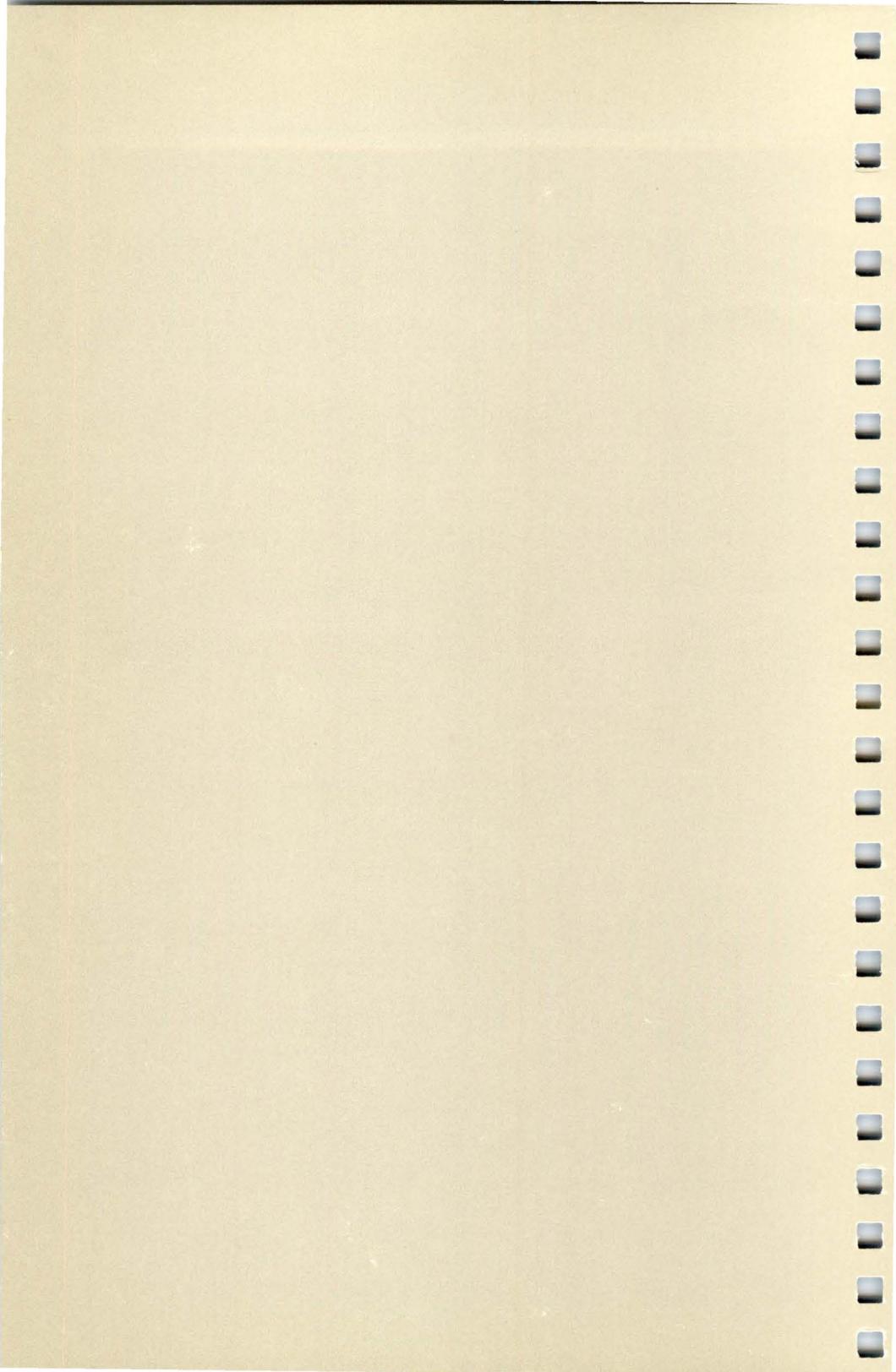
(continued)

Table 4-1 (cont)
SETUP COMMAND SUMMARY

Setup Command (Grouped by Function)	Parameters (Keywords ^a)	Defaults		Saved	Description (Examples ^b)
		Factory	If Omitted		
IEWS: Controlling Multiple Views (continued)					
VIEWPORT	first-corner	0,0	0,0	No	Sets the size and position of the current view's viewport on the terminal screen VIEWPORT 50,100,200,300
	second-corner	4095,3071	0,0		
VSELECT	view-number	1	0	No	Specifies which view will be the current view VSELECT 48
WINDOW	first-corner	0,0	0,0	Yes	Sets the boundaries of the current view's window in terminal space WINDOW 50,100,2372,2800
	second-corner	4095,3130	4095,3130		
IEWS: Zoom and Pan					
LOCKVIEWINGKEYS	locking-mode no yes	no	no	No	Locks or unlocks the viewing keys used for Zoom and Pan modes
WINDOW	first-corner	0,0	0,0	Yes	Sets the boundaries of the current view's window in terminal space WINDOW 50,100,2372,2800
	second-corner	4095,3130	4095,3130		

^a For commands that require keywords, we've listed the keywords below the parameter.

^b Examples of command syntax appear in bold type following some descriptions.



Appendix A

INSTALLATION AND SETUP

This appendix guides you through the installation and set up of your 4106, 4107, or 4109 Computer Display Terminal, which includes these steps:

1. Selecting a site.
2. Unpacking the terminal, checking the accessories, and checking the voltage settings.
3. Connecting the keyboard and host computer cables.
4. Running the terminal's Self Test diagnostic program.
5. Setting the terminal's communications parameters.
6. Testing the communications link between the terminal and host computer (including how to select the terminal's operating mode).
7. Connecting the peripherals.

The only tools you need to install the terminal are a box opener or knife and a small, flat-bladed screwdriver.

SELECTING A SITE

The installation site you select for the terminal should meet the following requirements.

CAUTION

Do not block air flow or cover the terminal's air vents in any way. This could cause overheating and result in circuit damage.

- **The site should provide enough room for adequate ventilation and cable routing.** The terminal's air vents should be at least 2 in. (50 mm) from the nearest wall or surface. Allow at least 3 in. (75 mm) at the rear of the terminal for cable routing. Use Figure A-1 or A-2 (next page) as a guide.
- **The site should provide a stable environment.** While the terminal is operating, the ambient temperature should stay within 50 to 104° F (+ 10 to + 40° C).

Relative humidity should stay between 0 and 75%. Do not operate the terminal at an altitude greater than 10,000 ft (3050 m).

If any of these operating limits are exceeded, the terminal may not operate properly.

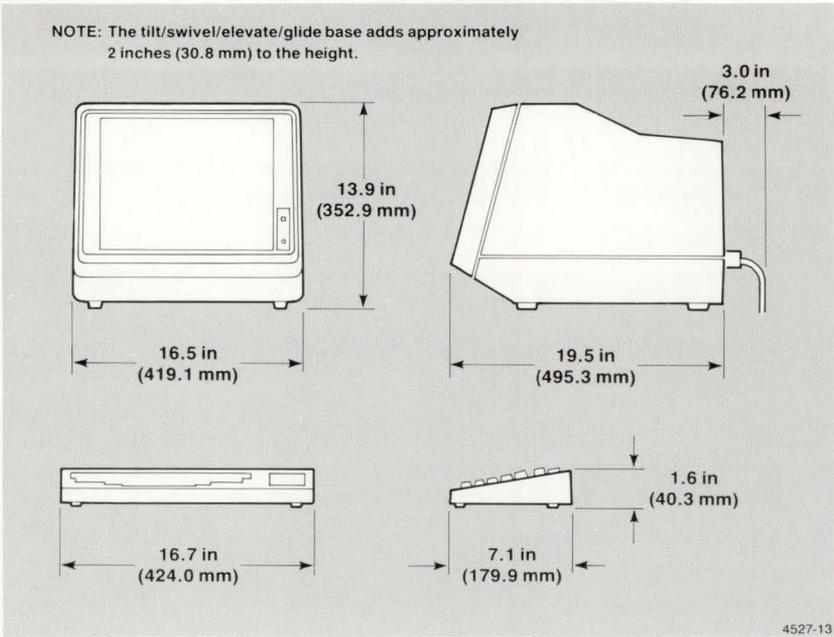


Figure A-1. 4106 and 4107 Terminal Dimensions.

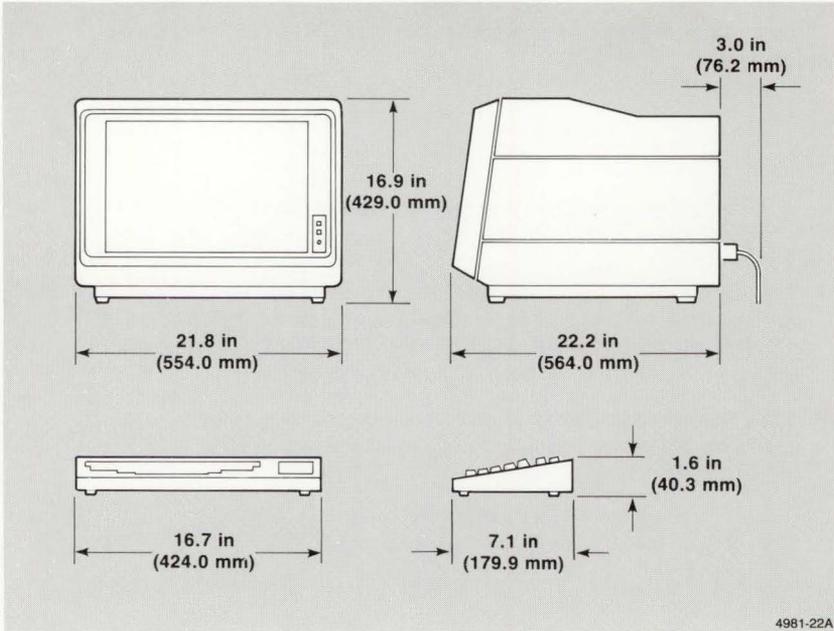


Figure A-2. 4109 Terminal Dimensions.

UNPACKING THE TERMINAL

If the terminal has already been unpacked, begin at Step 7.

Before unpacking the terminal, carefully inspect the shipping carton for any signs of damage. Report any damage to the carrier and contact your Tektronix sales representative immediately.

Retain all packing material in case you need to move or ship the terminal in the future.

The terminal and all its standard accessories are shipped in one carton. Unpack the carton by following these steps; use Figure A-3 or A-4 (next pages) as a guide:

1. Cut the strapping bands around the box, and lift off the entire top carton.
2. Remove the keyboard container and put it aside.
3. Remove the top packing material.
4. Remove the package containing the accessories and put it aside.
5. Lift the display unit out of the bottom pad and place it in the site previously selected. Remove the keyboard from its carton and place it next to the display unit.
6. Check the equipment you received against the accessories list in Section 1 of this manual. If any items are missing, notify your Tektronix sales representative immediately.

CAUTION



Both voltage selector switches on the rear panel of the display unit must be set to the same voltage. Setting the two switches to different voltages, or setting the switches to the wrong voltage, may seriously damage the terminal's circuits.

7. Check the voltage selector switches on the rear panel of the terminal to ensure they are set to the proper operating voltage, as required by your ac power source. (For the terminal's voltage ranges, refer to the Electrical Specifications table in Appendix F.) If the switches are not set to the proper voltage, move *both* switches to the same correct setting. Also, check that you have received the correct power cord (voltage and plug type).

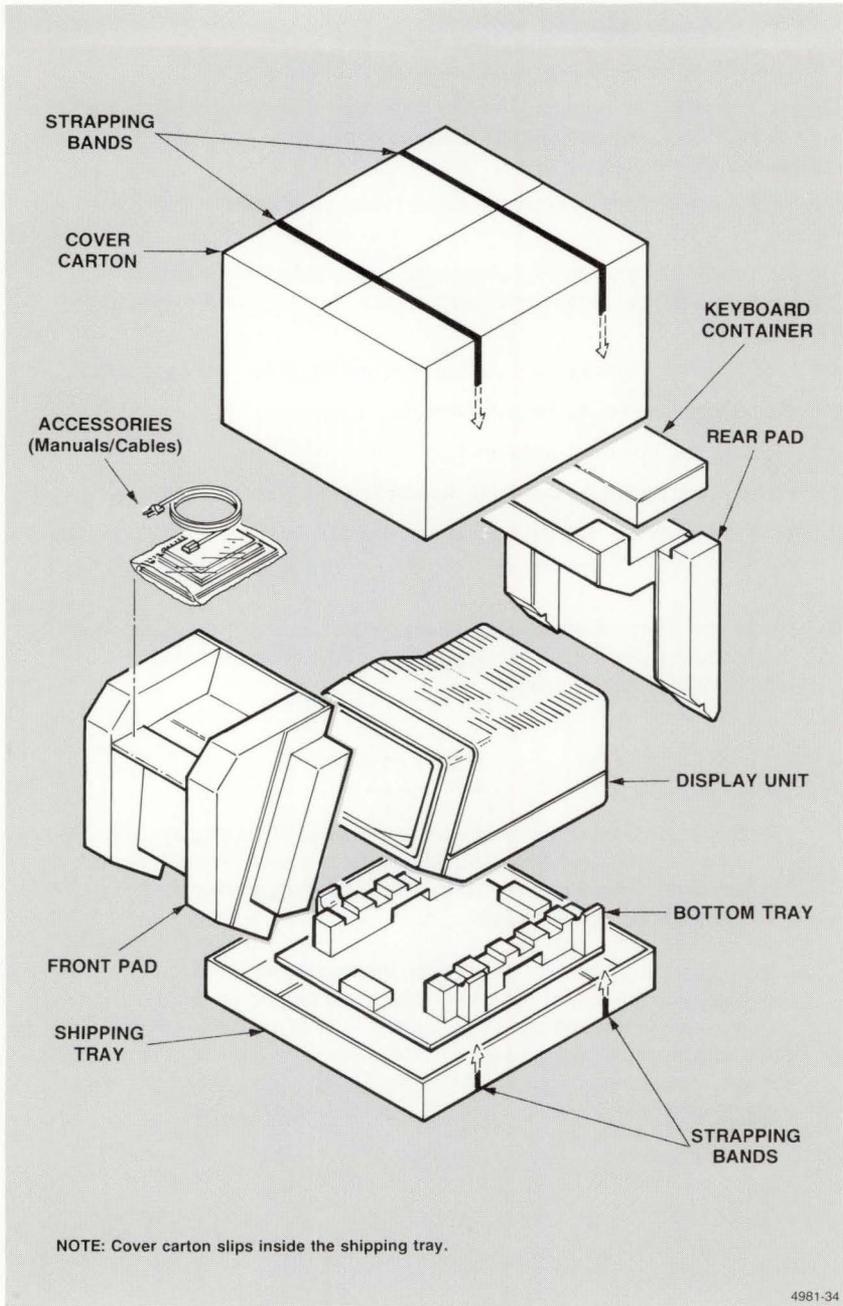
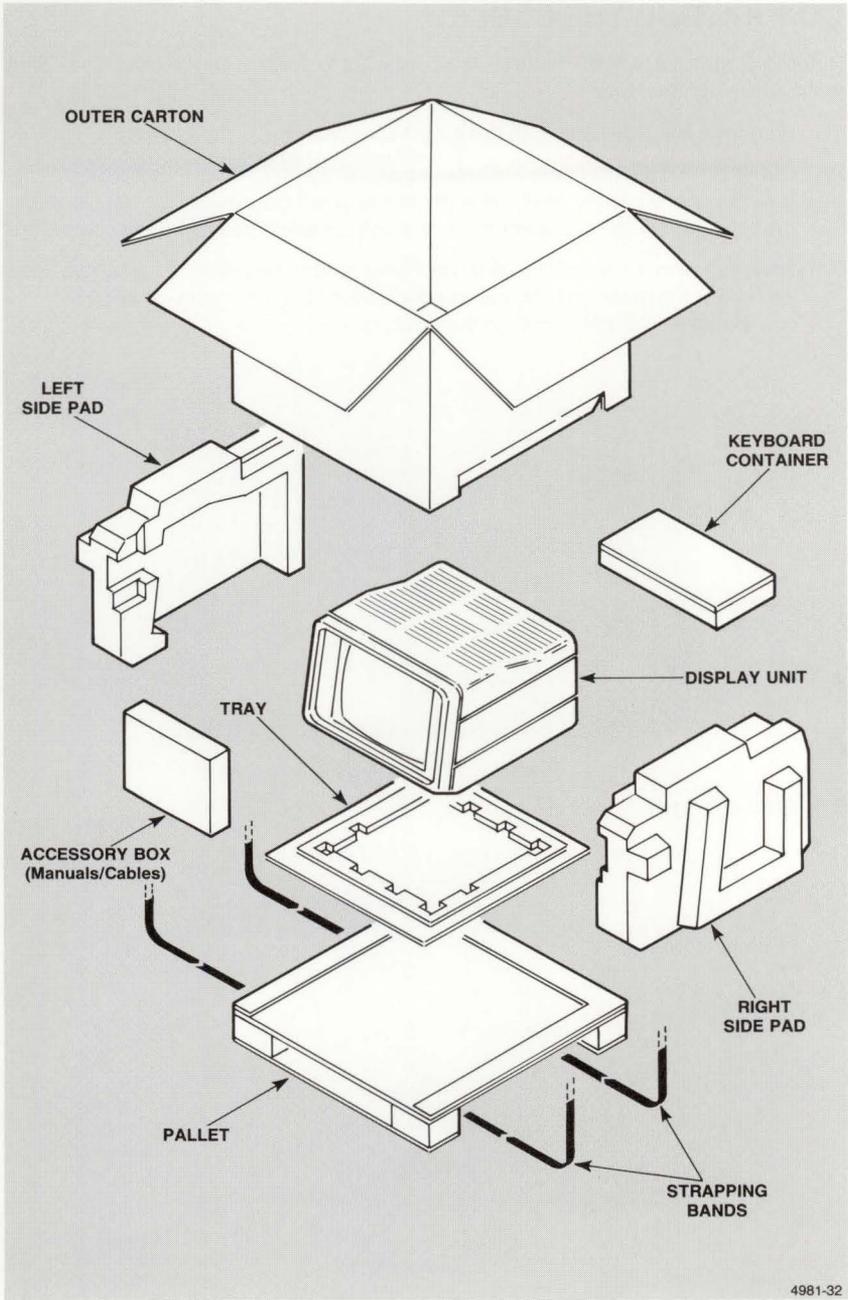


Figure A-3. 4106 and 4107 Packing Diagram.



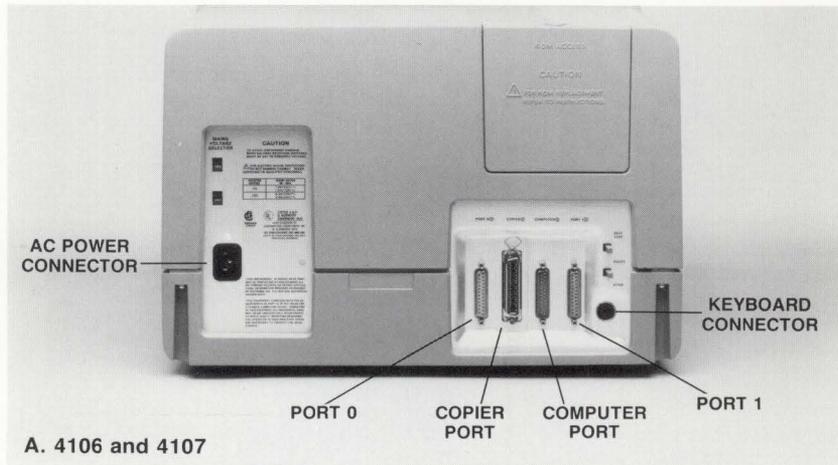
4981-32

Figure A-4. 4109 Packing Diagram.

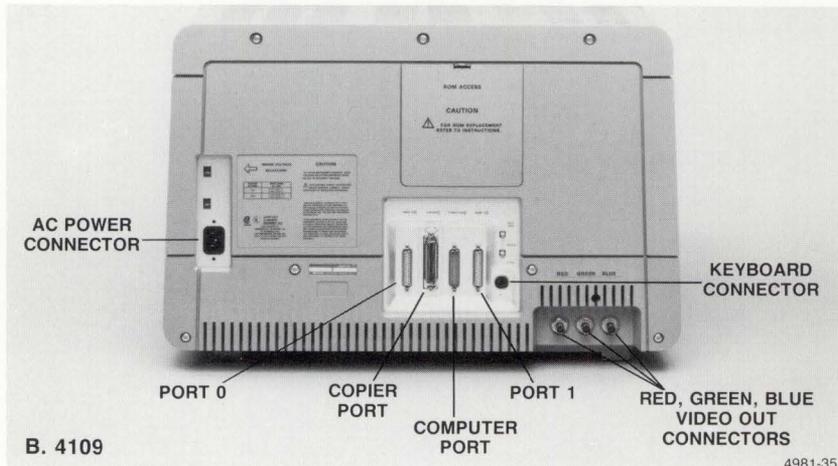
CONNECTING THE CABLES

Refer to Figure A-5, which identifies the connectors on the rear of the terminal, then make these connections:

1. Plug the keyboard cable into the *KYBD* connector.
2. Connect the RS-232 cable to the terminal's *COMPUTER* port. Secure the cable connector to the terminal with the two small connector screws. Connect the other end of the cable either to a modem or directly to your host computer.
3. Attach the female end of the ac power cord to the rear panel of the terminal, and insert the male end into the ac power source. Then, apply power by pressing the *POWER* button on the front panel.



A. 4106 and 4107



B. 4109

4981-35

Figure A-5. Terminal Connector Locations.

RUNNING SELF TEST

Run the Extended Self Test program (described here) to verify that the terminal is operating correctly (if necessary, refer to Appendix B for photographs and explanations of the keys and controls you'll need to use in these steps):

1. Locate the SELF TEST and RESET buttons on the rear of the terminal.
2. Press SELF TEST and hold it in. While holding in SELF TEST, press and release RESET.
3. Hold in SELF TEST for another two seconds, then release it.

You'll see a white crosshair cursor on the screen, which indicates that Extended Self Test is running. After about 30 seconds, the crosshair blinks once, the keyboard bell rings once, and this menu is displayed:

```

F5 Continuous Self Test
F6 Adjustment Procedures Menu
F7 Continue Self Test
F8 Exit Self Test
  
```

Selection:

4. Press Function Key F7 (at the top right of the keyboard) to continue Extended Self Test. (If you don't press a key within 20 seconds after the Extended Self Test menu appears, Extended Self Test continues automatically.)

The crosshair cursor reappears and blinks intermittently. After about four minutes, if no errors are detected, the crosshair disappears and this menu is displayed.

```

Adjustment Procedures Menu
F1 Reset Nonvolatile Parameters
F2 Keyboard Switch Test
F3 RS-232 Interface Test
F4 Hard Copy Menu
F5 Display Pattern Menu
F6 Graphics Tablet Test
  

S1 Set Nonvolatile Parameters to Factory Cycle Mode
  

F7 Continue Self Test
F8 Exit Self Test
  
```

Selection:

5. Press Function Key F8 to exit Extended Self Test.

When the terminal detects an error, it rings the keyboard bell twice, or writes a message on the screen, or both. (If no message appears, try turning up the Brightness knob.) If an error is indicated, refer to Appendix E, which tells you what to do.

After you have verified that the terminal is functioning properly, you can continue with these installation procedures.

SETTING COMMUNICATIONS PARAMETERS

If this is the first time you have used a Tektronix terminal, or if you need instructions for entering Setup commands, we suggest that you go back to Section 2, *Getting Acquainted With Your Terminal*, and complete those exercises before continuing with these setup procedures.

The 4106, 4107, and 4109 Terminals are already configured by the factory for typical RS-232 host communications; however, you probably need to change some of the terminal's settings to match the settings of your host computer.

Table A-1 lists the commands that set up RS-232 communications with your host computer. The third column, *Available Settings*, lists the available settings (parameters), and the fourth column lists the *factory defaults* (the terminal settings already built into the terminal). The last column is empty so that you can list the settings required by your host computer.

Follow these steps to configure the terminal for communication with your host:

1. Find out what settings are required by your host computer. Consult your host computer manuals, your computer center staff, or your system programmer for this information. Then, fill in these requirements in the last column of Table A-1. (The optional *4106/4107/4109/CX Programmers Reference Manual* describes RS-232 communications concepts and gives more detail about individual commands.)
2. Put the terminal in Setup and enter the required communications commands using Table A-1. You only need to enter those commands whose factory default settings are different from your host computer's requirements.
3. Display the terminal's communications settings by entering:

STATUS COMM

Check the list to make sure it matches the settings you listed in the last column of Table A-1.

4. After you set the terminal's communication parameters, save them in nonvolatile memory by entering:

NVSAVE

Nonvolatile memory is not erased when the terminal is turned off. Every time you turn on the terminal, it automatically sets its communications parameters to these saved values.

During future use of the terminal, you can temporarily change the communications settings without altering the nonvolatile (remembered) settings. The terminal reverts to the nonvolatile settings when you reset it or turn it off and back on.

Table A-1
COMMUNICATIONS COMMANDS

Command Name	Description	Available Settings	Factory Default Setting	Host Computer Settings (Fill in)
BAUDRATE	Sets the transmit and receive rates for host communications	1, 75, 110, 134, 150, 300, 600, 1200, 1800, 2000, 2400, 4800, 9600, 19200, 38400	2400, 2400	
BREAKTIME	Sets the length of the interrupt signal (in milliseconds) generated by the Break key	0 — 65535	200	
BYPASSCANCEL	Sets the bypass cancel character	Any ASCII character	LF (ADE 10)	
CRLF	Specifies whether Carriage Return implies Line Feed	NO, YES	NO	
ECHO	Specifies whether the terminal provides the echo to the screen	NO, YES	NO	
EOFSTRING	Specifies the string that the terminal uses to mark the end of a file transmission	Any ASCII character	Empty array	
EOLSTRING	Specifies the string the terminal sends to the host in reports	Any ASCII character	CR (ADE 13)	
EOMCHARS	Specifies the character(s) sent by the terminal at the end of each line of data	Any ASCII character	CR (ADE 13) and LF (ADE 10)	
FLAGGING	Specifies the handshaking protocol between the terminal and the host	NONE, INPUT, OUTPUT, IN/OUT, DTR/CTS	NONE	
IGNOREDEL	Specifies whether the terminal ignores incoming Delete characters	NO, YES	NO	
LFCR	Specifies whether Line Feed implies Carriage Return	NO, YES	NO	

(continued)

Table A-1 (cont)
COMMUNICATIONS COMMANDS

Command Name	Description	Available Settings	Factory Default Setting	Host Computer Settings (Fill in)
PARITY	Specifies how the parity bit is set on characters sent to the host	NONE, ODD, EVEN, HIGH, DATA	NONE (set to 0)	
PROMPTSTRING	Specifies the string that the host sends to the terminal to initiate Prompt mode	Any ASCII character	Empty array	
QUEUESIZE	Sets the number of bytes reserved for the input queue	1 — 65535	300	
STOPBITS	Sets the number of stop bits sent to the host after each character	1, 2	1	
XMTDELAY	Sets the transmit delay (in milliseconds) after an end-of-message character	0 — 65535	100	
XMTLIMIT	Sets an upper limit on the terminal's transmit rate to the host	110 — 65535	19200	

TESTING COMMUNICATIONS

After you have set the communications parameters, you are ready to select an operating mode and log in to your host computer. The instructions for selecting an operating mode are described next. The procedure for logging in and running programs depends on your particular computer. If you're not familiar with the procedure for your computer, consult your computer center staff for which operating mode to select for your application and how to log in to your host computer.

After you've selected a mode and logged in, enter some commands to the computer to verify the communications settings. Use commands that require a response from the host computer. For example: type a directory listing, create a file and edit it, etc.

Selecting a Terminal Operating Mode

The terminal has four modes of operation that are compatible with a variety of host applications programs. These modes are:

- TEK — For programs that use Tektronix 4100-style graphics and terminal control commands.
- ANSI — For programs that use ANSI Standard X3.64 text editing commands.
- EDIT — For DEC VT100 applications programs.
- VT52 — For DEC VT52 applications programs.

Follow these steps to set the terminal to the proper mode:

1. Check with your computer center staff or your systems programmer to determine which mode you should use to communicate with your host application.
2. Put the terminal in Setup (press the Setup key) and select the operating mode with the CODE command.
 - To select TEK mode, enter:


```
CODE TEK
```
 - To select ANSI mode, enter:


```
CODE ANSI
```
 - To select EDIT mode, enter:


```
CODE EDIT
```
 - To select VT52 mode, enter:


```
CODE VT52
```
3. Remove the terminal from Setup (press the Setup key again).

CONNECTING PERIPHERAL DEVICES AND ESTABLISHING COMMUNICATIONS

The following instructions help you connect peripheral devices to the terminal and set their communications parameters. You should also follow any other installation instructions provided with the peripheral device.

The rest of this appendix contains installation procedures for:

- 4691 and 4692 Color Graphics Copiers
- 4695 Color Graphics Copier
- Monochrome printers
- 4510 Color Graphics Rasterizer
- 4662 Interactive Digital Plotter
- 4663 Interactive Digital Plotter
- 4957 and 4958 Graphics Tablets

You need only refer to those procedures that apply to the device you want to install.

NOTE

Some applications programs running on a host computer may require that some peripherals, such as a 4662 Plotter, be connected to a specific port. Check with your systems programmer.

Section 3 of this manual explains the Setup commands to use for making copies and how to use a graphics tablet.

4691 AND 4692 COLOR GRAPHICS COPIERS

1. Plug the copier cable into the *COPIER* port. Secure the cable connector with the two clips attached to the port.
2. Put the terminal in Setup and enter the following command:

HCINTERFACE 2

The parameter value (2) tells the terminal you are using a Tektronix 4691, 4692, or 4695 Color Graphics Copier.

3. Save the setting in nonvolatile memory by entering:

NVSAVE

4695 COLOR GRAPHICS COPIER

1. Plug the copier cable into the *COPIER* port. Secure the cable connector with the two clips attached to the port.
2. Put the terminal in Setup and enter the following command:

HCINTERFACE 2

The parameter value (2) tells the terminal you are using a Tektronix 4691, 4692, or 4695 Color Graphics Copier.

3. Save the setting in nonvolatile memory by entering:

NVSAVE

4. You may also need to set the *C* and *M ADJUST* switches on the rear panel of the 4695.
 - Switch *C* tells the copier whether to ignore Carriage Returns from the terminal. If the copier double-spaces lines of text or prints a new line of text on top of the previous line, change the switch setting.
 - Switch *M* tells the copier whether to print in one direction or in two directions. Bidirectional printing is faster, but the dot alignment is better with one-directional printing. For highest quality copies, use the slower, one-directional setting.

MONOCHROME PRINTERS

You can connect a monochrome graphics printer that has a Centronics-style printer interface and supports Epson FX-80 graphics protocol, or a monochrome text printer with a Centronics-style printer interface. The manual accompanying the printer should tell you its type of interface and graphics protocol.

1. Plug the printer cable into the *COPIER* port.
2. Tell the terminal which printer is connected to the terminal:
 - If you are using a Tektronix 4644 Dot Matrix Printer or another printer with Epson FX-80 graphics protocol, enter:

HCINTERFACE 3

- If you are using a Hewlett-Packard ThinkJet printer, enter:

HCINTERFACE 4

- If you are using a printer without graphics capability, enter:

HCINTERFACE 0

3. Make sure the terminal sends the proper line endings for your printer. Find out what the printer expects by either checking the manual for your printer or, if the printer has a line-ending switch, checking the printer's switch setting.

Match what the terminal sends to what the printer expects — you can either change the printer's switch (if it's got one) or change what the terminal sends.

- To cause the terminal to send a Carriage Return/Line Feed combination (C^RL^F) at the end of each line (this is the default and is appropriate in most cases), enter:

HCMONOCHROME 1

If the printer expects Line Feeds and the terminal doesn't send any, all your lines of text or graphics will print on the same line — resulting in one unreadable black line.

- To cause the terminal to send just a Carriage Return at the end of each line, enter:

HCMONOCHROME 0

If the printer expects only Carriage Returns and the terminal sends Line Feeds also, the copies you make will have an extra blank line following each line of characters (that is, single-spaced text will be double-spaced, and graphics will have an extra blank line after each printed line).

4. Save the setting in nonvolatile memory by entering:

NVSAVE

4510 COLOR GRAPHICS RASTERIZER

1. Connect the Rasterizer's RS-232 communications cable to the terminal's PORT 0 or PORT 1 port. (For this discussion, we'll assume the Rasterizer is connected to PORT 0.) Secure the RS-232 cable connector to the port by tightening the two small connector screws.
2. Connect the 4691 or 4692 Copier to the Rasterizer, and turn on both the Rasterizer and copier.
3. Put the terminal in Setup and enter:

```
PASSIGN P0:,4510
PBAUD P0:,19200
PPARITY P0:,NONE
PFLAG P0:,CHAR,Ctrl-Q,Ctrl-S
PBITS P0:,1,8
```

(*Ctrl-Q* and *Ctrl-S* mean to hold down the Ctrl key while pressing the Q or S key. Don't type the hyphen.)

4. Save the setting in nonvolatile memory by entering:

```
NVSAVE
```

5. The Rasterizer's communications parameters must match those of the terminal's port. Refer to the manual accompanying the rasterizer and set its parameters as shown here:
 - Set transmit and receive baud rate to *19200*
 - Set parity to *no parity* (indicator should read *0*)
 - Set flagging to *D₁/D₃, bidirectional*
 - Set stop bits to *1*

4662 INTERACTIVE DIGITAL PLOTTER

1. Connect the plotter's RS-232 cable from the "modem" connector on the rear of the plotter to the terminal's PORT 0 or PORT 1 port. (For this discussion, we'll assume the plotter is connected to PORT 0.)
2. Set the plotter switches. Table A-2 shows one way to set the 4662 Plotter's switches; this configuration is recommended for communicating with the terminal. The settings not shown in the table use the plotter's power-up defaults.

Table A-2
4662 PLOTTER SETTINGS

Switch	Setting	Communications Parameter ^a
A	3	CR generates LF No Flagging
B	3	Number of Stop Bits is 1
C	2	Address is A No Parity
D	3	Baud rate is 1200

^a Each plotter switch controls more than one communications parameter.

3. Power up the terminal.
4. Use Setup commands to configure the peripheral port. Put the terminal in Setup and enter these commands:

```
PASSIGN P0:,4662
PFLAG P0:,NONE
PBITS P0:,1,8
PPARITY P0:,NONE
PBAUD P0:,1200
NVSAVE
```

If the plotter is connected to PORT 1, use *P1:* instead *P0:* in the above commands.

5. Power up the plotter and prepare its pen and paper for use.

Other plotter settings may be used; check with your systems programmer. Be sure to configure the terminal's port to match the plotter settings.

Configuring a 4662 Plotter With Option 31

If you have a 4662 with Option 31, the multiple-pen plotter, follow the steps for the 4662, but use this PASSIGN command instead:

```
PASSIGN P0:,4662/MP
```

If the plotter buffer overflows, you should use DC1/DC3 flagging (available only if you have Option 31). Enter this PFLAG command instead:

```
PFLAG P0:,CHAR
```

If you use other plotter settings, be sure to configure the terminal's port to match.

4663 INTERACTIVE DIGITAL PLOTTER

1. Connect the plotter's RS-232 cable from the "modem" connector on the rear of the plotter to the terminal's PORT 0 or PORT 1 port. (For this discussion, we'll assume the plotter is connected to PORT 0.)
2. Set the plotter switches. Table A-3 shows one sequence of 4663 parameter settings for communicating with the terminal. The settings not shown use the plotter's power-up defaults. (The *4663 Operators Manual* tells you how to enter the parameter settings.)

Table A-3
4663 PLOTTER SETTINGS

Parameter	Setting
Output Terminator	CR
Attention Character	<ESC>
Interface Functions	CR Generates LF DEL IGNORE
Communications Control Mode	Full Duplex
Receive Parity	Ignore
Transmit Parity	Logic 0
Character Format	8 Data Bits 1 Stop Bit
Transmit Baud Rate	9600
Receive Baud Rate	9600
Serial Device Address	A
Initial Command/Response Format	3 (emulates a 4662)
Interface Select	1 (RS-232 interface)
Initial Axis Orientation	Y vertical, X horizontal
Initial Aspect Ratio	4X:3Y

3. Power up the terminal.
4. Use Setup commands to configure the peripheral port. Put the terminal in Setup and enter the following commands:

```
PASSIGN P0:,4663
PFLAG P0:,NONE
PPARITY P0:,NONE
PBITS P0:,1,8
PBAUD P0:,9600
NVSAVE
```

If the plotter is connected to PORT 1, use P1: instead of P0: in the above commands.

5. Power up the plotter and prepare its pen and paper for use.

Other plotter settings may be used; for example, you could use DC1/DC3 flagging. If you use other plotter settings, be sure to configure the terminal's port to match.

4957 AND 4958 GRAPHICS TABLETS

1. Connect the puck or stylus cable to the tablet.
2. Connect the tablet's communications cable to either the PORT 0 or PORT 1 connector on the rear of the terminal.
3. Plug in the tablet's power cord to a standard power outlet.

That's all there is to it. The terminal automatically sets the proper communications parameters between itself and the tablet.

Appendix B

CONTROLS, KEYS, AND CONNECTORS

This appendix describes the external controls and connectors on the display unit. It also shows the keyboard layout and discusses the function of the keys.

DISPLAY UNIT

Figure B-1 shows the location of the front panel controls on the display units. These controls are:

- *POWER button* — Turns the terminal on or off.
- *BRIGHTNESS knob* — Increases or decreases brightness of the display.
- *DEGAUSS button (4109 only)* — Demagnetizes the display frame and chassis to restore color accuracy and purity.

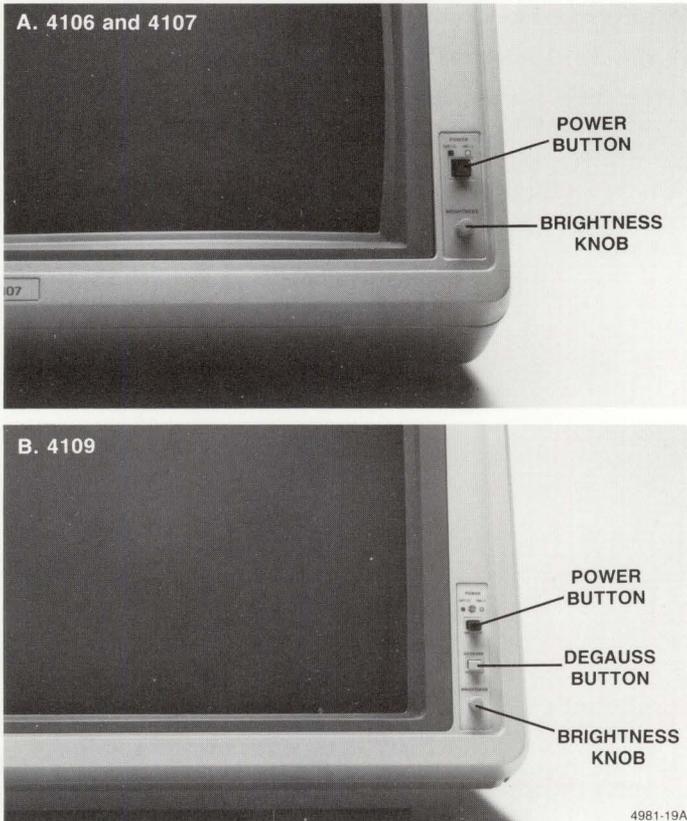


Figure B-1. Front Panel Controls.

Figure B-2 shows the location of each display unit's rear panel controls and connectors. They are:

- **VOLTAGE SELECTOR switches** — Set the terminal's operating line voltage.
- **RESET button** — Resets the terminal to its power-up condition (equivalent to turning the power off, then back on). When used with the SELF TEST button, it starts Extended Self Test (refer to Appendix E).
- **SELF TEST button** — When used with RESET, starts Extended Self Test (refer to Appendix E).
- **AC POWER connector** — Accepts power from a standard ac power source. The voltage rating of the source should be consistent with the setting of the VOLTAGE SELECTOR switches.
- **COPIER port** — Provides a Centronics-style interface to (1) Tektronix 4691, 4692, and 4695 Color Graphics Copiers, (2) monochrome graphics printers that use Epson FX-80 graphics protocol, such as the Tektronix 4644 Dot Matrix Copier and Hewlett-Packard ThinkJet, and (3) some monochrome text printers.
- **COMPUTER port** — Provides RS-232 connection to a host computer.
- **KYBD connector** — Connects the keyboard cable to the terminal.
- **PORT 0 and PORT 1** — Provide standard RS-232-C signals to Tektronix peripheral devices such as the 4510 Rasterizer, 4662 and 4663 Plotters, 4957 and 4958 Graphics Tablets,
- **RED, GREEN, and BLUE video out connectors (4109 only)** — Provide red, green, and blue color signals to an external monitor or color hard copy device, such as a 35 mm slide camera.

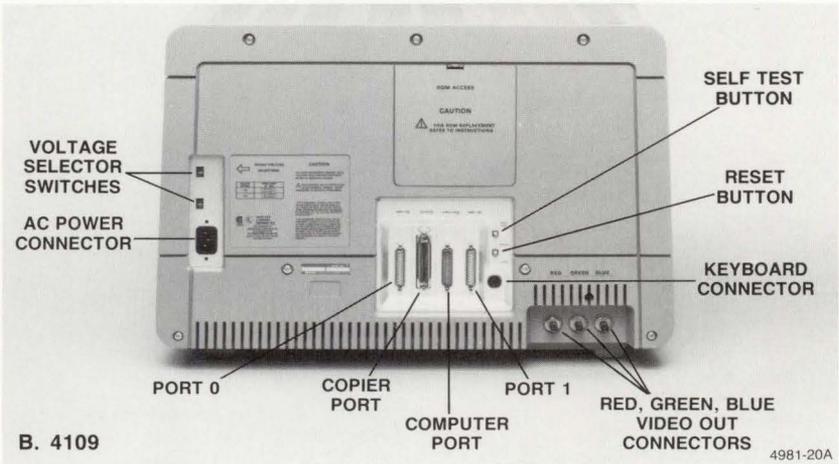
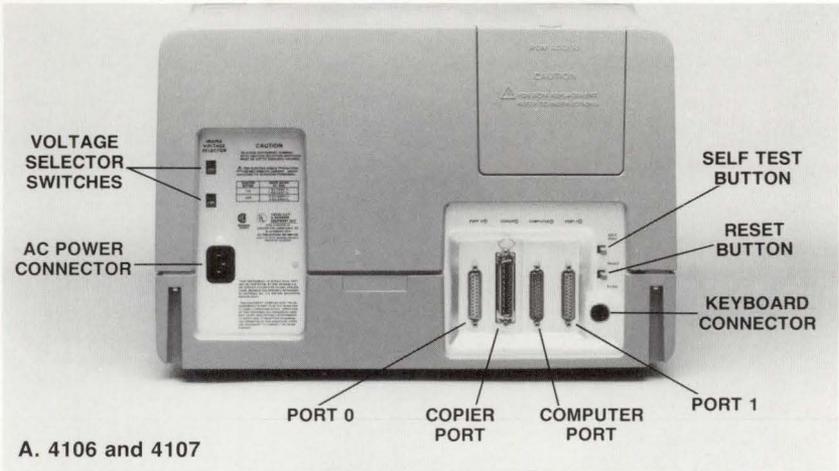


Figure B-2. Rear Panel Controls and Connectors.

DESCRIPTION OF KEYS

Figure B-3 shows the keyboard and highlights the various keys and key groups.

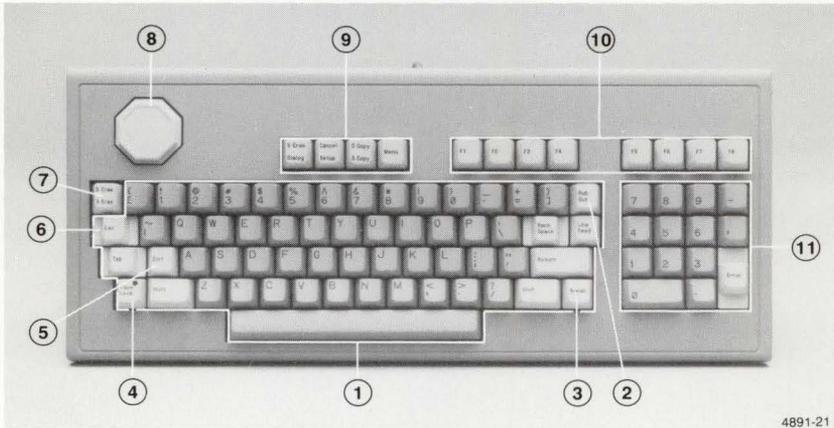


Figure B-3. Keyboard Layout.

- ① **ASCII Keys** — Standard alphanumeric keys, similar to those on a typewriter keyboard.
- ② **Rub Out** — Typically used to delete characters by backspacing.
- ③ **Break** — Sends an interrupt signal to the host computer.
- ④ **Caps Lock¹** — Uppercases alphabetic characters, but does not affect numeric or special symbol keys.
- ⑤ **Ctrl** — *Control*. When used with another key, defines a special function of that key; often used for editing functions.
- ⑥ **Esc** — *Escape*. Sends the Escape character to the host.
- ⑦ **S Erases/D Erases** — *S Erases* erases the entire screen. *D Erases* (Shift-S Erases) erases just the dialog area.
- ⑧ **Joydisk** — In the dialog area, scrolls text; in the graphics area, moves the crosshair cursor when the Set Color function or GIN is enabled.
- ⑨ **Dialog/G Erases** — *Dialog* turns the dialog area on or off. *G Erases* (Shift-Dialog) erases the graphics area.
- ⑩ **Setup/Cancel** — *Setup* places the terminal in Setup. *Cancel* (Shift-Setup) stops terminal operations in process.
- ⑪ **S Copy/D Copy** — *S Copy* makes a copy of the screen. *D Copy* (Shift-SCopy) makes a copy of the dialog area.
- Menu¹** — Accesses the Set Color and Zoom/Pan functions.
- ⑩ **F1 through F8** — Used with the Set Color and Zoom/Pan functions; can also be programmed with macros.
- ⑪ **Numeric Keypad keys** — Display the number or symbol labeled on the key, except *Enter*, which acts like the Return key for numeric entry.

¹ These keys toggle the indicated function. That is, you press the key once to turn the given function on, and press it again to turn the function off.

Appendix C

KEYBOARD LAYOUTS, CHARACTER CODES, AND MACRO NUMBERS

The terminal can display eight different character sets, all of which are stored in the terminal's firmware. Six character sets support the terminal's international keyboards (North American, United Kingdom, French, Swedish, Danish/Norwegian, and German), and two character sets provide supplementary symbols and rulings characters.

Plugging a keyboard into the terminal automatically designates that keyboard's character set as the primary character set. For example, if you are using the North American keyboard, the terminal displays the North American character set, and if you are using the Option 4G German keyboard, the terminal displays the German character set.

In Setup, your terminal always displays the character set associated with your keyboard. However, if you want to use other character sets, you can do so when the terminal is *not* in Setup — that is, when displaying data from the host or data entered at the keyboard while communicating with the host.

Use the Setup command `SELECTCHARSET` (an ANSI command) to select another character set. Table C-1 lists the parameter entries required to select each character set. For example, to select the Rulings character set, enter Setup and issue:

```
SELECTCHARSET G0,0
```

Remember, since Setup always uses the character set associated with your keyboard, you won't be able to see the new characters until you exit Setup.

Table C-1
CHARACTER SET PARAMETERS

Parameter Value	Character Set Designated
A	United Kingdom
B	American
G	Swedish
K	German
f	French
'	Danish/Norwegian
0	Rulings Set
3	Supplementary Set

(continued)

This appendix shows each character set's code chart and each keyboard's layout:

- The code charts list the binary and ADE (ASCII decimal equivalent) values for the characters and control codes in each character set. (Code charts for the Supplementary and Rulings character sets are at the end of this appendix.)
- The keyboard layouts show the location of the keys on each keyboard, as well as the macro numbers invoked by each key and key combination. For more information about macros, refer to Section 3.

KEYBOARDS, CODES, AND MACROS

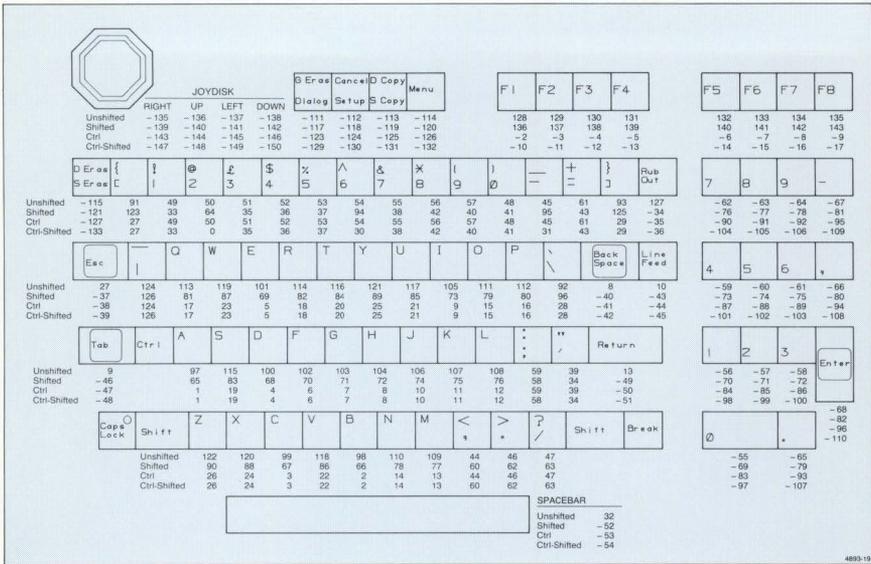


Figure C-3. United Kingdom Keyboard Layout and Key Macro Numbers.

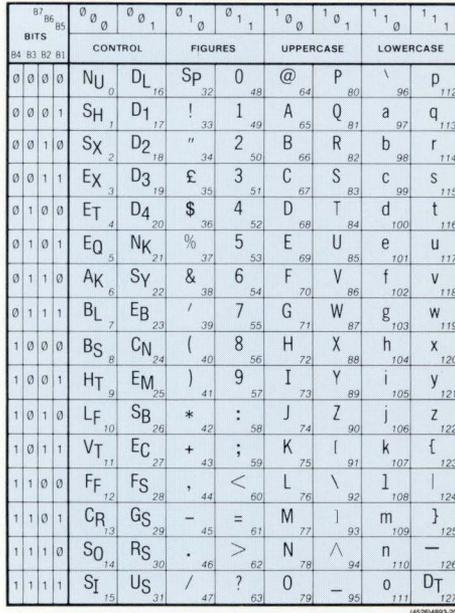


Figure C-4. United Kingdom Character Set Code Chart.

KEYBOARDS, CODES, AND MACROS

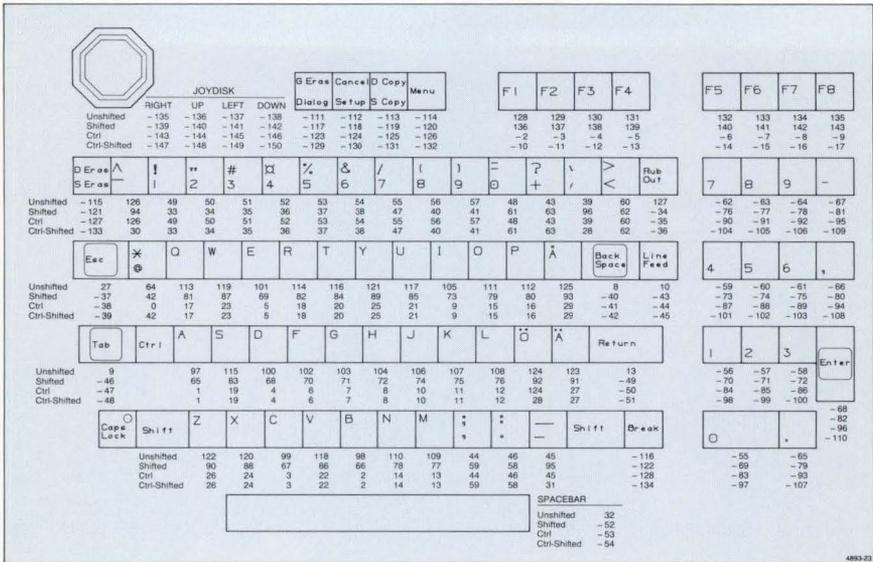


Figure C-7. Swedish Keyboard Layout and Key Macro Numbers.

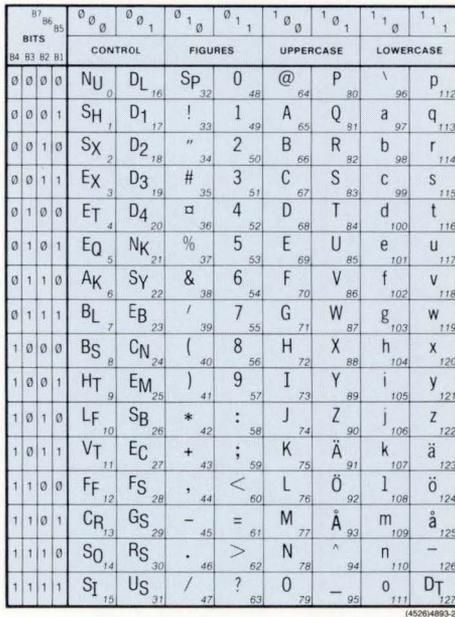


Figure C-8. Swedish Character Set Code Chart.

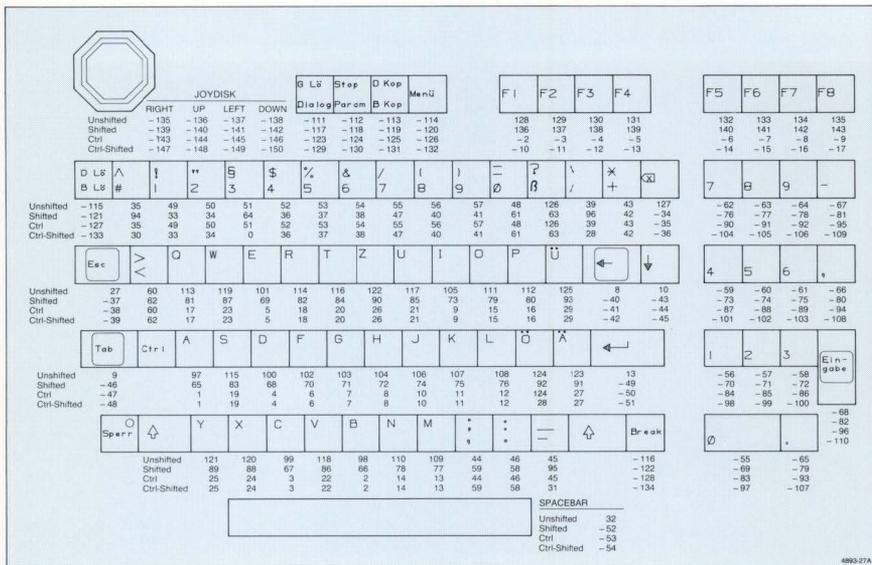


Figure C-11. German Keyboard Layout and Key Macro Numbers.



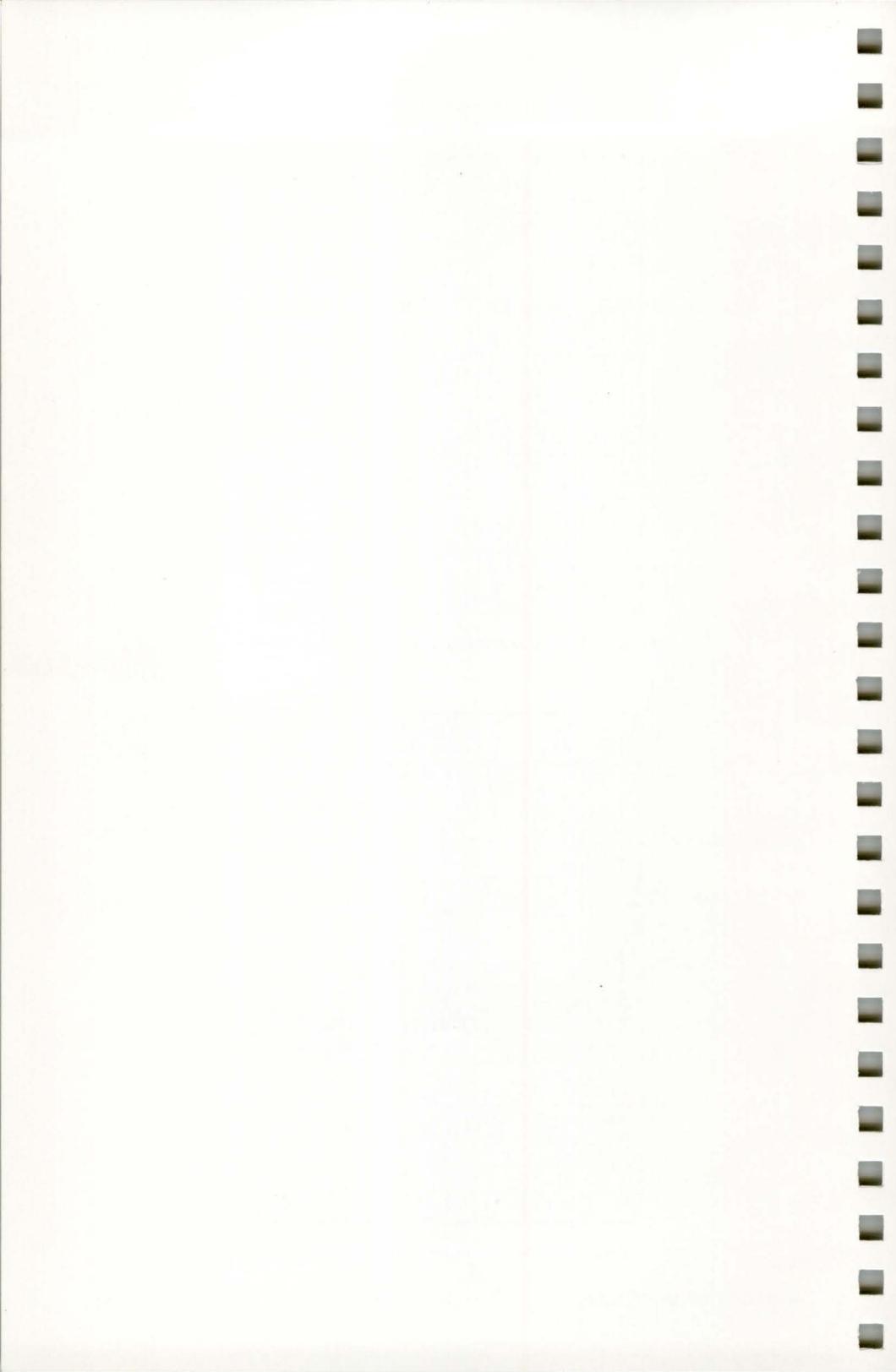
Figure C-12. German Character Set Code Chart.

BITS		0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
84	83 82 81	CONTROL		FIGURES		UPPERCASE		LOWERCASE	
0	0 0 0	NU ₀	DL ₁₆	Sp ₃₂	0 ₄₈	— ₆₄	Ñ ₈₀	◆ ₉₆	112
0	0 0 1	SH ₁	D1 ₁₇	Ä ₃₃	1 ₄₉	ç ₆₅	ñ ₈₁	■ ₉₇	113
0	0 1 0	SX ₂	D2 ₁₈	ä ₃₄	2 ₅₀	l ₆₆	ç ₈₂	HT ₉₈	114
0	0 1 1	EX ₃	D3 ₁₉	Å ₃₅	3 ₅₁	† ₆₇	i ₈₃	FF ₉₉	115
0	1 0 0	ET ₄	D4 ₂₀	å ₃₆	4 ₅₂	□ ₆₈	α ₈₄	CR ₁₀₀	116
0	1 0 1	EQ ₅	NK ₂₁	Æ ₃₇	5 ₅₃	■ ₆₉	σ ₈₅	LF ₁₀₁	117
0	1 1 0	AK ₆	SY ₂₂	æ ₃₈	6 ₅₄	● ₇₀	τ ₈₆	○ ₁₀₂	118
0	1 1 1	BL ₇	EB ₂₃	à ₃₉	7 ₅₅	Δ ₇₁	ρ ₈₇	± ₁₀₃	119
1	0 0 0	BS ₈	CN ₂₄	ç ₄₀	8 ₅₆	δ ₇₂	μ ₈₈	NL ₁₀₄	120
1	0 0 1	HT ₉	EM ₂₅	é ₄₁	9 ₅₇	λ ₇₃	Σ ₈₉	VT ₁₀₅	≤ ₁₂₁
1	0 1 0	LF ₁₀	SB ₂₆	è ₄₂	10 ₅₈	∇ ₇₄	Ω ₉₀	□ ₁₀₆	≥ ₁₂₂
1	0 1 1	VT ₁₁	EC ₂₇	ö ₄₃	11 ₅₉	∫ ₇₅	∫ ₉₁	□ ₁₀₇	π ₁₂₃
1	1 0 0	FF ₁₂	FS ₂₈	ö ₄₄	12 ₆₀	∅ ₇₆	∫ ₉₂	□ ₁₀₈	≠ ₁₂₄
1	1 0 1	CR ₁₃	GS ₂₉	φ ₄₅	13 ₆₁	∟ ₇₇	÷ ₉₃	□ ₁₀₉	£ ₁₂₅
1	1 1 0	SO ₁₄	RS ₃₀	ü ₄₆	14 ₆₂	¬ ₇₈	≈ ₉₄	□ ₁₁₀	• ₁₂₆
1	1 1 1	SI ₁₅	US ₃₁	ü ₄₇	15 ₆₃	∞ ₇₉	∫ ₉₅	□ ₁₁₁	DT ₁₂₇

Figure C-13. Supplementary Character Set Code Chart.

BITS		0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1	
84	83 82 81	CONTROL		FIGURES		UPPERCASE		LOWERCASE		
0	0 0 0	NU ₀	DL ₁₆	Sp ₃₂	0 ₄₈	@ ₆₄	P ₈₀	◆ ₉₆	112	
0	0 0 1	SH ₁	D1 ₁₇	! <td>33</td> <td>1₄₉</td> <td>A₆₅</td> <td>Q₈₁</td> <td>■₉₇</td> <td>113</td>	33	1 ₄₉	A ₆₅	Q ₈₁	■ ₉₇	113
0	0 1 0	SX ₂	D2 ₁₈	" ₃₄	2 ₅₀	B ₆₆	R ₈₂	HT ₉₈	114	
0	0 1 1	EX ₃	D3 ₁₉	# ₃₅	3 ₅₁	C ₆₇	S ₈₃	FF ₉₉	115	
0	1 0 0	ET ₄	D4 ₂₀	\$ ₃₆	4 ₅₂	D ₆₈	T ₈₄	CR ₁₀₀	116	
0	1 0 1	EQ ₅	NK ₂₁	% ₃₇	5 ₅₃	E ₆₉	U ₈₅	LF ₁₀₁	117	
0	1 1 0	AK ₆	SY ₂₂	& ₃₈	6 ₅₄	F ₇₀	V ₈₆	○ ₁₀₂	118	
0	1 1 1	BL ₇	EB ₂₃	' ₃₉	7 ₅₅	G ₇₁	W ₈₇	± ₁₀₃	119	
1	0 0 0	BS ₈	CN ₂₄	(₄₀	8 ₅₆	H ₇₂	X ₈₈	NL ₁₀₄	120	
1	0 0 1	HT ₉	EM ₂₅) ₄₁	9 ₅₇	I ₇₃	Y ₈₉	VT ₁₀₅	≤ ₁₂₁	
1	0 1 0	LF ₁₀	SB ₂₆	* ₄₂	10 ₅₈	J ₇₄	Z ₉₀	□ ₁₀₆	≥ ₁₂₂	
1	0 1 1	VT ₁₁	EC ₂₇	+ ₄₃	11 ₅₉	K ₇₅	[₉₁	□ ₁₀₇	π ₁₂₃	
1	1 0 0	FF ₁₂	FS ₂₈	, ₄₄	12 ₆₀	L ₇₆	\ ₉₂	□ ₁₀₈	≠ ₁₂₄	
1	1 0 1	CR ₁₃	GS ₂₉	- ₄₅	13 ₆₁	M ₇₇] ₉₃	□ ₁₀₉	£ ₁₂₅	
1	1 1 0	SO ₁₄	RS ₃₀	. ₄₆	14 ₆₂	N ₇₈	^ ₉₄	□ ₁₁₀	• ₁₂₆	
1	1 1 1	SI ₁₅	US ₃₁	/? ₄₇	15 ₆₃	O ₇₉	∫ ₉₅	□ ₁₁₁	DT ₁₂₇	

Figure C-14. Rulings Character Set Code Chart.



Appendix D

ROM REPLACEMENT PROCEDURE

The terminal contains several *ROMs* (read-only memory) that contain the internal programming that controls the terminal. If updates become available, these *ROMs* can be replaced by an operator without the aid of a service technician. The only tool required for this procedure is a small flat-bladed screwdriver.

To replace the *ROMs*:

1. **Turn the terminal off** and wait several minutes for it to cool.
2. **Remove the *ROM* access door** located at the rear of the terminal (Figure D-1). Remove the door by pulling it out from the top, then set it aside. The *ROMs* are now exposed (Figure D-2a — next page).

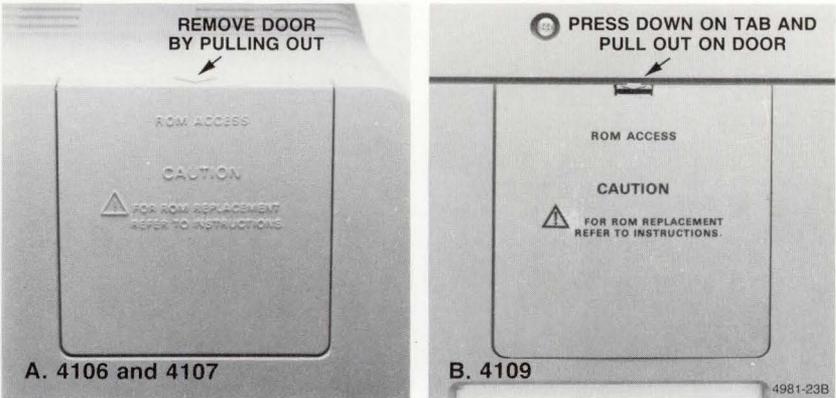


Figure D-1. *ROM* Access Door.

CAUTION

*The terminal's *ROMs* and some of the other components are highly sensitive to electrostatic discharge. Before touching the *ROMs*, remove static discharge from yourself by touching the silver metal backplate on the terminal.*

NOTE

*The first time a *ROM* is replaced it may be difficult to remove from the socket. With gentle pressure, however, the *ROM* should come free.*

3. **Remove all old ROMs.** Use the screwdriver to pry the top and bottom of the ROM from its holder (Figure D-2b). Place the old ROMs in a safe location until you've verified operation of the new ROMs.
4. **Install the new ROMs.** Install each ROM in the proper socket (each ROM is labeled by a component number, such as U90; match this number to the number on the circuit board). The ROMs are keyed so they cannot be installed upside down. Lock each ROM in place by pushing it in firmly.
5. **Reinstall the ROM access door.** Place the bottom of the door in the chassis first, then lock the door in place by pressing it in firmly on the top.
6. **Power up the terminal.** The Power-Up Self Test will verify correct ROM installation and proper operation. If the terminal doesn't operate correctly, recheck that each ROM is in its proper socket.

This completes the ROM replacement procedure. Your terminal is now ready for use with its new firmware.

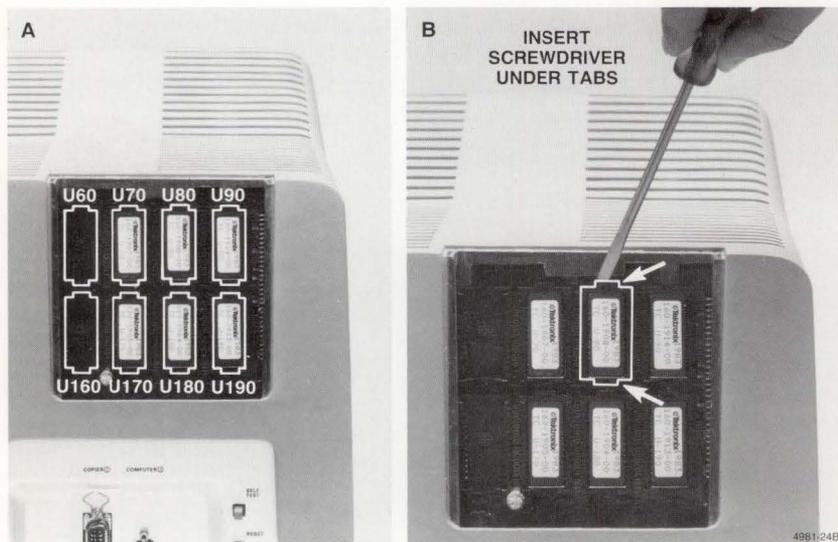


Figure D-2. Removing the ROMs.

Appendix E

SELF TEST DIAGNOSTIC PROGRAM

The Self Test diagnostic program allows the terminal to test itself and identify any errors it finds. The Self Test error messages help locate the probable source of the problem.

You can use the Self Test diagnostic program to identify a bad module, allowing you to return that module to Tektronix for repair or replacement without incurring the cost of a service call.

LEVELS OF SELF TEST

The terminal has three Self Test levels:

- *Power-Up Self Test* — Runs automatically every time the terminal is turned on or reset. It performs a quick check of terminal circuitry before allowing the terminal to be used. Power-Up Self Test takes approximately 15 seconds to complete, and requires no user interaction.
- *Extended Self Test* — Contains all the tests performed by Power-Up Self Test, plus more extensive tests of terminal circuitry, particularly memory. Extended Self Test takes about four minutes to complete. It requires user response at the end of the test.
- *Adjustment Self Test* — Displays a menu of tests and patterns. You can check or adjust specific parts of the terminal as well as the terminal's interaction with a peripheral.

Figure E-1 illustrates how the three levels of Self Test are related.

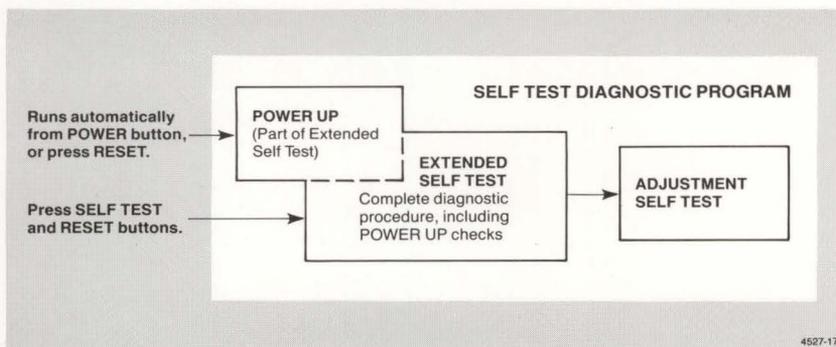


Figure E-1. Levels of Self Test.

ERROR REPORTING

When Self Test detects an error, it reports it in one or more of three ways:

- Writes a message on the screen
- Rings the terminal's bell twice
- Turns on the small light in the Caps Lock key

All written error messages begin with the words *Self Test Error*. If a Self Test error message appears on the display, write it down. In some tests, you'll need to determine whether the terminal is working properly.

When you find a problem, write down the error message or the nature of the problem, and call the Tektronix service center. This information will help the service technician diagnose the problem more quickly.

USER INTERACTION

When Self Test requires user interaction, it rings the bell once. Normally, this happens when a menu is displayed and you must select an item or install a connector. Only Extended and Adjustment Self Tests display menus.

POWER-UP SELF TEST

Power-Up Self Test runs every time you turn on the terminal or push the RESET button. The test checks the keyboard first (if it is connected), then it checks the circuitry in the display unit. During the keyboard test, the light in the Caps Lock key blinks on and off.

If Power-Up Self Test does not detect any errors, the terminal displays a blinking underline or block cursor when the test is complete.

If the keyboard test fails, the Caps Lock light stays on and the bell rings twice. A message may also be written on the screen.

If there is a problem in the display unit, the terminal writes a message on the screen and rings the bell twice. (If the bell rings twice and no message appears, try turning up the Brightness knob.)

POWER-UP SELF TEST ERRORS

If a Self Test error occurs during power-up, follow these procedures:

1. Turn the terminal off and wait about 15 seconds, then turn it back on. If the terminal powers up again with no Self Test error, it is operating normally.
2. If a Self Test error occurs on the second power-up, note the message — then:
 - If the message includes the words *Keyboard Failure* or *Not Attached*, check the keyboard cable connection on the rear of the terminal.
 - If the message includes the words *Uxxx ROM is Wrong Part*, go to Appendix D of this manual and follow the procedures for opening the ROM access door. Check to see that the eight ROMS are arranged as follows:

U60	U70	U80	U90
U160	U170	U180	U190

If the ROMS are not properly installed, follow the procedures in Appendix D to remove and then reinstall them in their proper locations.

- If the message includes the words *Nonvolatile Parameters Failure — Defaults Reset*, you may have to reset some operating parameters before running an applications program. Consult the communications command table in Appendix A of this manual for the proper settings.
- If any other messages appear, write them down and call your Tektronix service center. The service technician may ask you to remove the ROM access door and note the status of the three LED indicator lights just below the ROMS.

You can still use the terminal if the failure does not affect your application. For example, if one of the peripheral ports failed and your application doesn't require that port, you could go ahead and use the terminal.

EXTENDED SELF TEST

To start Extended Self Test:

1. Locate the SELF TEST and RESET buttons on the rear of the terminal.
2. Press SELF TEST and hold it in. While holding in SELF TEST, press and release RESET.
3. Hold in SELF TEST for another two seconds, then release it.

The crosshair cursor blinks once, indicating that Extended Self Test is running. After about 30 seconds, the terminal rings the bell and displays the Extended Self Test Menu:

F5 Continuous Self Test
F6 Adjustment Procedures Menu
F7 Continue Self Test
F8 Exit Self Test

Selection:

NOTE

If you don't press one of these keys within 20 seconds after the Extended Self Test Menu appears, Extended Self Test continues (the same as pressing Function Key F7).

The Self Test prompt is *Selection:* — that is, whenever you see *Selection:* displayed on the screen, it means that the terminal is waiting for your input before continuing. The prompt always refers to selections listed in the last menu displayed.

At this point, you can exit Self Test or continue to test the terminal. If you do not press a key within 20 seconds, the terminal continues Extended Self Test (the same as pressing Function Key F7). If 20 seconds have not yet passed, you can press one of the function keys at the top right of the keyboard:

- Pressing F5 causes Extended Self Test to execute repeatedly. To get out of this continuous testing mode, you must press the RESET button or turn the terminal off, or you can press F8 when you see the Extended Self Test Menu reappear.
- Pressing F6 exits Extended Self Test and displays the Adjustment Procedures Menu (see the next discussion).
- Pressing Function Key F7 continues Extended Self Test.
- Pressing Function Key F8 exits Extended Self Test.

If you continue Extended Self Test, the crosshair cursor reappears and blinks intermittently. After about four minutes, if no errors are detected, the crosshair cursor disappears, the bell rings, and the Adjustment Procedures Menu is displayed.

You can either exit Self Test (by pressing Function Key F8) or go on to perform the Adjustment Self Test.

ADJUSTMENT SELF TEST

Adjustment Self Test begins by first displaying this menu:

Adjustment Procedures Menu

Dialog Coax Interface Test

F1 Reset Nonvolatile Parameters

F2 Keyboard Switch Test

F3 RS-232 Interface Menu

F4 Hard Copy Menu

F5 Display Pattern Menu

F6 Graphics Tablet Test

S1 Set Nonvolatile Parameters to Factory Cycle Mode

F7 Continue Self Test

F8 Exit Self Test

Selection:

If the Adjustment Self Test Menu is not already displayed on the terminal screen, you'll need to rerun part of the Extended Self Test. Just press in the SELF TEST button, hold it in while you press and release RESET, then hold in SELF TEST for another two seconds and release it. Then, when you see the Extended Self Test menu appear, press Function Key F6, which displays the Adjustment Procedures Menu.

Once the Adjustment Procedures Menu is displayed, the terminal waits for you to press one of the function keys:

- Pressing the Dialog key simply prints a message that tells you that you do not have a COAX Interface (which is available in the CX4100 Series terminals).
- Pressing F1 resets all parameters to their factory default value.
- Pressing F2 through F6 enters a specific part of Adjustment Self Test, indicated by its title.
- Pressing F7 causes the terminal to continue Self Test from the point at which the Adjustment Procedures menu was called.
- Pressing F8 exits Extended Self Test.

To start one of the tests, just select one of the seven items from the menu by pressing the appropriate function key. The rest of this appendix describes each of these menu items.

NOTE

This discussion only covers the areas of Adjustment Self Test that terminal users would need. Some menu items are for internal adjustment of the terminal and are normally performed by service personnel. For a discussion of these parts of Self Test, refer to the service manual for your terminal.

F1: RESET NONVOLATILE PARAMETERS

CAUTION

Pressing F1 resets all parameters — including the communications parameters — to their factory defaults. Unless you want all parameters reset to their factory defaults, do not press F1.

Pressing F1 from the Adjustment Procedures Menu resets all terminal parameters to their factory defaults, just as the FACTORY command followed by an NVSAVE does. This may take up to a minute, depending on how many parameters must be reset. Then this message is displayed:

**Nonvolatile Parameters Reset
Selection:**

Now all volatile and nonvolatile parameters are at factory default, and the terminal prompts you for another selection from the Adjustment Procedures Menu.

CAUTION

The terminal's nonvolatile memory will sustain approximately ten thousand resets. This should be sufficient for many years of normal terminal operation. However, to prolong the life of the memory, it is best to reset nonvolatile parameters only when necessary.

F2: KEYBOARD SWITCH TEST

Pressing F2 from the Adjustment Procedures Menu starts the Keyboard Switch Test and displays a message identifying which international keyboard you have. For example:

**North American Keyboard
Press Keyboard keys. Press F7 twice to exit.**

When you press any key, the key label is displayed. As long as you hold the key down, the displayed character blinks. When you release the key, the blinking stops and the character label remains on the screen. The label displayed on the screen should match the unshifted key label.

For example, pressing the A, S, F1, Esc, and Tab keys cause the following display:

A S F1 Esc Tab

If a key does not display the right label, the keyboard or the cable is probably defective.

To exit the Keyboard Switch Test and return to the Adjustment Procedures Menu, press F7 twice.

F3: RS-232 INTERFACE MENU

NOTE

To run this test, you need a host port loopback connector. This is not a standard accessory to the terminal, but can be ordered as an optional accessory (see Appendix I for ordering information).

Pressing F3 from the Adjustment Procedures Menu displays the RS-232 Interface Menu:

RS-232 Interface Menu

F1 Host Port Test

F2 Port 0 Test

F3 Port 1 Test

F7 Exit Current Menu

F8 Exit Self Test

Selection:

The following paragraphs describe each part of the RS-232 Interface.

Host Port Test

Pressing F1 from the RS-232 Interface Menu starts the Host Port Test, and displays this message:

Install RS-232 Loopback. Press Space Bar.

Disconnect the cable connected to the COMPUTER port and connect the host port loopback connector. Then press the Space Bar to start the test.

If the test finishes with no errors detected, the terminal displays the following message and prompts you for another selection from the RS-232 Interface Menu:

RS-232 Interface Test Completed.

Selection:

If an error is detected, the bell rings twice, and the terminal displays this message:

Self Test Error - Host Port Failure¹

RS-232 Interface Test Completed.

Selection:

¹ If you have not attached the host port loopback connector, the error message [A1.02D8] will also be displayed.

PORT 0 and PORT 1 Tests

Pressing F2 from the RS-232 Interface Menu starts the PORT 0 Test, and pressing F3 starts the PORT 1 Test. In both cases, the terminal displays this message:

Connect Host Port Cable to Port x. Press Space Bar.

(x represents the port number.)

Connect the host port cable to either PORT 0 or PORT 1, making sure the cable is also connected to the host port (labeled COMPUTER). Press the Space Bar to execute the test.

If the test finishes with no errors detected, the terminal displays the following message and prompts you for another selection from the RS-232 Interface Menu:

**Peripheral Port Test Completed.
Selection:**

If an error is detected, the bell rings twice, and the terminal displays this message, prompting you for another selection from the RS-232 Interface Menu:

**Self Test Error - Port x Failure²
Peripheral Port Test Completed.
Selection:**

Exit Current Menu

Pressing F7 from the RS-232 Interface Menu exits the RS-232 Interface Test and returns you to the Adjustment Procedures Menu.

² If you have not attached the host port cable to the peripheral port, error message [A1.0001] will also be here.

F4: HARD COPY MENU

Pressing F4 from the Adjustment Procedures Menu displays the Hard Copy Menu:

Hard Copy Menu

- F1 Loopback Test
- F2 4695 Copier Pattern
- F3 4691/4692 Copier Pattern
- F7 Exit Current Menu
- F8 Exit Self Test

Selection:

The following paragraphs describe each part of the Hard Copy Test.

COPIER Port Loopback Test

NOTE

To run the COPIER port loopback test, you must have a COPIER port loopback connector. This is not a standard accessory to the terminal, but may be ordered as an optional accessory.

Pressing F1 from the Hard Copy Menu starts the COPIER Port Test and displays the following message:

Install Copier Port Loopback. Press Space Bar.

Disconnect the cable connected to the COPIER port and connect the COPIER port loopback connector. Then press the Space Bar to start the test.

If the test finishes with no errors detected, the terminal displays the following message and prompts you for another selection from the Hard Copy Menu:

Copier Loopback Test Completed.

Selection:

If an error is detected, the bell rings twice, and the terminal displays this message:

Self Test Error - Printer Port Failure³

Copier Loopback Test Completed.

Selection:

³ If you have not attached the loopback connector to the COPIER port, error message [A1.0001] will also be displayed.

4695 Color Copier Pattern

This test outputs a color pattern to a 4695 Color Copier connected to the COPIER port to check the interface connection between the terminal and the copier. You can use this test to verify that the 4695 is accurately reproducing the screen display.

Pressing F2 from the Hard Copy Menu starts the 4695 Pattern Test and displays the following message:

**Connect Copier. Check that the copier ready light is on.
Press Space Bar.**

Be sure the copier is connected and turned on.

If the copier is functioning properly, the terminal displays the pattern and this message:

This pattern should be on the Copier and display:

The pattern consists of eight adjacent vertical bars (each is 10 character-cells wide), each filled with a different color: black, blue, red, magenta, green, cyan, yellow, and white.

The test then prints the following message, and returns you to the Hard Copy Menu.

**Test Completed.
Selection:**

If the copier is not connected or not functioning when you press the Space Bar, the terminal exits this test and displays the following message, prompting you for another selection from the Hard Copy Menu:

*****Copier not ready***
Selection:**

4691/4692 Color Copier Pattern

This test outputs a color pattern to a 4691 or 4692 Color Copier connected to the COPIER port to check the interface connection between the terminal and the copier. You can use this test to verify that the copier is accurately reproducing the screen display.

Pressing F3 from the Hard Copy Menu starts the 4691/4692 Pattern Test and displays the following message:

**Connect Copier. Check that the copier is ready.
Press Space Bar.**

Be sure the copier is connected and turned on.

If the copier is functioning, the terminal displays the pattern preceded by this message appears on the screen:

This pattern should be on the Copier and display:

The pattern consists of eight adjacent vertical bars (each is 10 character-cells wide). The bars are painted these colors: black, blue, red, magenta, green, cyan, yellow, and white. The test then prints the following message, prompting you for another selection from the Hard Copy Menu:

**Test Completed.
Selection:**

If the copier is not connected or not functioning when you press the Space Bar, the terminal displays the following message and prompts you for another selection from the Hard Copy Menu:

*****Copier not ready***
Selection:**

Exit Current Menu

Pressing F7 from the Hard Copy Menu exits the Hard Copy Test and prompts you for another selection from the Adjustment Procedures Menu.

F5: DISPLAY PATTERN MENU

Pressing F5 from the Adjustment Procedures Menu invokes the Display Pattern Menu. The patterns in this menu are used primarily for making internal adjustment to the terminal and are discussed in detail in the service manual for your terminal.

F6: GRAPHICS TABLET TEST

NOTE

To run the tablet test, you must have a Tektronix 4957 or 4958 Graphics Tablet.

Pressing F6 from the Adjustment Procedures Menu starts the Tablet Test and displays the following message:

Connect Tablet to Port 1. Press Space Bar.

Connect the tablet to PORT 1 (if it's not already), then press the Space Bar to start the test. If the test finishes with no errors detected, one of these messages is displayed on the screen:

Tablet Self Test Passed - Cursor on Tablet [4F].

Selection:

Or:

Tablet Self Test Passed - Cursor off Tablet [47].

Selection:

If an error is detected, the bell rings twice, and the terminal displays the following message:

Tablet Self Test Failed

Selection:

If there is no response from the tablet, the terminal displays this message, prompting you for another selection from the Adjustment Procedure Menu:

No Response from Tablet.

Selection:

S1: SET NONVOLATILE PARAMETERS TO FACTORY CYCLE MODE

CAUTION

Factory Cycle mode resets the terminal's parameters, including those saved in nonvolatile memory, to their factory defaults.

CAUTION

Once you press S1, the next time you reset the terminal or turn it off and on again, it will begin cycling through Factory Cycle mode continuously until you follow the procedures to exit it — even if you turn the terminal off and on again.

Pressing S1 (Shift-F1) from the Adjustment Procedures Menu resets all terminal parameters to their factory defaults, and the terminal enters Factory Cycle mode, which is used during manufacturing testing.

Do not press S1. If you do, the terminal will remain in Factory Cycle mode — even if you turn off the terminal — until you follow the steps to exit it.

In case you accidentally enter Factory Cycle mode, we've given you the steps to exit it.

When you press S1, the screen displays this message:

**Nonvolatile Parameters set to Factory Cycle Mode
Selection:**

The terminal will actually begin cycling through this test when you press RESET or turn the terminal off and on again.

To exit Factory Cycle mode:

1. Press RESET and SELF TEST buttons
2. Release RESET button
3. Release SELF TEST button
4. Wait for Main Self Test Menu
5. Press Function Key F8

F7: CONTINUE SELF TEST

Pressing F7 from the Adjustment Procedures Menu causes the terminal to continue Extended Self Test from the point at which the Adjustment Procedures Menu was called. If the terminal has completely cycled through Extended Self Test, pressing F7 exits Self Test (same as F8).

F8: EXIT SELF TEST

Pressing F8 from the Adjustment Procedures Menu exits Self Test. The underline or block cursor is displayed and the terminal is ready for use, just as if you had just powered up.

Appendix F

SPECIFICATIONS

This section contains specifications that relate to the installation and use of the terminal (excluding Option 21). A complete list of specifications is included in the terminal's *Service Manual*.

The following terms are used in these specification tables:

- *Performance Requirement* — Statements that define characteristics essential to the intended application of the product. Self Test verifies many of these characteristics.
- *Supplemental Information* — Statements that describe typical performance for characteristics of secondary importance, or that further explain related performance requirements.

Table F-1
PHYSICAL DIMENSIONS^a

Characteristic	Performance Requirement for 4106 and 4107	Performance Requirement for 4109
Weight	44 lbs (20 kg)	80 lbs (36.4 kg)
Length	19.5 in. (495 mm)	22.2 in. (564 mm)
Width	16.5 in. (419 mm)	21.8 in. (554 mm)
Height	13.9 in. (353 mm)	16.9 in. (429 mm)
Display Area	9.4 × 7.1 in. (240 × 180 mm)	14.1 × 10.5 in. (357.1 × 267.7 mm)

^a These specifications do not include the keyboard. See Figures A-1 and A-2 for dimensional drawings.

Table F-2
ELECTRICAL SPECIFICATIONS

Characteristic	Performance Requirement for 4106 and 4107	Performance Requirement for 4109
Nominal Input Voltages		
115V	87 — 128V	87 — 128V
230V	174 — 250V	174 — 250V
Max Input Power	200 W	320 W
Frequency Range	48 — 66 Hz	48 — 66 Hz
Video Output	(none)	60-Hz noninterlaced RGB video at RS-17 levels, sync combined with green

**Table F-3
ENVIRONMENTAL SPECIFICATIONS**

Characteristic	Performance Requirement for 4106 and 4107	Performance Requirement for 4109
Temperature		
Power on	+ 50 through + 104°F (+ 10 through + 40°C)	+ 50 through + 104°F (+ 10 through + 40°C)
Power off	- 40 through + 149°F (- 40 through + 65°C)	- 40 through + 149°F (- 40 through + 65°C)
Altitude		
Power on	To 10,000 ft (3,050 m)	To 15,000 ft (4,575 m)
Power off	To 40,000 ft (12,200 m)	To 50,000 ft (15,250 m)
Humidity		
Power on	10 — 75% rel. hum. (non-cond.)	10 — 75% rel. hum. (non-cond.)
Power off	10 through 95% rel. hum. (non-cond.)	10 through 95% rel. hum. (non-cond.)
Vibration	Withstands .015 in. displacement, at 10 to 55 to 10 Hz (all 3 major axes)	Withstands .010 in. displacement, at 10 to 55 to 10 Hz (all 3 major axes)
Shock	Main cabinet withstands a 20-g shock to all faces	Main cabinet withstands a 20-g shock to bottom only
Electrostatic Immunity		
Power on	No interruption of operation, loss of data, or change of operating mode from 15-kV shock	No interruption of operation, loss of data, or change of operating mode from 15-kV shock
Power off	No damage to terminal from 20-kV shock	No damage to terminal from 20-kV shock

**Table F-4
INSTALLATION REQUIREMENTS**

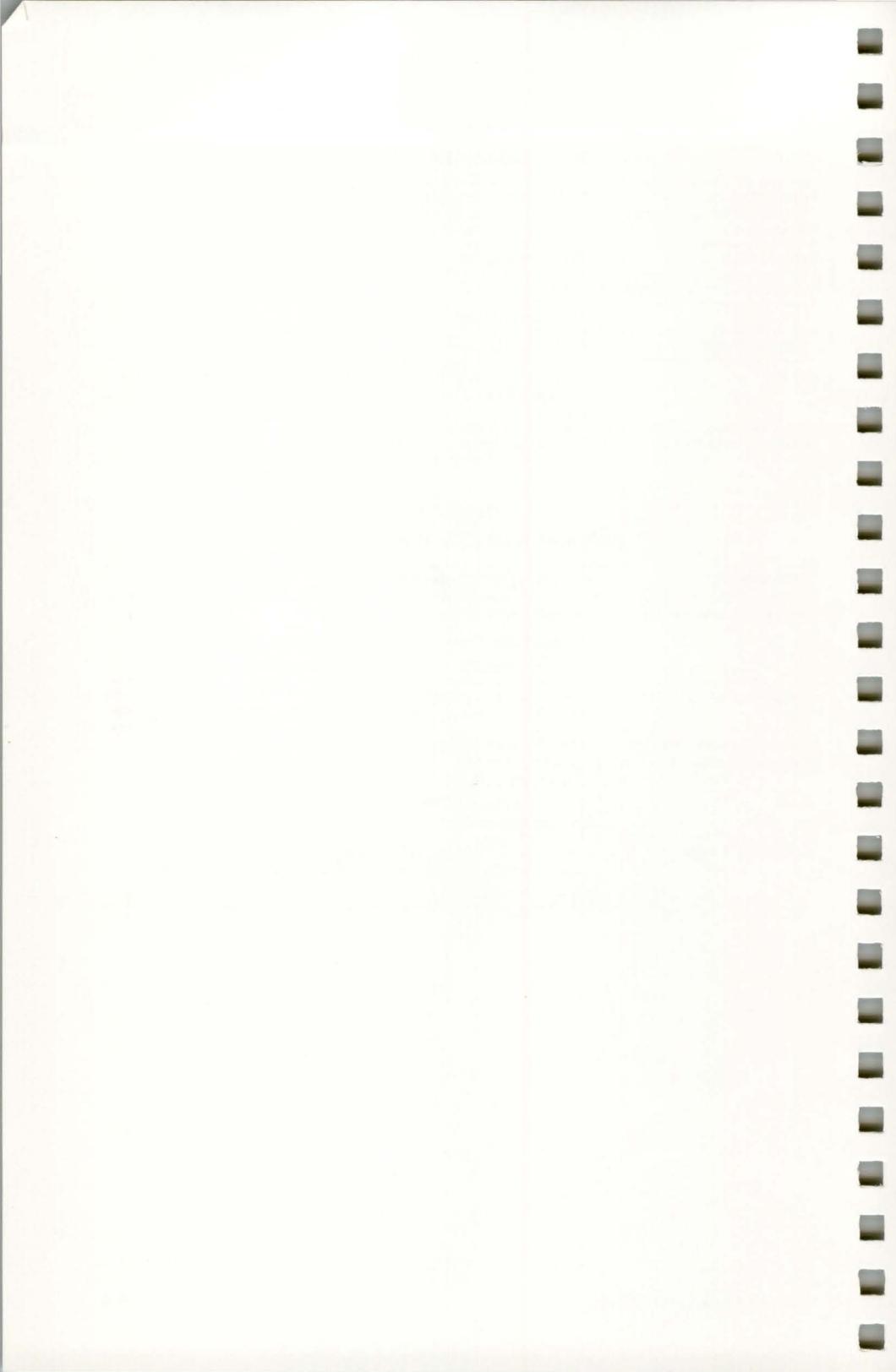
Characteristic	Supplemental Information for 4106 and 4107	Supplemental Information for 4109
Heat Dissipation		
Typical	450 BTU/hr	684 BTU/hr
Max load	570 BTU/hr	900 BTU/hr
Surge Current	34 A	45 A
Cooling Clearance	3 in. rear 2 in. top and sides	3 in. rear 2 in. top and sides

Table F-5
GRAPHICS CHARACTERISTICS

Characteristic	Performance Requirement
Resolution	640 (horizontal) by 480 (vertical) resolvable pixels
Addressability	4096 × 4096 points
Graphics Command Syntax	Compatible with 4110- and 4010-style escape sequences
Line Types	Solid, dashed (various styles)
Graphics Primitives	Vectors, panels (polygons), text, markers, arcs, and called segments
Colors	64 possible color mixtures (4096 in 4109). In graphics area, 16 colors displayed at one time; in dialog area, eight colors displayed at one time
Graphics Input (GIN)	The joydisk controls a crosshair cursor

Table F-6
ALPHANUMERIC CHARACTER SETS

Characteristic	Performance Requirement
Standard Character Set	Full ASCII character set 95 displayable characters (including Space) In Snoopy mode all 128 characters are displayable
Supplementary Character Set	A set of 94 special characters (rulings, math symbols, etc.) accessible via the SO (Shift Out) control
Other Character Sets and Optional Keyboards	United Kingdom (Option 4A) French (Option 4B) Swedish (Option 4C) Danish/Norwegian (Option 4F) German (Option 4H)
Character Format	80-column × 32-line or 132-column (scrolling) × 30-line screen display, using 7 × 9 dot matrix in a 8 × 15 character cell (with descenders)



Appendix G

TEKTRONIX COLOR STANDARD

In the **HLS** color coordinate system, the color space is represented as a double-ended cone.

The **HUE** coordinate runs counterclockwise around the cone. (0 to 360 degrees.)

The **LIGHTNESS** coordinate runs vertically up the cone. (0% to 100%.)

The **SATURATION** coordinate runs radially outward from the axis of the cone. The **SATURATION** coordinate is a percentage of the maximum possible saturation at a particular **LIGHTNESS** level. (0% to 100%.)

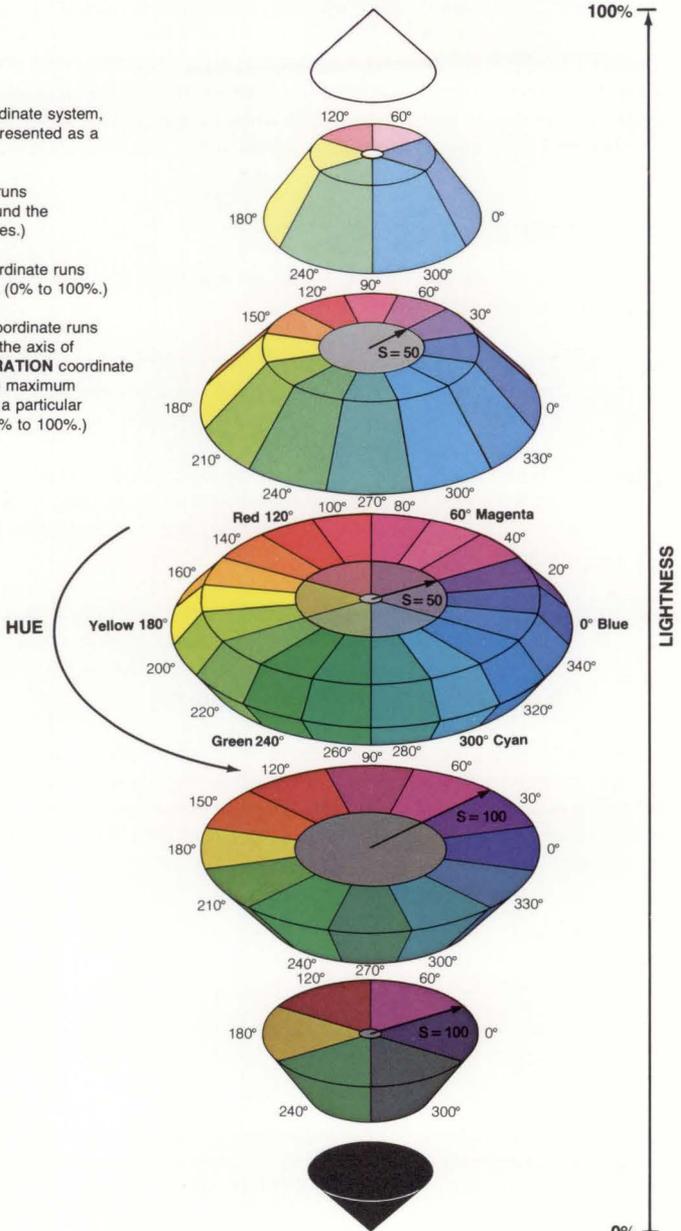


Figure G-1. HLS Color Cone.

(continued)

OVERVIEW

The world of color is filled with ambiguous terminology, i.e. intensity, purity, value, etc. Many color users feel that "color theory" is a prerequisite to operating color systems; T.V., Videotaping, Photography, Computer Graphics.

To end this confusion, Tektronix has developed a color language and function based on human engineering, rather than machine engineering. Below is a description of this system, which will provide a clear and concise means for understanding how color is defined and how our syntax was derived.

COLOR CONCEPTS

Color selection is specified by hue, lightness and saturation which is the HLS method. The definitions are as follows:

Hue: The characteristic associated with a color name such as red, yellow, green, blue, etc. Hue is a gradation of color advanced by degrees, thus represented as an angle from 0 to 360.

Lightness: The characteristic that allows the color to be ranked on a scale from dark to light. Lightness is expressed as a parameter ranging from 0 to 100% with black being 0% (bottom of cone) and white being 100% (top of cone).

Saturation: The characteristic which describes the extent to which a color differs from a gray of the same lightness. Saturation is expressed as percentage, ranging from 0% (maximum white content at that lightness level) to 100% (fully saturated).

Geometrically, colors can be described in terms of a double cone. Variations in lightness are represented along the axis, with white at the apex of the cone and black at the opposite apex. Variations in saturation are represented by radial distances from the lightness axis, in constant lightness planes. Hue is represented as an angular quantity from a known reference point.

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Appendix H

PREDEFINED FILL PATTERNS

The terminal contains predefined patterns for filling panels (polygons). To use one of these patterns, enter the FILLPATTERN command and specify the appropriate pattern number as a command parameter. The next panel drawn will be filled with the specified pattern.

The patterns shown on this foldout page are mixtures of colors from the terminal's factory default color map. If the color map is changed, the appearance of some or all of these patterns will change accordingly.

◀ FOLDOUT

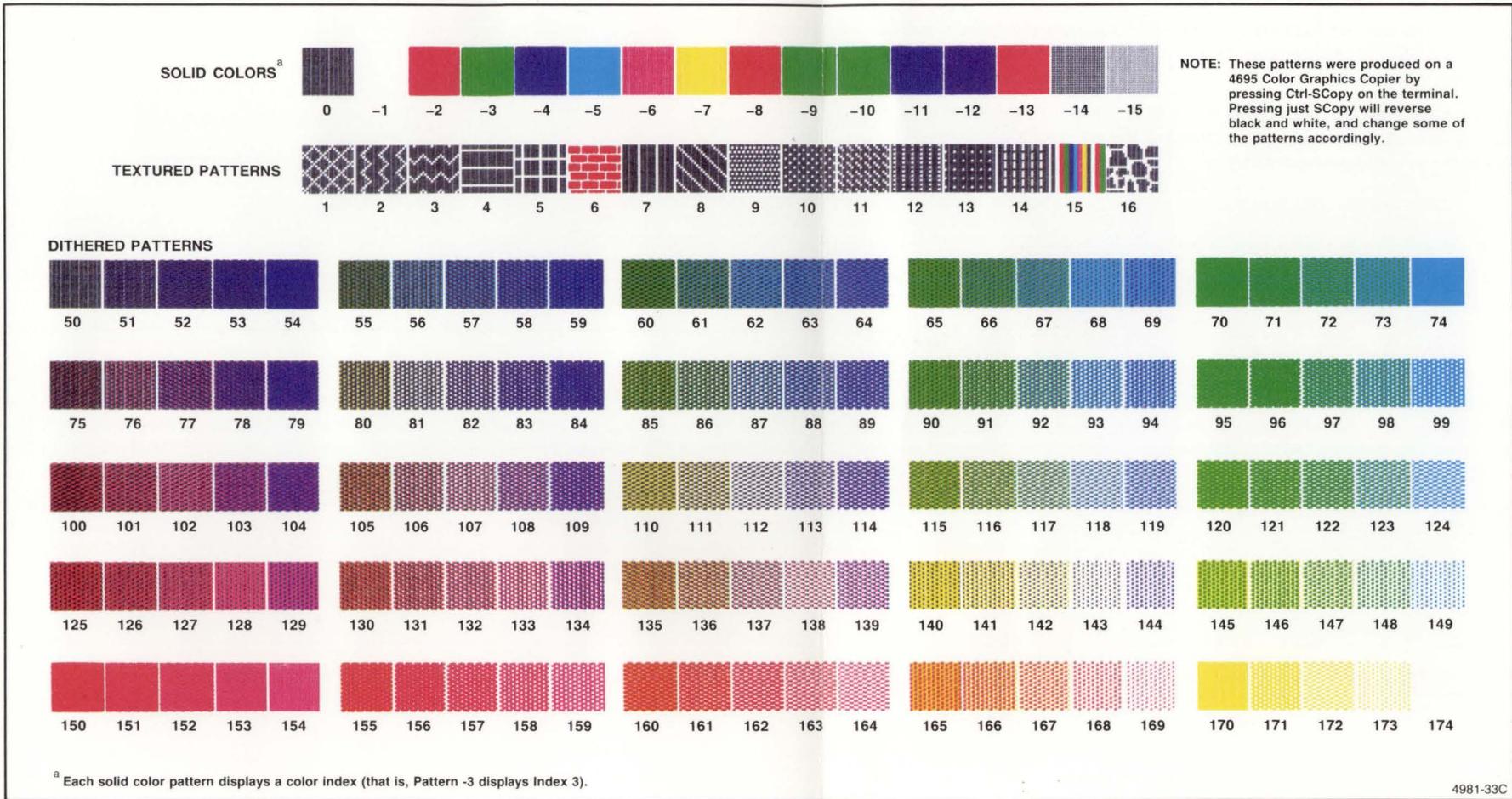


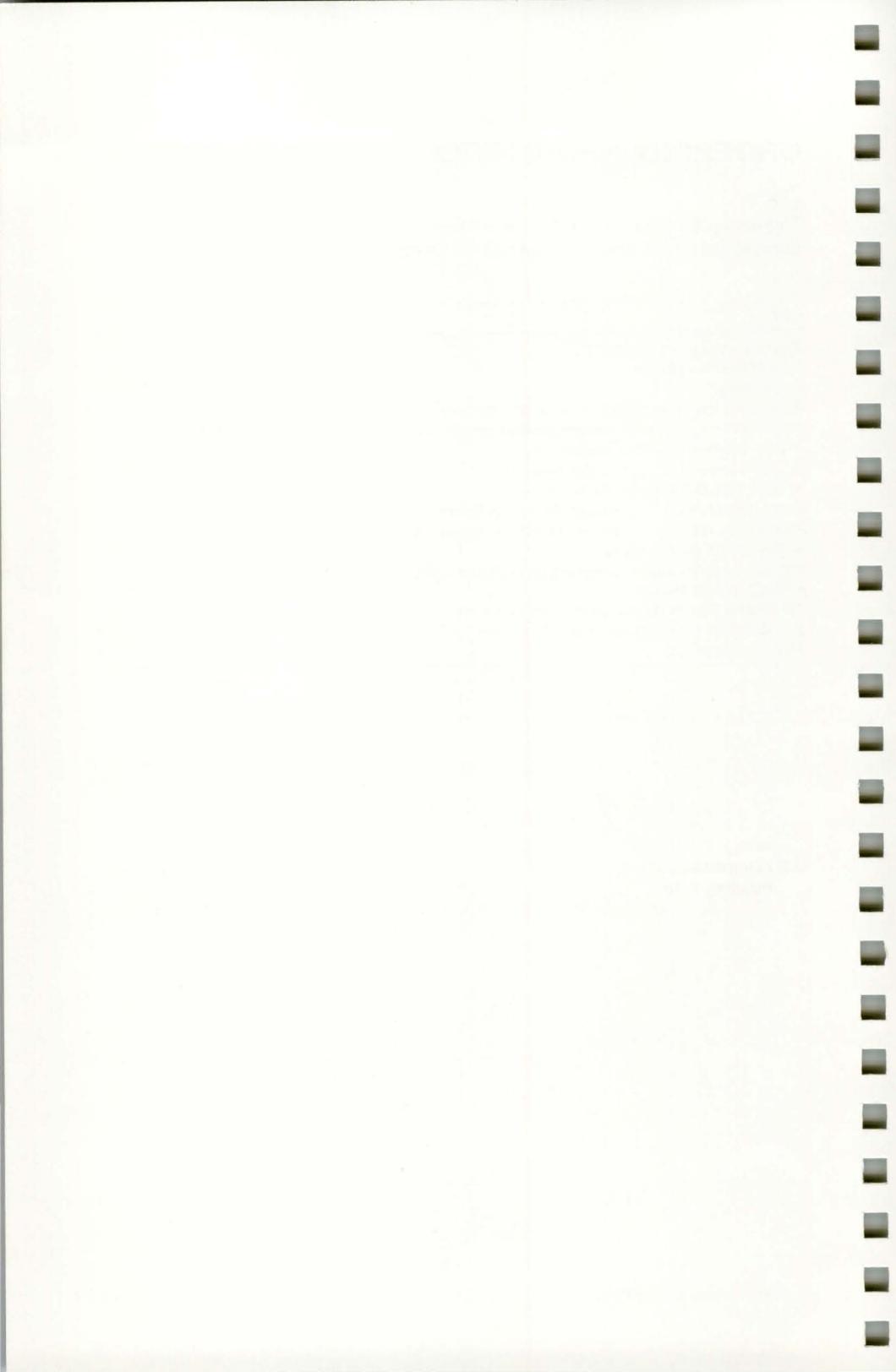
Figure H-1. Predefined Fill Patterns.

Appendix I

ORDERING INFORMATION

This appendix contains part numbers for ordering replacement or optional accessories for the 4106, 4107, and 4109 Computer Display Terminals.

Item	Part Number
Function Key Overlay (set of 6)	334-5164-00
RS-232 Host Port Cable	012-0911-00
Power Cord	Depends on voltage option
RS-232 Hostport Loopback Connector (can be used for Self Test)	067-1043-00
COPIER Port Loopback Connector (can be used for Self Test)	013-0214-00
<i>4106/4107/4109 Operators Manual</i>	070-4981-02
<i>An Introduction to Computer Color Graphics</i>	070-5239-00
<i>4106/4107/4109/CX Reference Guide</i>	070-4892-02
<i>4106/4107/4109/CX Programmers Reference Manual</i>	070-4893-01
<i>4106/4107/4109/CX Programmers Reference Supplement</i>	070-5723-00
<i>4106/4107/CX Service Manual</i>	070-4889-01
<i>13" Display Module Service Manual (for 4106 and 4107)</i>	070-5655-00
<i>4109/CX Service Manual</i>	070-4890-01
<i>19" Display Module Service Manual (for 4109)</i>	070-5656-00
<i>4106A/4107A/4109A Option 21 Service Manual</i>	070-5724-00
Alignment Graticule	067-1181-00



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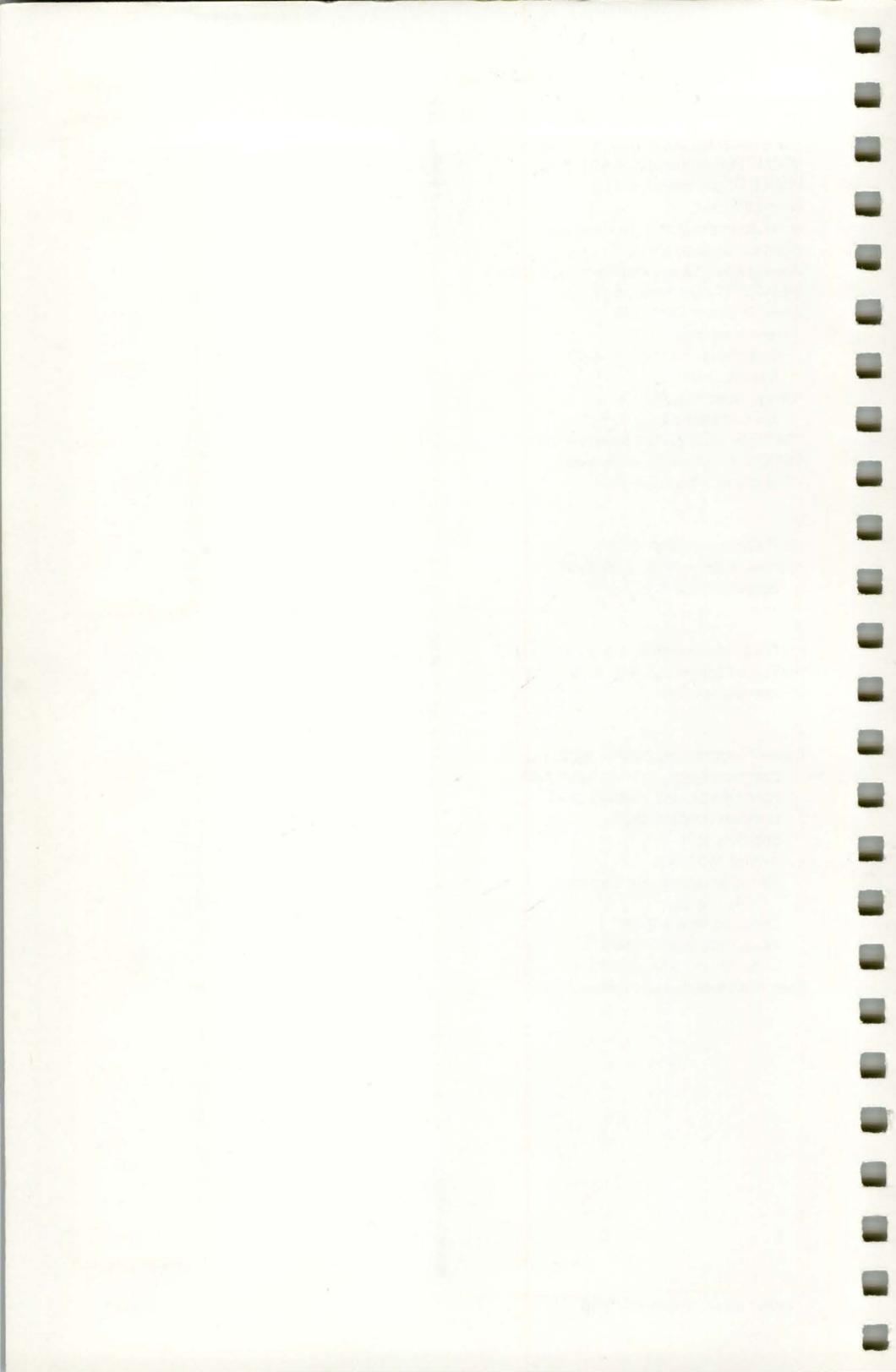
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Tektronix, Inc.
Wilsonville Industrial Park
P.O. Box 1000
Wilsonville, OR 97070

102683087