CIT224
Video Display Terminal

User's
Manual

C.ITOH

USER'S MANUAL
CIT224
VIDEO TERMINAL

C.ITOH

CIE Terminals

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NOTICE

This equipment generates, uses, and may emit radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. The equipment has been tested and found to comply with the limits for a Class A computing device 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 may cause interference in which case the user, at his own expense, may be required to take measures to correct this interference.

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CIT-220+
CIT-101e
CIT-101

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DEC
VT52
VT100
VT101
VT102
VT200
VT220

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Chapter 1

INTRODUCTION

PRODUCT DESCRIPTION

The CIT224 is a versatile, low cost, multifunctional video data terminal with a 108-key detachable keyboard. The terminal allows the user to communicate with a host computer system via the keyboard and display screen. The CIT224 can be interfaced with a variety of computer systems and peripheral devices. It is compatible with the following terminals: DEC VT220, VT100 and VT52, and CIE Terminals CIT-101e, CIT-101 and CIT-220+.
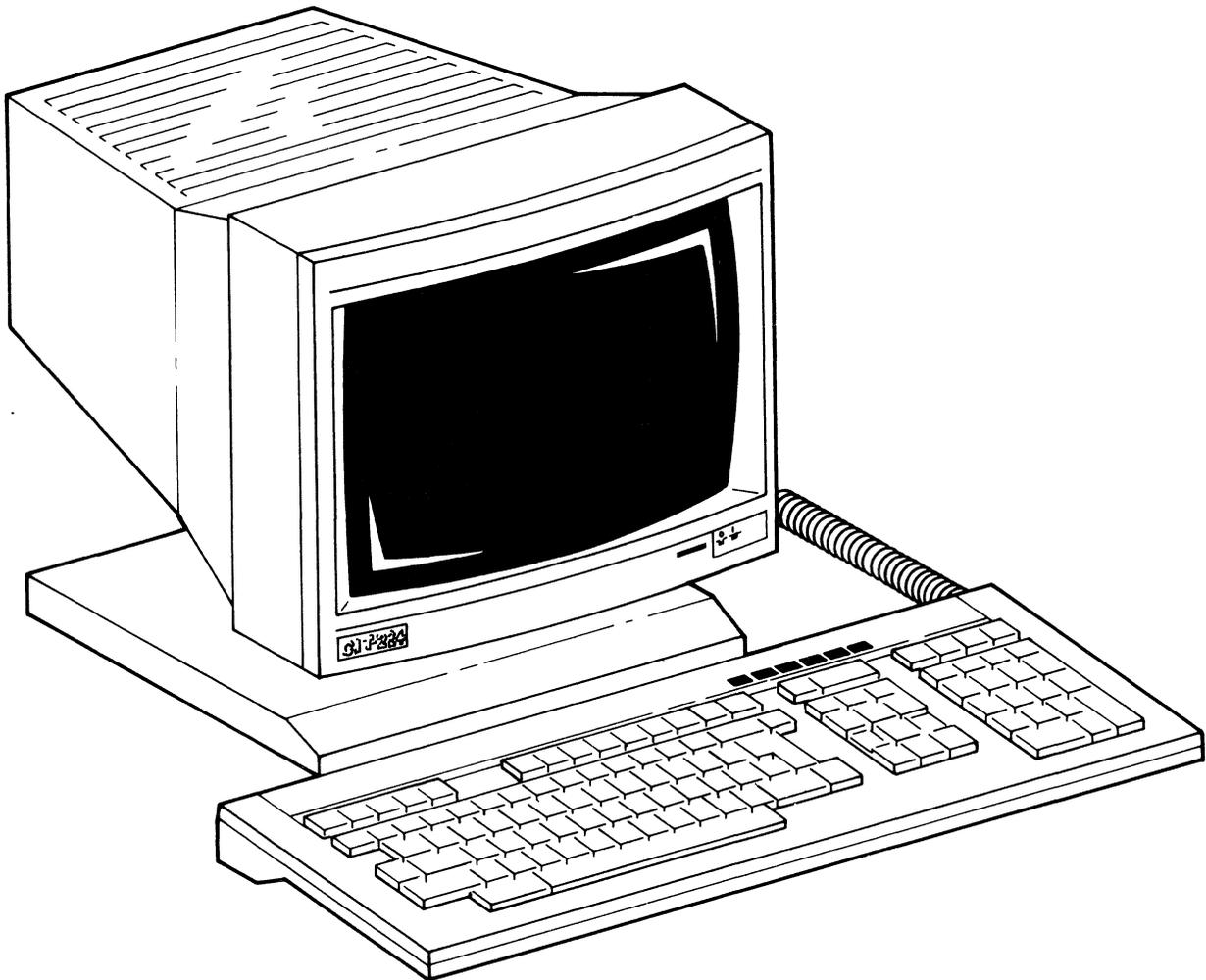
Figure 1-1. CIT224 Video Terminal

The CIT224 operates in either an ANSI mode or a VT52 mode. In the ANSI mode the terminal uses American National Standards Institute (ANSI) programming standards and is compatible with DEC VT220 and VT100, and CIE Terminals CIT-101e, CIT-101 and CIT-220+ video terminals. In the VT52 mode, the CIT224 is compatible with DEC VT52 terminals.

FEATURES

Standard features include a full and half duplex communication mode, RS-232-C or 20 mA current loop communication interface, and an auxiliary full duplex port. The CRT has a 14-inch diagonal screen with a choice of a black and white, green, or amber phosphor. Additional features of the CIT224 include:

- Keyboard layouts available in 15 languages

- A total of 60 function keys, 15 fixed, 45 programmable in non-volatile memory in either VT100 or VT220 mode

- A Function Key Editor Page to provide local programming of function keys

- A selectable host addressable status line displayed as a 25th display row

- Optional RS-422/423 interface

- Compatibility with DEC VT200 7- and 8-bit control modes

- Multi-mode bidirectional auxiliary port

- Two- and three-key compose sequences

- Four predefined character sets and a 'soft' character set that is down-line loadable from the host

- National Replacement Character (NRC) sets available in 7-bit modes

- Eleven set-up screens to set or reset terminal parameters

RELATED DOCUMENTS

CIT224 documentation can be ordered from CIE Terminals' Field Service Center. Additional documentation includes a CIT224 Maintenance Manual.

SPECIFICATIONS

Physical dimensions, environmental requirements, and certain functional characteristics of the CIT224 terminal are contained in this listing.

POWER

Line Voltage	100-120 VAC single phase, 3 wire 220-240 VAC single phase, 3 wire (switch selectable)
Line Frequency	47-63 Hz
AC Input Current	1.1 amps max. @ 90-135 VAC 0.7 amps max. @ 180-270 VAC
Input Power	50 watts
Power Cord	Detachable, 3 conductor, 2m

DISPLAY

CRT	14-inch diagonal, non-glare, choice of P4, P31 green, or PLA amber phosphor, 36 MHz dot frequency in 132 mode using a 24 KHz non-interlace CRT
Active Display Size	Approximately 23.0 cm x 17.5 cm (9.0 in. by 6.9 in.)
Format	24 lines x 80 or 132 characters (selectable), light on dark or reverse with selectable host addressable 25th status line
Character Matrix	7 x 15 dot matrix within a 10 x 16 cell in 80 column 24 line mode
Character Cell	10 x 16 dot matrix (80 char., 24 rows) 9 x 16 dot matrix (132 char., 24 rows) 10 x 15 dot matrix (80 char., 24 data, 1 status row) 9 x 15 dot matrix (132 char., 24 data, 1 status row)
Cursor Types	Block, underline or invisible (selectable)

Cursor Attributes	Blinking or non-blinking
Video Attributes	Normal, reverse, blinking, underline, bold
Scrolling	Jump, variable speed smooth scroll, and split screen
Character Sets	ASCII, Special Graphics (line drawing), Supplemental, National Replacement Character Sets, and User-definable character set
Structure	Tilt = 30°, Swivel = 45° left or right from center

KEYBOARD

General	Low-profile, DIN-standard detachable keyboard with three-position tilt adjustment and a 1.8m (6 ft.) coiled cord
Key Layout	108 keys: 80-key main pad, 18-key auxiliary keypad, 6-key editing pad and 4-key cursor control pad
Key Caps	Sculptured key caps with matte textured finish
Home Row Height	30 mm (1.18 in.) above desk surface
Auxiliary Keypad	18-key numeric pad with period, comma, minus, ENTER and 4 function keys or 0-F hexadecimal pad (selectable)
Visual Indicators	Six LEDs: Hold Screen, Wait, Compose, On Line, Shift Lock, and Caps Lock
Audible Indicators	Keyclick: sounds for each keystroke (keyboard selectable)
	Bell: Sounds when Ctrl-G (BEL) character is received, when the cursor nears the right margin, and for compose sequence errors.
	Multiple Bell: Sounds on error in Set-Up Save or Recall operation

COMMUNICATION

Type	Full-duplex asynchronous with selectable local echo and full or half-duplex modem control
Interface	EIA RS-232C, or 20mA current loop (RS-422/423 option)
Speeds	75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19.2K baud (Transmit/ Receive speeds can be set separately)
Character Length	7 or 8 bits with 1 or 2 stop bits (keyboard selectable)
Parity	Even, odd, or none, mark or space (7-bit only) (keyboard selectable)
Buffer Overflow Prevention	XON and XOFF control codes
Control Codes	ASCII, ANSI x3.64, DEC VT220, VT102, VT100 and VT52 compatible

AUXILIARY PORT

Specifications	Independent, bidirectional, same as main port in full duplex

DIMENSIONS

Monitor	Height: 33.0 cm (13.00 inches) Width: 32.4 cm (12.75 inches) Depth: 34.3 cm (13.50 inches)
Keyboard	Height: 3.5 cm (1.38 inches) Width: 53.3 cm (21.00 inches) Depth: 17.4 cm (6.87 inches) Tilt: 5° maximum

WEIGHT

Monitor	9.09 kg (20 pounds)
Keyboard	1.82 kg (4 pounds)
Shipping Weight	13.86 kg (30.5 pounds)

ENVIRONMENT

Operating

Temperature: 10 to 40° C (50 to 105° F)

Relative humidity: 10 to 90% (non-condensing)

Altitude: Not to exceed 2.5 Km (8200 ft.)

Non-Operating

Temperature: -40 to 66° C (-40 to 150° F)

Relative humidity: 20 to 95% (non-condensing)

Altitude: Not to exceed 9.1 Km (29,850 ft.)

Chapter 2

INSTALLATION

This chapter describes the unpacking and installation procedures for the CIT224. A brief description of the terminal configuration and factory default conditions are also provided.

UNPACKING

The CIT224 is shipped complete in one shipping container. Refer to the following figure to unpack the terminal.
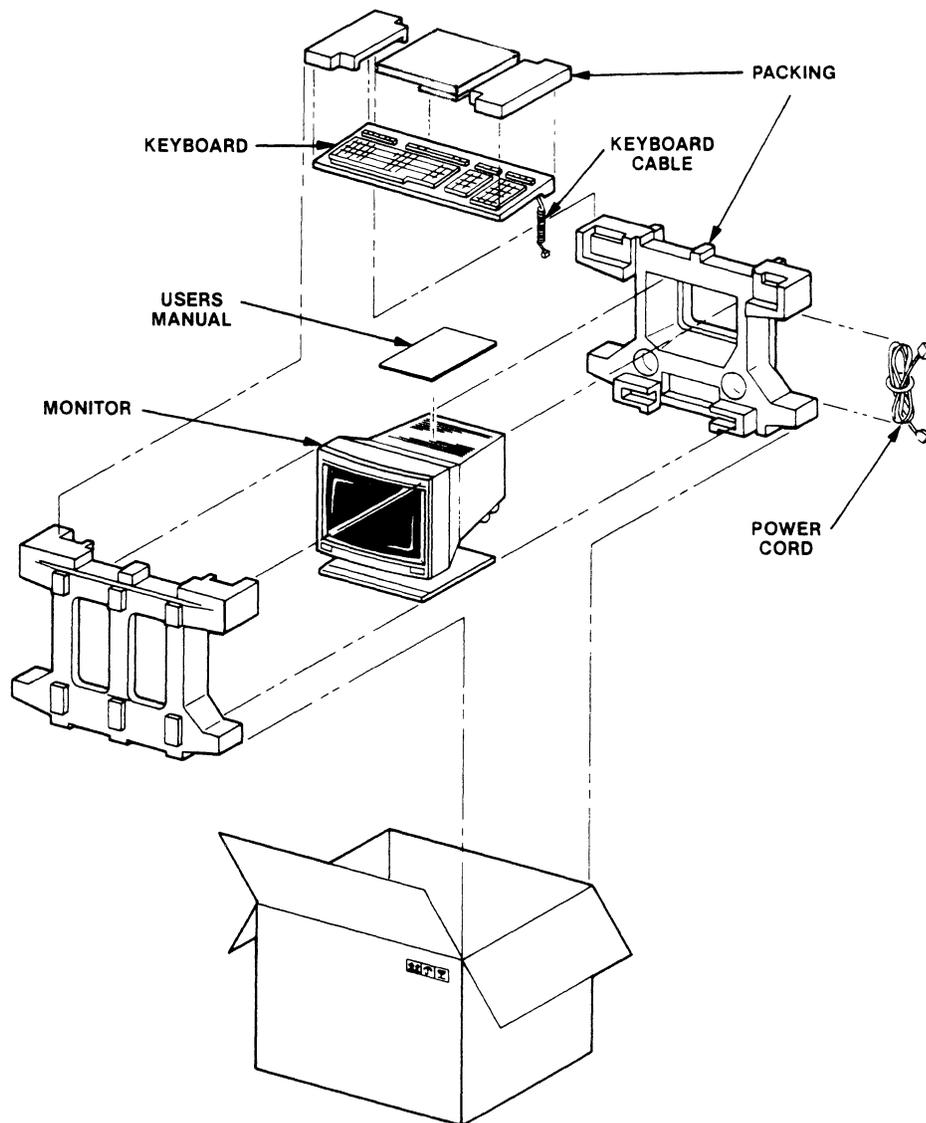
Figure 2-1. CIT224 Unpacking

INSPECTION FOR DAMAGE

Carefully inspect each component for any signs of shipping damage. All shipping containers have been specially designed to protect their contents and special care has been taken to prevent damage under normal shipping conditions. Mishandling should be evident upon the inspection of the shipping container. If damage is found after visual inspection, take care not to destroy the evidence. If necessary, document the damage with photographs and contact the transport carrier immediately.

LOCATION

The location of the CIT224 in a working environment should conform to the environmental operating specifications listed in Chapter 1. However, the operational reliability of the terminal requires that the following guidelines be adhered to:

1. Locate the terminal so that there is free airflow through the top and bottom air vents.

2. Do not place working materials on the air vents.

3. Do not locate the terminal where it can be exposed to direct sunlight or intense heat.

ELECTRICAL CONNECTIONS

The following two electrical connections must be made in order to operate the terminal:

The coiled keyboard cable
The AC line cord

Keyboard Cable Attachment

Plug the keyboard cable connector into the jack located at the lower right side of the monitor case, refer to Figure 2-2.
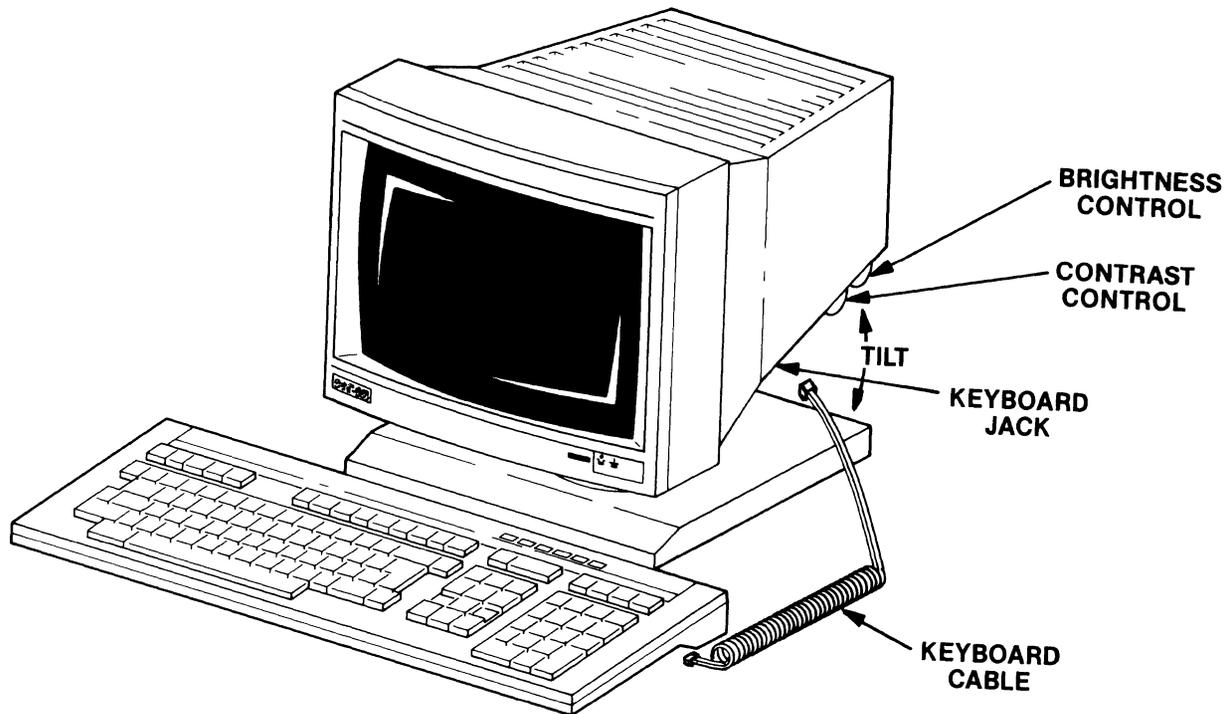
Figure 2-2. CIT224 Monitor Controls

AC Line Voltage Connection

    BEFORE connecting power, verify that the CIT224 AC line switch
setting is set to the value of the voltage supplied (see Figure 2-3).
The terminal can be set to operate on 110V or 220V. Refer to the
specifications in Chapter 1 for the correct setting.

CAUTION

DO NOT ATTEMPT TO OPERATE THE CIT224 WITH
AN INCORRECT AC VOLTAGE SETTING OR DAMAGE
TO THE TERMINAL CAN OCCUR.

FUSE HOLDER

110V/220V AC VOLTAGE
SELECTION SWITCH

AC POWER
INPUT

BRIGHTNESS
CONTROL

CONTRAST
CONTROL

AUXILIARY
PORT CONNECTOR

COMMUNICATION
PORT CONNECTOR
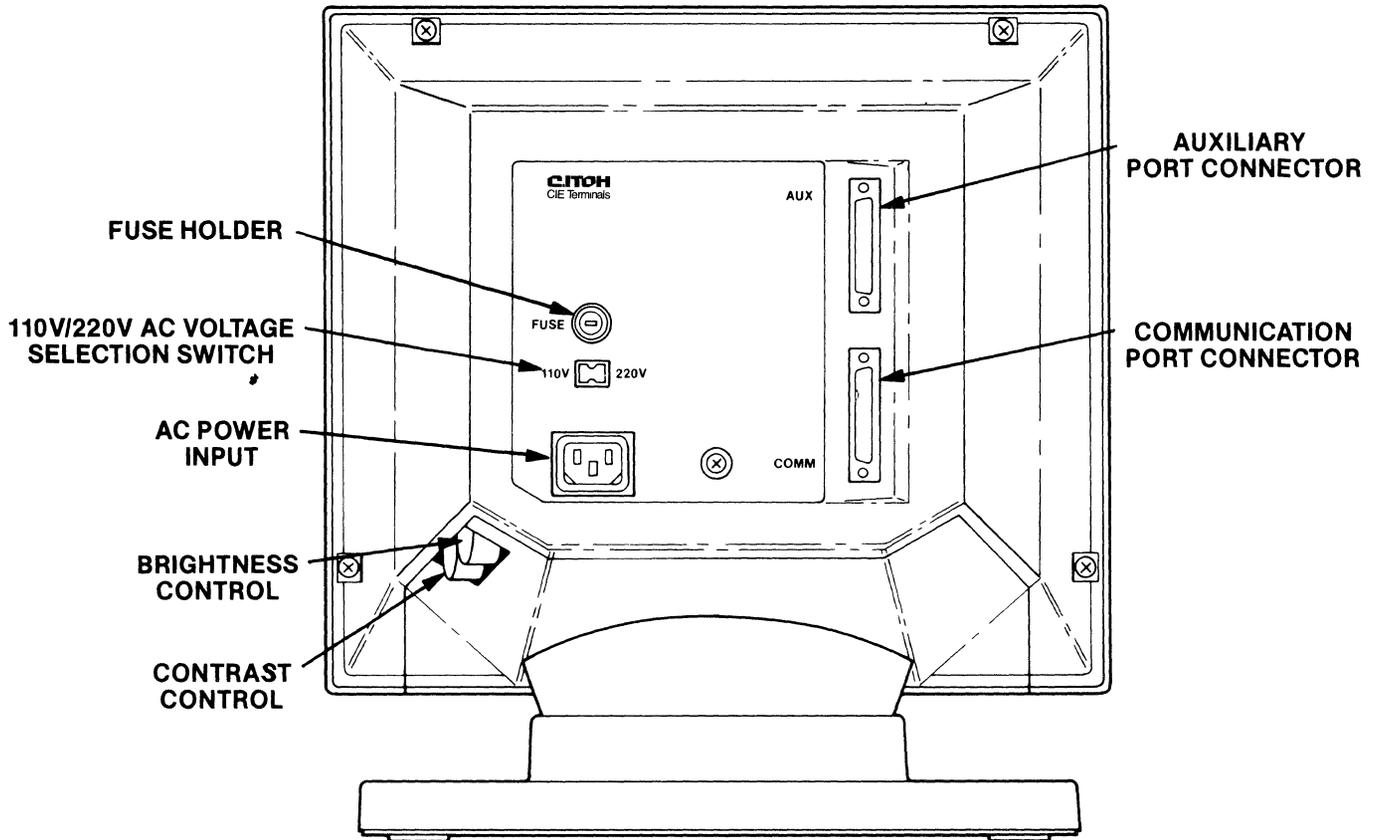
Figure 2-3. CIT224 Controls and Connectors

Check the AC voltage selection switch and ensure it is set to the correct voltage. If it is not correct, use a pen or a small screwdriver to set the slide switch to the value of the AC line voltage. Ensure also that the correct fuse is installed for the line voltage setting.

Connect the AC cord to the receptacle at the rear of the video terminal. Plug the cord into the desired AC outlet.

TERMINAL CHECKOUT

Press the power ON/OFF switch located on the front of the terminal as shown in the following figure. The terminal responds with a beep tone and performs a self-test. When the test is successfully completed, the message "CIT224 OK" appears on the screen and the terminal is ready for connection to a host computer and terminal SET-UP procedures. Initial power-on self-test information is given later in this chapter.

The operator section of the manual contains information about configuring the terminal for specific applications.

To adjust contrast and brightness use the controls located on the lower right corner of the terminal, as shown in Figure 2-2.

**POWER ON/OFF
SWITCH**
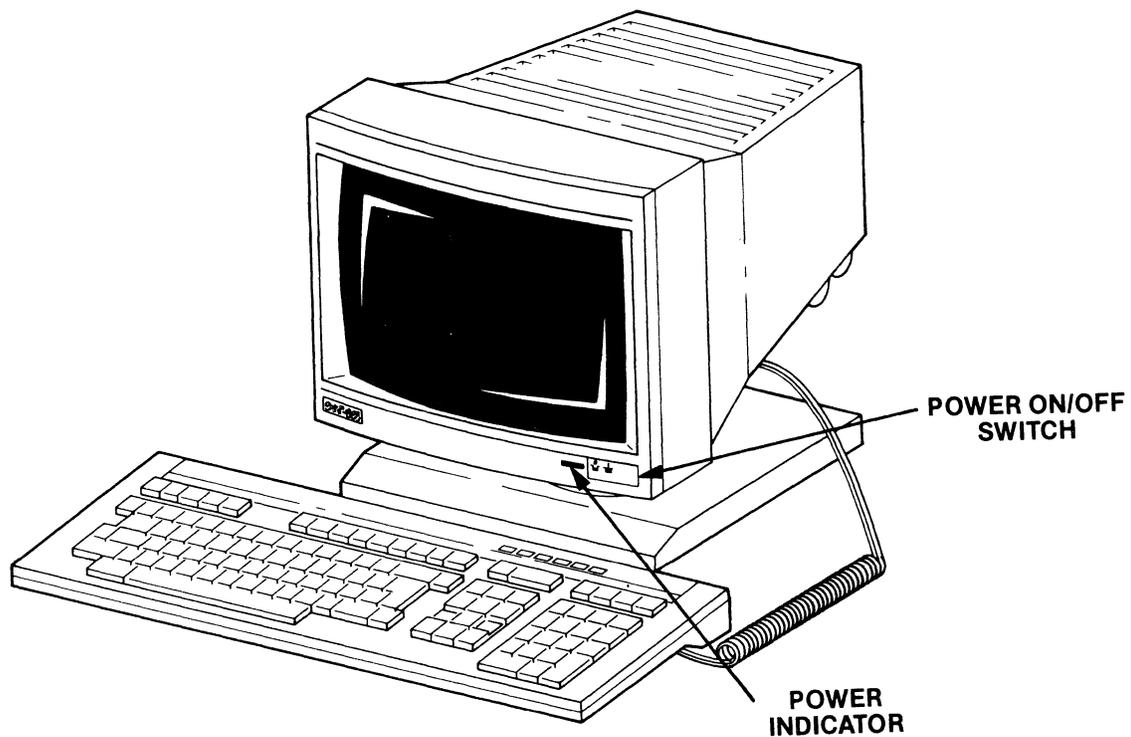
**POWER
INDICATOR**

Figure 2-4. CIT224 Indicator and Power Switch

TERMINAL OPERATING CONFIGURATION

The operational configuration (SET-UP) of the CIT224 is achieved through either the keyboard or the host computer. Since the SET-UP parameters may be permanently stored in NVR memory (no loss of data occurs during power-off), standard default conditions are programmed into the NVR memory at the factory. These default conditions for each SET-UP mode are displayed on the screen after power-on and selection of the desired SET-UP mode.

Chapter 4 provides a complete description of the SET-UP modes, their respective displays, and factory default values. The procedures for either permanently saving operator selected SET-UP parameters or restoring factory default conditions are also included.

INTERFACING

In the standard system configuration the CIT224 is interfaced with the host via the bidirectional communication port according to EIA RS-232-C or 20 mA current loop conventions. The terminal also provides a bidirectional auxiliary port. This port is RS-232-C or current loop compatible and is designed to support a variety of peripheral devices. Figure 2-3 shows the location of the communication and auxiliary connectors.

The male D connector labeled COMM, is used for host communication. The female D connector, labeled AUX, is used for peripheral device communication. The following tables provide the pin assignments for the ports.

Communication parameters, (e.g. baud rates, parity, etc.), are selected in the SET-UP mode.

Table 2-1. Communication D Connector Pin Assignments

Pin	Mnemonic	Function	Notes
1	SGND	Signal Ground	Chassis and reference ground.
2	TXD	Transmit Data	Transmits serial data from the terminal.
3	RXD	Receive Data	Receives serial data into the terminal.
4	RTS	Request to Send	Asks the host to transmit.
5	CTS	Clear to Send	Tells the terminal that the host is ready to transmit.
6	DSR	Data Set Ready	Tells the terminal the host is in the data mode and is ready to exchange RTS, CTS and CD.
7	SGND	Signal Ground	Chassis and reference ground.
8	CD	Carrier Detect	Tells the terminal that the signal received on the communication line is of adequate quality to ensure proper demodulation of received data. If off, indicates no signal received or signal not suited for demodulation.
2Ø	DTR	Data Terminal Ready	Tells the host that the terminal is ready to transmit or receive.
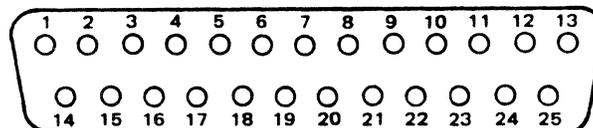
Figure 2-5. Male D Connector Pin Locations (labeled COMM)

Table 2-2. AUX Port D Connector Pin Assignments

Pin	Mnemonic	Function	Notes
1	PGND	Protective Ground	Chassis ground.
2	RXD	Receive Data	Receives serial data into the terminal.
3	TXD	Transmitted Data	Transmits serial data from the terminal.
7	SGND	Signal Ground	Chassis and reference ground.
20*	CTS	Clear To Send	Tells the terminal it is okay to send data to the peripheral.

* If the printer does not send this signal, pin 20 may be pulled high by jumpering to pin 21 at the terminal connector.
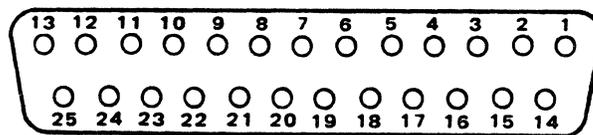
Figure 2-6. Female D Connector Pin Locations (labeled AUX)

MODEMS

The CIT224 operates with modems with standard EIA RS-232-C and RS-423 interfaces, and is in accordance with national and international standards and recommendations. The modems at the terminal end and at the host computer end must be compatible with each other.

20 mA CURRENT LOOP

The terminal offers a 20 mA current loop interface as a standard feature. The interface may only be used on one of the two ports at one time. No modifications are required to use the 20 mA current loop since it is implemented via normally unused pins in the two port connectors.

External jumpering, as illustrated in Figures 2-7 and 2-8, is used to establish the desired current loop configuration. The pins used on the connector are listed below in Tables 2-3 and 2-4.

The loop has two selectable modes of operation, either active or passive. In the active configuration the terminal is the current source; while in the passive configuration the terminal is the current sink. Selection of either mode requires external jumpering within the D connector.

In the passive mode, the XTMR line is optically isolated and goes to a MARK condition when off. In the active mode the XMTR is not optically isolated and goes to a SPACE condition.

Table 2-3. COMM Port D Current Loop Pin Assignments

Pin	Function	Notes
7	Signal Ground	Reference and Chassis ground
9	Current Loop Receive+	Tied to Auxiliary channel pin 9
1Ø	Current Loop Receive-	Tied to Auxiliary channel pin 1Ø
13	Receive Loop Bias	Tied to Auxiliary channel pin 13
14	Current Loop to EIA in	Tied to Auxiliary channel pin 14
16	EIA to Current Loop in	Tied to Auxiliary channel pin 16
21	Transmit Loop Bias	Tied to Auxiliary pin 21
24	Current Loop Transmit+	Tied to Auxiliary channel pin 24
25	Current Loop Transmit-	Tied to Auxiliary channel pin 25

Table 2-4. AUX Port D Current Loop Pin Assignments

Pin	Function	Notes
7	Signal Ground	Reference and Chassis ground
9	Current Loop Receive+	Tied to Communication channel pin 9
1Ø	Current Loop Receive-	Tied to Communication channel pin 1Ø
13	Receive Loop Bias	Tied to Communication channel pin 13
14	Current Loop to EIA in	Tied to Communication channel pin 14
16	EIA to Current Loop in	Tied to Communication channel pin 16
21	Transmit Loop Bias	Tied to COMM pin 21
24	Current Loop Transmit+	Tied to COMM channel pin 24
25	Current Loop Transmit-	Tied to COMM channel pin 25
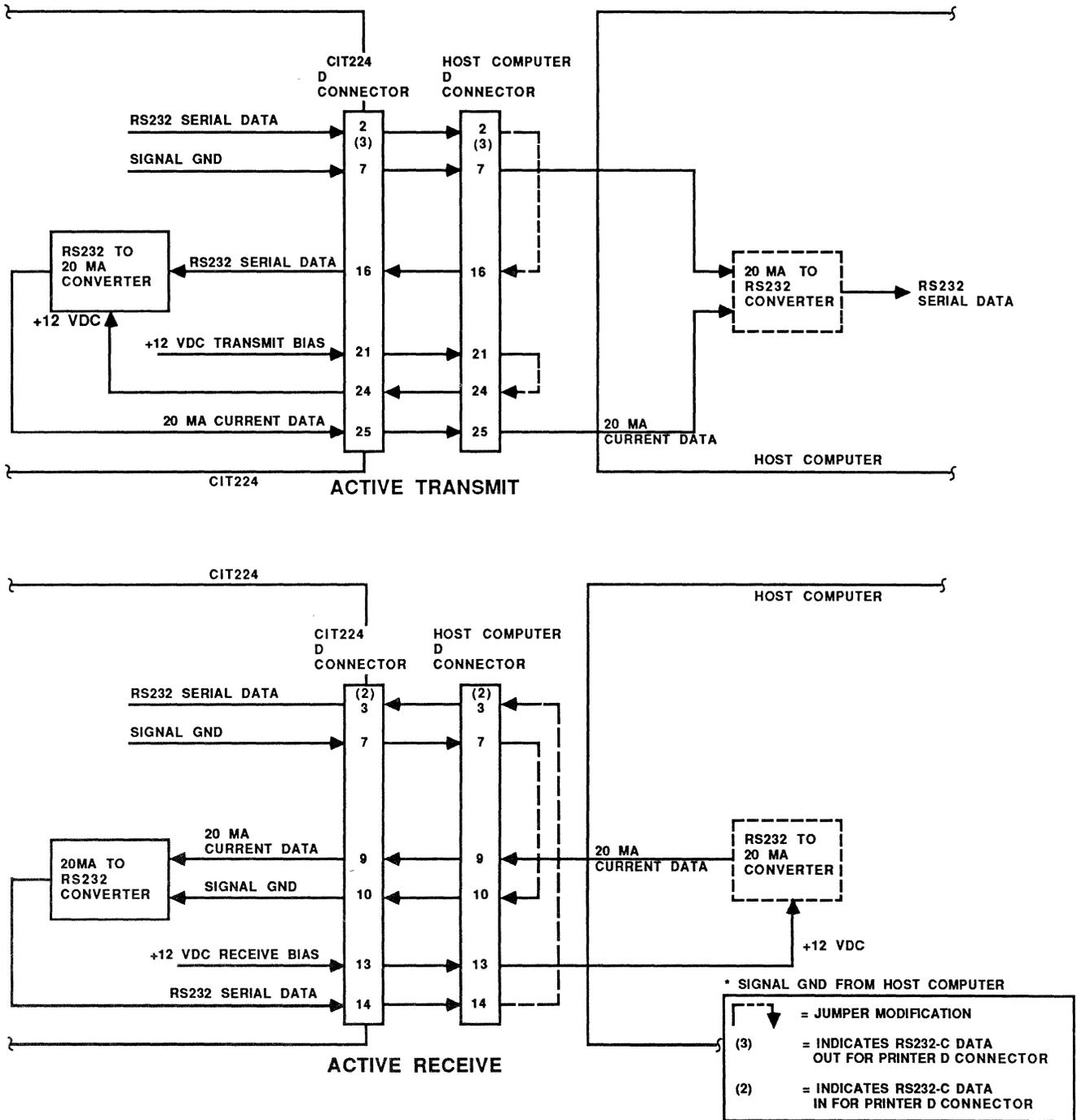
Figure 2-7. Active Configuration, 20 mA Current Loop
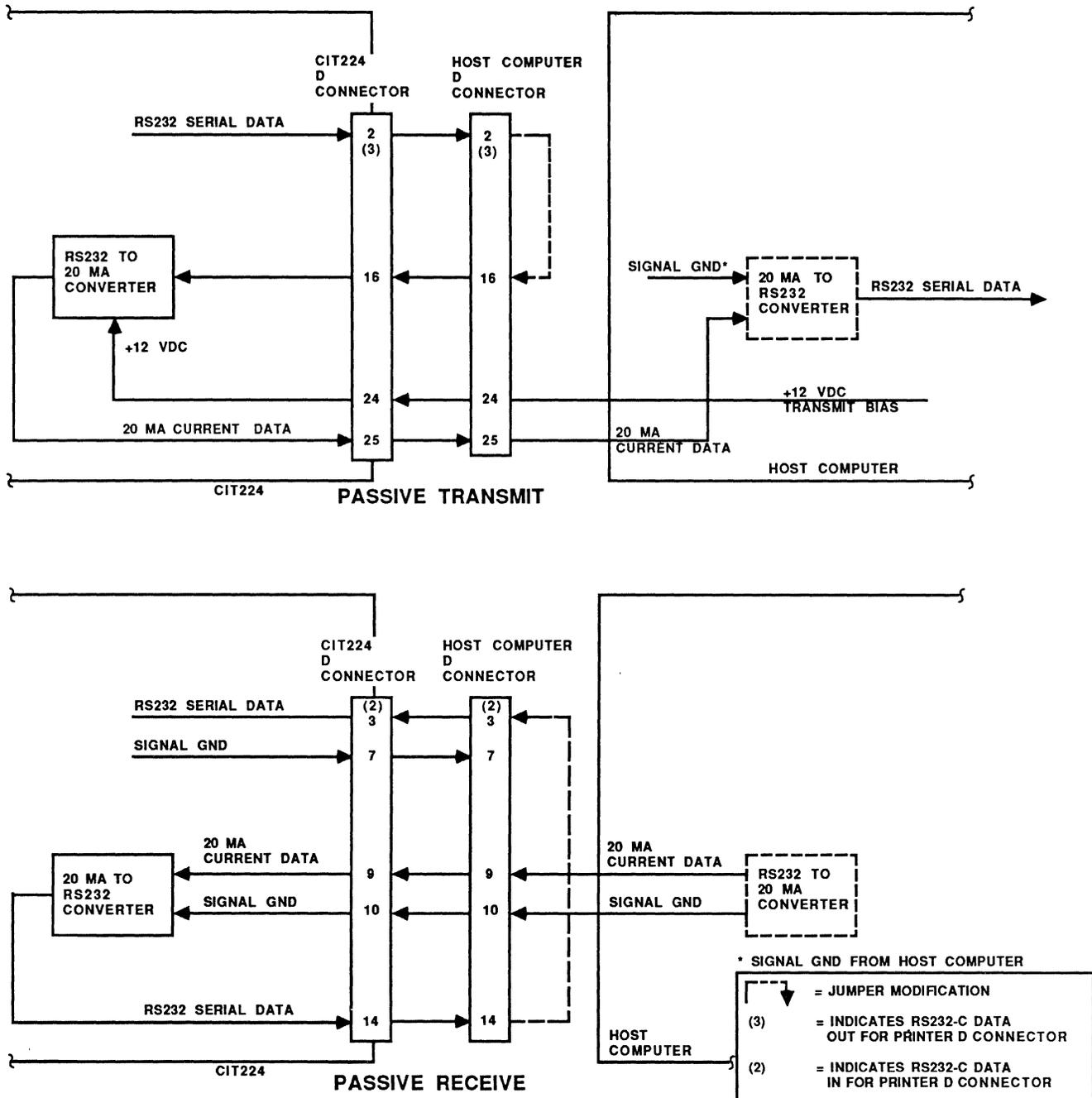
Figure 2-8. Passive Configuration, 20 mA Current Loop

COMMUNICATIONS PORT PROTOCOL

The CIT224 terminal utilizes XON/XOFF handshake protocols for control of data flow. The following describes the communications XON/XOFF handshake controls.

Incoming characters are stored by the terminal in a receiver buffer manager that transmits XON/XOFF control. The manager processes the characters on a first-in/first-out basis. It does so on the appropriate transitions of the receiver buffer minimum and maximum thresholds determined by the terminal's logic. When the receiver buffer fills to the maximum number of characters (or 70% of the buffer), the terminal transmits an XOFF character to inhibit the host computer from sending more data.

An XON is asserted to resume communications when the data in the receiver buffer falls below 20% of the buffer space. Additional conditions that transmit XON are:

- A Clear Comm function
- A Recall function
- Completion of the self-test
- Pressing the HOLD SCREEN key to "free" the screen when the receiver buffer is at or below the XON point.

NOTE: If XOFF is disabled in Set-Up, the receiver buffer manager is inactive and does not transmit an XOFF character to the host computer. The keyboard HOLD SCREEN key is inactive also. There is no way to ensure that characters will not be lost.

The receiver buffer continues to fill with characters if XOFF is disabled. Any characters received after the buffer has filled up are lost. Reverse question marks appear on the screen replacing the lost characters.

Unrecognized XON/XOFF Characters

Software packages that do not recognize XON/XOFF characters sent from the terminal may access the terminal's features in the following ways:

- through the use of fill characters, or
- by limiting the send/receive rate to 9600 and avoiding the use of an escape code, slow scrolling, the printer port, and the split screen.

Modem Connect/Disconnect

A modem may be used to connect the terminal to the host computer. When connected, all buffers, transmissions in progress, and XOFF's are cleared by the terminal, and the keyboard is unlocked if it is in the locked condition.

To disconnect the communications line, press the SHIFT BREAK keys.

Other actions that cause a disconnect between the host computer and terminal are:

- Selecting Recall or Default in the Set-Up mode
- The loss of a Data Set Ready (DSR) signal
- The loss of a carrier detect signal for 2 seconds (or 60 ms) as determined in the Communications Set-Up menu
- Lack of a carrier detect signal within 30 seconds after a DSR
- The host sends a self-test·directive to the terminal
- Changing from the EIA port to the 20 mA port, or vice versa

PRINTER PORT PROTOCOL

The CIT224 receives XON/XOFF signals from the printer, but does not send them to it. When the printer buffer becomes full, it transmits an XOFF to the terminal to temporarily halt transmission of data characters. As the buffer empties, the printer sends an XON to the terminal to resume transmission of data.

Selecting Clear Comm in the Set-Up Directory menu also clears the buffer and sends an XON to the terminal.

> **NOTE:** If an older printer is being used, it may not acknowledge 8-bit C1 control codes. It is advisable to set the printer port to 7-bit operation through the Printer Set-Up menu.

INITIAL POWER-ON SELF-TEST

Each time the terminal is turned on it automatically performs a self-test. Control of the terminal is relinquished to the test during this time. The terminal is unable to acknowledge any commands other than those used for the self-test. Upon completion of the test cycle, control is returned to the terminal.

Activate the power-on self-test by pressing the power on/off switch to ON. All of the LED indicators turn on and off and the bell tone sounds. When the test is successful the LED indicators turn off and the CRT displays the message: 'CIT224 OK'. When a character is received from the host computer, the message is removed. Or, to remove the message, press any key on the keyboard.

Error Messages

The CRT and three of the LED indicators (HOLD SCREEN, CAPS LOCK and COMPOSE) are used to display any errors found during the power-on self-test. An error message is displayed on the CRT and a coded message is provided by the LED indicators.

Refer to Table 2-5 below for an explanation of the screen error messages.

Table 2-5. Screen Error Messages

Message	Problem
ROM ERROR	ROM Checksum Error - Reports an error that occurred when the checksum stored for each program ROM (or PROM) in the main program memory was compared against the checksum computed by the diagnostic.
RAM ERROR	RAM Read/Write Error - Indicates that an error was detected during various read and write operations performed throughout the two 16K RAM banks in the unit.
NVR ERROR	NVR Checksum Error - Indicates a fault in the Non-Volatile RAM (NVR) circuitry detected by comparing the checksum stored in NVR at the time of the last SAVE operation with the checksum computed by the diagnostic. It may mean that one or more SET-UP bits or features may be altered or unstable.
KBD ERROR	Keyboard Error - The terminal is operational to receive input from the host computer only, the keyboard is not plugged in to the terminal.

If the self-test is successful, the screen message is displayed in normal video, while error messages are displayed in reverse video. The blinking LED error codes are as follows:

Table 2-6. LED Error Messages

Keyboard Indicator	Problem
Hold Screen LED	Blinks if ROM error
Caps Lock LED	Blinks if RAM error
Compose LED	Blinks if NVR error

CARE AND MAINTENANCE

With the exception of occasional dusting or cleaning, the CIT224 should require very little care or maintenance. The terminal should be cleaned with a dry, lint-free cloth, when required. If the CRT screen or the plastic case need cleaning, remove the AC power cord first to prevent any accidents. Clean the terminal with a cloth dampened with a mild detergent solution. Avoid the use of strong solvent cleaners or detergents which may damage the plastic surfaces.

Chapter 3

KEYBOARDS

This chapter contains information on the keyboards available with the CIT224. The keyboards provide full compatibility with the DEC VT220, including such features as COMPOSE CHARACTER, User Defined Keys (F6 through F20), and editing key functions, plus additional CIE Terminals' enhancements. A total of fifteen keyboard layouts are available.

KEYBOARD DESCRIPTION

Functionally there are four types of keys and two types of indicators on the CIT224 keyboard (refer to Figure 3-1). The basic types include:

1. Standard typewriter keys

2. Editing keypad with cursor control keys

3. A calculator type numeric keypad with special function control keys

4. Terminal control and function keys (User Defined Keys)

5. Six LED status indicators

6. Two audible indicators: a keyclick and a bell tone
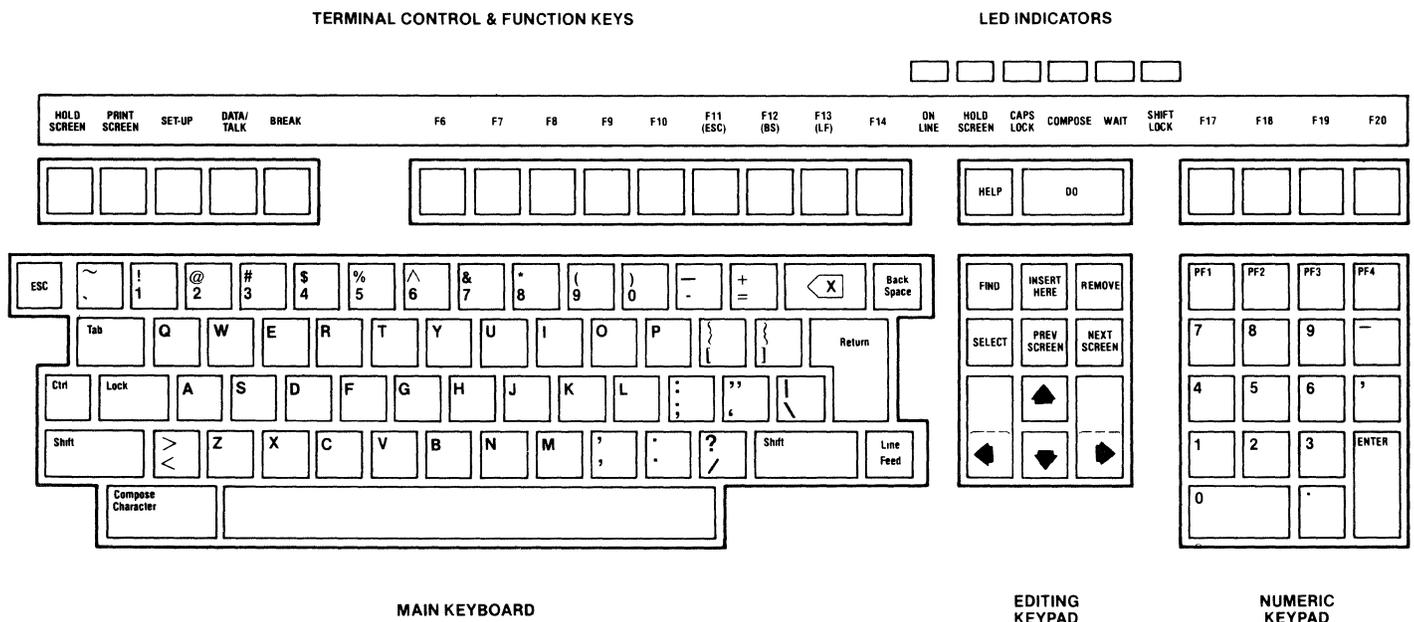
Figure 3-1. CIT224 Keyboard

Main Keypad Keys

The main keypad consists of standard typewriter alphanumeric keys and symbols, and keyboard function keys. Figure 3-2 illustrates the main keyboard layout.
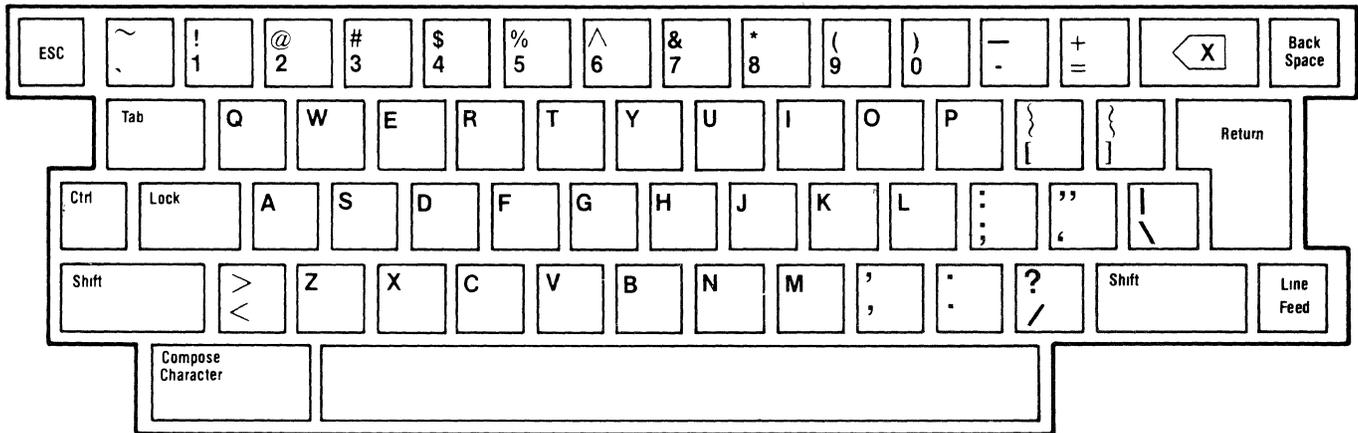
Figure 3-2. Main Keyboard Keys

Standard Keys. The standard keys of the keyboard, in conjunction with the SHIFT and/or LOCK keys, provide all the uppercase and lowercase letters, numerals, and symbols found in a standard ANSI typewriter layout. When the LOCK key is pressed once, the CAPS LOCK LED comes on and uppercase letters are produced. When pressed a second time, the CAPS LOCK LED goes off and lowercase letters are produced.

The standard keys on the North American keyboard display and generate only ASCII characters. Most of the other keyboards generate supplemental as well as ASCII characters.

The CIT224 has fifteen different keyboard set-ups. The standard-key patterns vary among these keyboards, and some graphic characters (either special characters with diacritical marks or special symbols) may or may not be available as standard keys on particular keyboards. However, a compose sequence may be used to create any multinational graphic character that is needed.

On all keyboards, all of the GL characters can be used in both 7-bit and 8-bit modes while GR characters can only be used in an 8-bit mode.

With the exception of the North American keyboard, all keyboards
have one or more standard keys that generate different graphic
characters and related codes, depending on whether Data Processing or
Typewriter mode has been selected in Set-Up. These keys have more than
two characters shown on their keycaps. When the terminal is in
Typewriter mode the character on the left side of the keycap is
generated. When the terminal is in Data Processing mode, the character
on the right side of the keycap is generated.

Main Keyboard Function Keys.   The main keypad function keys are
described below.   The ASCII codes generated are also noted in
hexadecimal notation.

Table 3-1.   Main Keyboard Function Keys

Key	HEX Code	Description
<x]	7FH	Transmits a DEL character. Erases one character to the left of the cursor. Entering SHIFT <x] generates a CAN (Cancel) character (18H)
BACK SPACE	Ø8H	Transmits a BS character. It moves the cursor one position to the left until the cursor reaches the first column of the current line.
COMPOSE CHARACTER		Does not transmit a code. Starts a compose sequence which is used to generate characters that do not exist on the standard keypad.
CTRL		Does not transmit a code. This key is used with other keys to generate special function codes.
ESC	1BH	Generates an ESC code which introduces a sequence of key actions that constitute an escape command.
LINE FEED	ØAH	Transmits an LF character. When in Line Feed mode, it causes the cursor to move down one line while maintaining its current column position. When in New Line Mode, it causes the cursor to advance to the first position on the next line.

Table 3-1.   Main Keyboard Function Keys (Cont.)

Key	HEX Code	Description
LOCK		Does not transmit a code. When CAPS LOCK mode is activated in the Keyboard Set-Up menu, when pressed, all uppercase letters are produced. When SHIFT LOCK mode is active, this key toggles upper and lowercase letters and symbols. To return to normal keyboard operation, press the LOCK key a second time.
RETURN	ØAH (LF) or ØDH (CR)	Transmits either an LF character or an LF and CR characters, depending on the set/reset state of Line Feed/New Line mode. (Refer to Terminal Modes in the Programmer section.) Pressing RETURN moves the cursor to the next line when editing text, or it is a signal to the system that a particular operation is finished.
SHIFT		Does not transmit a code. This key is used with other keys to generate special function codes or uppercase letters and symbols.
SPACE BAR	2ØH	Transmits an SP character and advances the cursor one position to the right.
TAB	Ø9H	Transmits an HT character. Moves the cursor to the next tab stop. Used with the SHIFT key, it generates a BACKTAB.

Editing Keypad

The editing keys enable the operator to position the cursor on the display screen, find specific characters, insert and/or remove data, and advance and/or backup to the next or previous screens. The cursor attributes (blinking, static, block, underline, or invisible) are selectable via the set-up modes. Cursor control key sequences and their use are described in Chapter 5. The active cursor position is also altered when certain control function keys, such as LF (Line Feed), RETURN, or BS (Back Space), are used. Figure 3-3 shows the Editing Keypad.
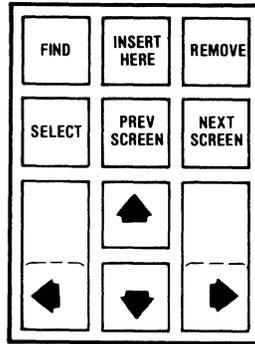
Figure 3-3. Editing Keypad

Table 3-2 lists the codes generated by the cursor control keys, and Table 3-3 lists the codes generated by the editing keys.

Table 3-2. Codes Generated by Cursor Control Keys

| Key | ANSI Mode* | | VT52 Mode | |
| | Cursor Key Mode | | | |
	Reset Normal	Set Application	Normal	Application
↑	CSIA	SS3A	ESCA	ESCA
↓	CSIB	SS3B	ESCB	ESCB
→	CSIC	SS3C	ESCC	ESCC
←	CSID	SS3D	ESCD	ESCD

* ANSI mode refers to VT200 and VT100 modes.

The cursor control keys position the cursor up, down, right or left. The left and right arrow keys also control horizontal scrolling. In Set-Up mode, the keys enable the operator to select Set-Up mode parameters for alteration.

Table 3-3. Codes Generated by Editing Keys

Key	Code Generated
FIND	CSI1~
INSERT HERE	CSI2~
REMOVE	CSI3~
SELECT	CSI4~
PREV SCREEN	CSI5~
NEXT SCREEN	CSI6~

The editing keys are inoperable in VT100 or VT52 modes.

Numeric Keypad

The numeric keypad adds versatility and convenience to the CIT224 (see Figure 3-4). The keypad permits single key entry of various special control sequences and direct input of decimal data.
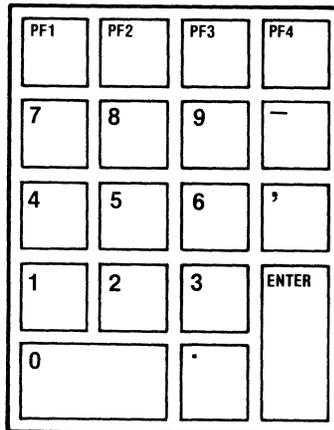
Figure 3-4. Numeric Keypad

The keypad can operate in one of two modes, numeric or application, as selected in the General Set-Up menu. The modes can also be set through escape sequences as described in Terminal Modes in Chapter 5. In either mode the keypad generates ANSI or VT52 compatible code sequences. Refer to Table 3-4 for a listing of the code sequences.

Table 3-4.   Numeric Keypad Generated Codes

Key	ANSI Keypad Numeric Mode	ANSI Keypad Application Mode	VT52 Keypad Numeric Mode	VT52 Keypad Application Mode
Ø	Ø	SS3p	Ø	ESC?p
1	1	SS3q	1	ESC?q
2	2	SS3r	2	ESC?r
3	3	SS3s	3	ESC?s
4	4	SS3t	4	ESC?t
5	5	SS3u	5	ESC?u
6	6	SS3v	6	ESC?v
7	7	SS3w	7	ESC?w
8	8	SS3x	8	ESC?x
9	9	SS3y	9	ESC?y
PF1	SS3P	SS3P	ESCP	ESCP
PF2	SS3Q	SS3Q	ESCQ	ESCQ
PF3	SS3R	SS3R	ESCR	ESCR
PF4	SS3S	SS3S	ESCS	ESCS
-	-(minus)	SS3m	-	ESC?m
,	,(comma)	SS3l	,	ESC?l
.	.(period)	SS3n	.	ESC?n
ENTER	CR or		CR or	
	CR LF	SS3M	CR LF	ESC?M

Keypad Numeric Mode. The keypad enters the numeric mode whenever the terminal is powered-up or reset. In this mode, the numeric and punctuation keys function the same as the corresponding keys on the main keyboard. The ENTER key performs the same function as the RETURN key when the edit mode is not on. The code generated by RETURN can be changed with the Line Feed/New Line Mode. When reset, this mode causes RETURN to generate a CR only. When set, both a CR and an LF are generated.

The four special function keys (PF1, PF2, PF3, and PF4) generate character control sequences (refer to Chapter 5). The sequences are sent to the host computer to support special software functions.

Keypad Application Mode. The numeric keypad may be configured (via control sequences) to transmit either ANSI or VT52 compatible multiple key sequences in place of the normal keypad functions. These application mode key sequences allow additional 18-key codes for efficient user control.

Bidirectional Auxiliary Port Keyboard Control. The bidirectional
auxiliary port may be controlled from the numeric keypad using the
keyboard keys SHIFT and CTRL. The interaction and routing of data from
the keyboard, display, communications port, and auxiliary port are all
affected by these keys. The available configurations are listed and
explained below.

Table 3-5.   Numeric Keypad Special Functions

Special Function Keys	Description
SHIFT & PF1	LINE SEND-Transfers the current display line occupied by the cursor to the auxiliary port. This functions in the on-line or local mode.
CTRL & PF1	PAGE SEND-Transfers the entire contents of the display to the auxiliary port. If origin mode is set only the active portion of the display is output. This function operates in the on-line or local mode.
SHIFT & PF2	KEYBOARD TO AUXILIARY MODE-Directs keyboard data exclusively to the auxiliary port and disables the SHIFT PF3 function.
CTRL & PF2	AUTO AUXILIARY MODE-Transfers the current display line occupied by the cursor to the auxiliary port whenever a line feed code is received from any port input line or the keyboard.
SHIFT & PF3	KEYBOARD TO COMMUNICATION MODE-Directs keyboard data exclusively to the communication port and disables the SHIFT PF2 function.
CTRL & PF3	AUXILIARY CONTROL MODE-Directs data received on any I/O port exclusively to the auxiliary port. Data is not displayed on the screen.
SHIFT & PF4	AUXILIARY OUTPUT DISABLE-Disables all modes directing data to the auxiliary port, except the SHIFT PF2 function.
CTRL & PF4	CONCURRENT AUXILIARY MODE-Directs data at any port to the display and auxiliary port.
SHIFT & CTRL & PF2	AUXILIARY TO COMMUNICATION MODE-Directs data input at auxiliary port to be output at communications port. This function can be performed concurrently with the SHIFT CTRL PF3 function.

Table 3-5.   Numeric Keypad Special Functions (Cont.)

Special Function Keys	Description
SHIFT & CTRL & PF3	AUXILIARY TO DISPLAY MODE-Directs data from the auxiliary port to the display. This function can be performed concurrently with the SHIFT CTRL PF2 function.
SHIFT & CTRL & PF4	AUXILIARY INPUT DISABLE-Disables SHIFT CTRL PF2 and SHIFT CTRL PF3.

Terminal Control and Function Keys

Across the top of the CIT224 keyboard is a row of function keys. (See Figure 3-5 below.) These are used for set-up, applications, and control of terminal functions. There are 20 function keys, F1 through F20. Keys F1 through F5 (HOLD SCREEN, PRINT SCREEN, SET-UP, DATA/TALK, AND BREAK) perform terminal control functions and do not transmit codes. Keys F6 through F20 are used individually to generate special control sequences and are used with the CTRL and/or SHIFT keys in order to generate up to 45 User Defined Key sequences (UDK's). The UDK sequences are defined by application programs, through the Function Key Editor Page (described in Chapter 4), or through control sequences (described in Chapter 5).
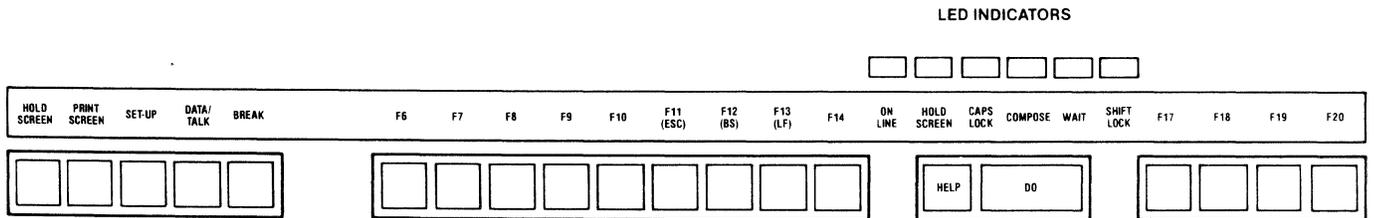
Figure 3-5.   Terminal Control and Function Keys

Table 3-6 lists the codes generated by the terminal control and function keys.

Table 3-6.   Codes Generated by Terminal Control and Function Keys

Key Label	Key Designation	Codes VT200 Mode	VT100 * VT52 Modes
HOLD SCREEN	(F1)	-	-
PRINT SCREEN	(F2)	-	-
SET-UP	(F3)	-	-
DATA/TALK	(F4)	-	-
BREAK	(F5)	-	-
F6	F6	CSI17~	-
F7	F7	CSI18~	-
F8	F8	CSI19~	-
F9	F9	CSI20~	-
F10	F10	CSI21~	-
F11 (ESC)	F11	CSI23~	ESC
F12 (BS)	F12	CSI24~	BS
F13 (LF)	F13	CSI25~	LF
F14	F14	CSI26~	-
HELP	(F15)	CSI28~	-
DO	(F16)	CSI29~	-
F17	F17	CSI31~	-
F18	F18	CSI32~	-
F19	F19	CSI33~	-
F20	F20	CSI34~	-

* In VT100 mode, keys F6 through F20 may be set to operate as
  in VT200 mode through the Keyboard Enhancements Set-Up menu.

A description of the actions of the terminal control and function
keys follows.

Hold Screen   Halts transmission of data to the screen. To unlock
               the screen, press the key a second time.

Print Screen   Initiates a printout of the screen display as defined
               by the Print Extent feature selected in Set-Up Mode.
               When pressed with the CTRL key, it sets or resets the
               Auto Print Mode.

Set-Up   Toggles the Set-Up mode. Press once to enter Set-Up
               mode, press again to return to previous screen
               display.

Data/Talk   This key is reserved for future use.

Break   Transmits a break signal if break is set in the
                    Keyboard Set-Up menu. When pressed with the SHIFT key
                    it performs a disconnect. When pressed with the CTRL
                    key it sends the answerback message to the host.

F6 - F10   These keys are defined by applications programs, or
                    programmed as UDK sequences.

F11 (ESC)   This key is defined by application programs, pro-
                    grammed as a UDK sequence, or transmits an escape
                    (ESC) character in VT100 and VT52 modes.

F12 (BS)   This key is defined by application programs, pro-
                    grammed as a UDK sequence, or transmits a back space
                    (BS) character in VT100 and VT52 modes.

F13 (LF)   This key is defined by application programs, pro-
                    grammed as a UDK sequence, or transmits a line feed
                    (LF) character in VT100 and VT52 modes.

F14 - F20   These keys are defined by applications programs, or
                    programmed as UDK sequences.

LED Indicators

The CIT224 has six LED indicators that provide status information
on the terminal operations. A functional description of each indicator
is listed below.

Hold Screen   Indicates that the display screen is on-hold, or
                    locked.

Wait   Indicates that the keyboard is locked and cannot
                    transmit information. To unlock the keyboard, enable
                    the "Clear Comm" feature in the Set-Up Directory
                    menu.

Compose   Indicates that a "compose sequence" is being
                    performed. (Refer to Compose Character Sequences in
                    Chapter 4.)

On-Line   Indicates that the terminal is in the on-line state
                    and ready to communicate with the host computer.

Shift Lock   Indicates that the terminal is in the Shift-Lock
                    mode.

Caps Lock   Indicates that the terminal is in the Caps-Lock mode.

Audible Indicators

The keyboard provides two types of audible indicators, a keyclick and a bell tone. These indicators are enabled through the Keyboard Set-Up menu.

Keyclick   A keyclick sounds when you press any key except the SHIFT and CTRL keys, or when the keyboard is locked and the WAIT indicator is on.

Bell   The terminal sounds a bell tone (or beep) when the cursor approaches the right margin, except when in the insert mode. It also sounds when an error is made during a compose sequence, when the host sends a BEL character to the terminal, or during the power-up self-test.

Keyboard Auto Repeat

A key pressed for more than 0.5 seconds automatically repeats when Auto Repeat Mode is selected. Auto repeat can be enabled or disabled through the Keyboard Set-Up menu or by using the control sequences described in Chapter 5. However, the following keys do not auto repeat:

HOLD SCREEN   COMPOSE CHARACTER
PRINT SCREEN   SHIFT
SET-UP   RETURN
DATA/TALK   LOCK
BREAK   CTRL

The rate of auto repeat is set through the Keyboard Enhancements Set-Up screen. Auto repeat can be set to slow or fast. When the slow selection is active, the repeat rate is approximately 14 characters per second (cps). When set to fast, the repeat rate is approximately 21 cps.

KEYBOARD GENERATED CONTROL CODES

The CIT224 generates 7-bit control codes by pressing the CTRL key simultaneously with the appropriate key chosen from among the standard characters. Table 3-7 lists the control codes together with their hexadecimal values and corresponding standard keys. All CIT224 keyboards accept these keys and key combinations.

Table 3-7. Keyboard Generated Control Codes

Control Code	Hex Value	Key *
NUL	00H	@
SOH	01H	A
STX	02H	B
ETX	03H	C
EOT	04H	D
ENQ	05H	E
ACK	06H	F
BEL	07H	G
BS	08H	H
HT	09H	I
LF	0AH	J
VT	0BH	K
FF	0CH	L
CR	0DH	M
SO	0EH	N
SI	0FH	O
DLE	10H	P
DC1	11H	Q **
DC2	12H	R
DC3	13H	S **
DC4	14H	T
NAK	15H	U
SYN	16H	V
ETB	17H	W
CAN	18H	X
EM	19H	Y
SUB	1AH	Z
ESC	1BH	3, [
FS	1CH	4, \
GS	1DH	5,]
RS	1EH	6, ~
US	1FH	7, ?
DEL	7FH	8

* The CTRL key is held down while these keys are pressed.

** CTRL-S locks the screen if XOFF support is enabled, and CTRL-Q unlocks it. If XOFF support is disabled these keystrokes generate the 7-bit control codes listed.

CONDITIONS THAT CAUSE KEYBOARD LOCK

If the host sends a command to lock the keyboard (CSI2h), or if the keyboard's output buffer becomes full, the WAIT indicator lights up, keyclick is disabled, and the keyboard locks up. All keys, except F1 through F5, are disabled.

The keyboard unlocks when one of the following occurs:

- The keyboard's output buffer begins to empty (if a CSI2h escape sequence has not been sent from the host)

- The host sends a command to unlock the keyboard (CSI2l)

- Entering Set-Up and enabling Clear Comm, Reset Terminal, Recall, or Default

- Performing a hard terminal reset

KEYBOARD LAYOUTS

The various keyboard layouts that are available on the CIT224 terminal are shown on the following pages.
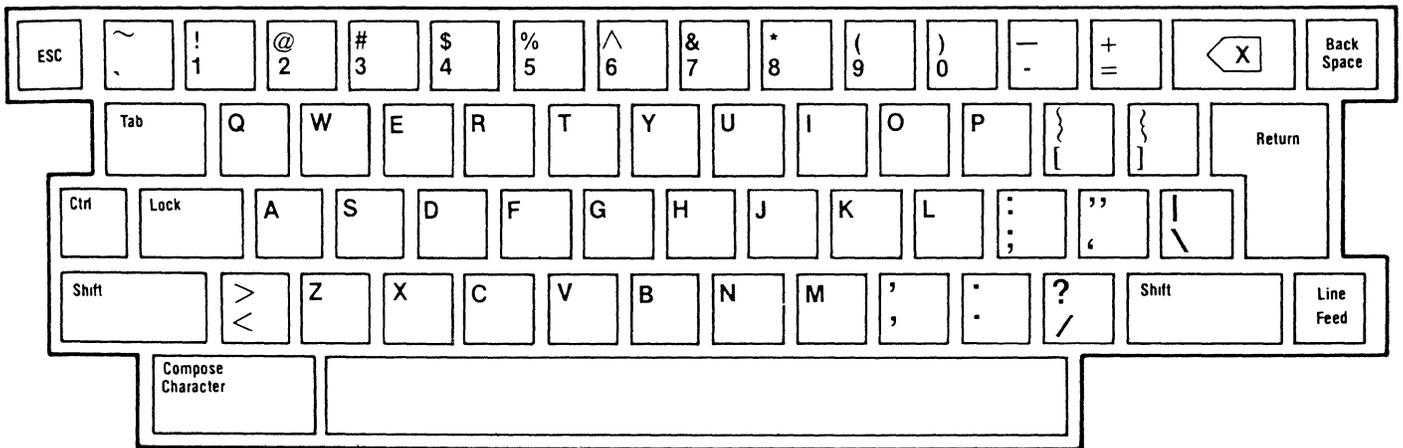
Figure 3-6. NORTH AMERICAN KEYBOARD
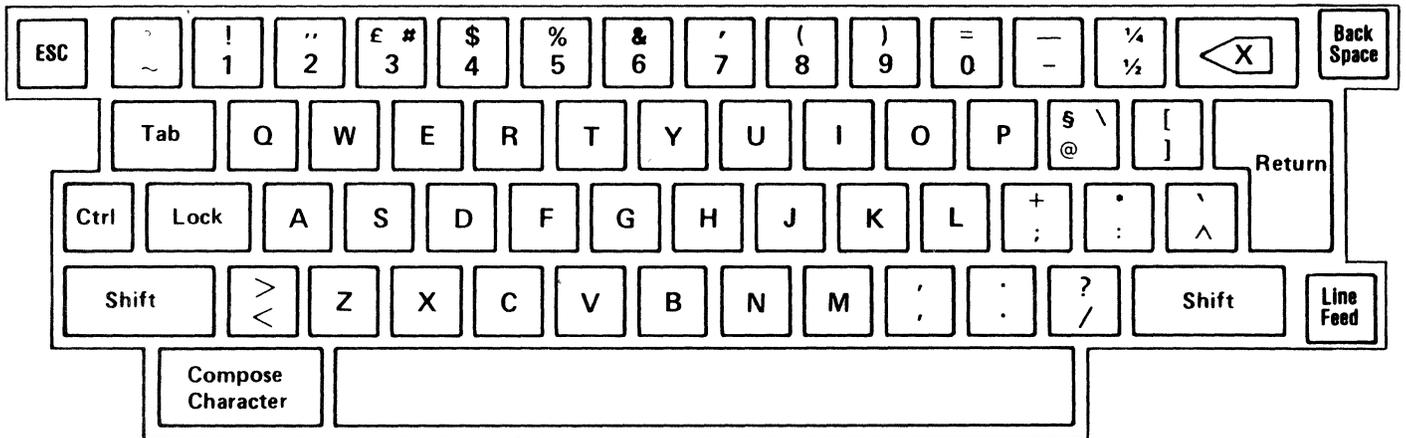
Figure 3-7. BRITISH KEYBOARD
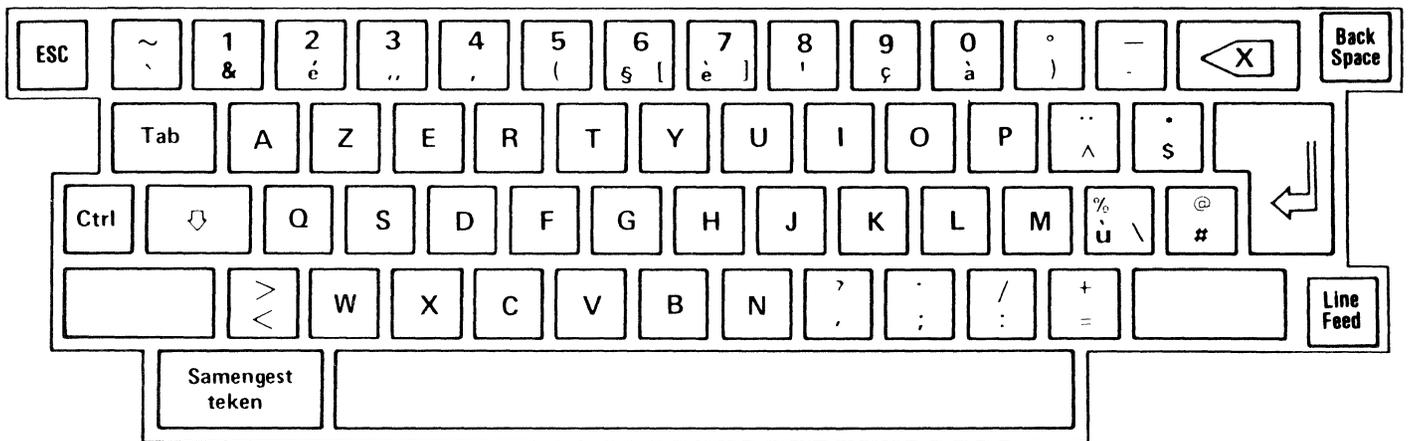
Figure 3-8. FLEMISH KEYBOARD
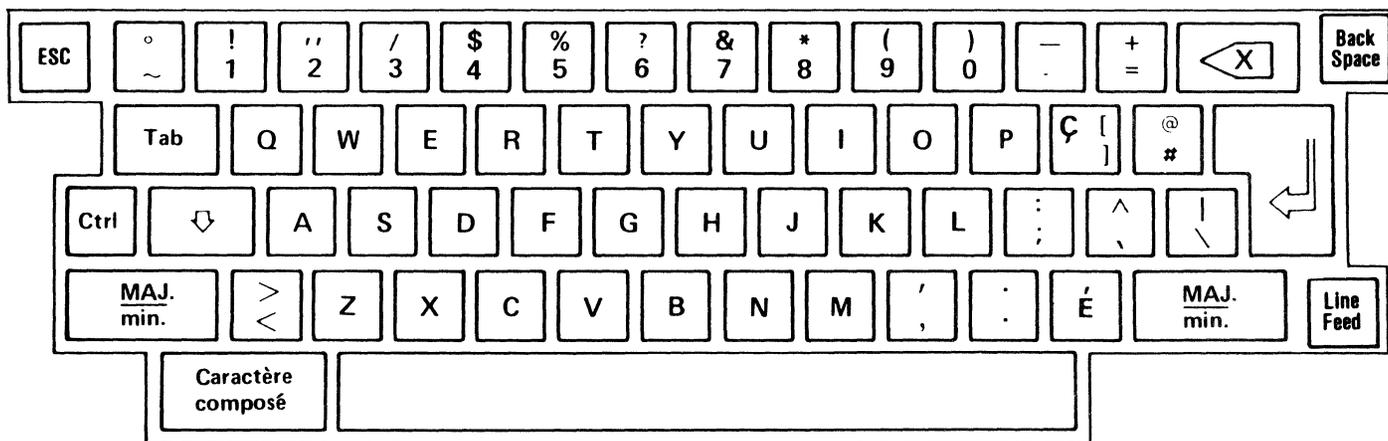
Figure 3-9. CANADIAN (FRENCH) KEYBOARD
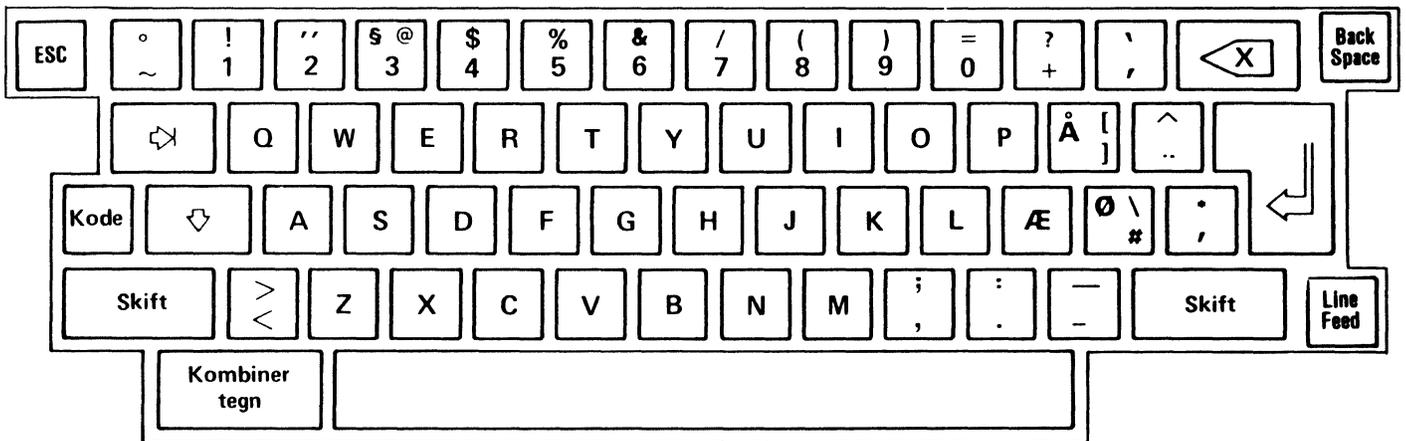
Figure 3-10. DANISH KEYBOARD
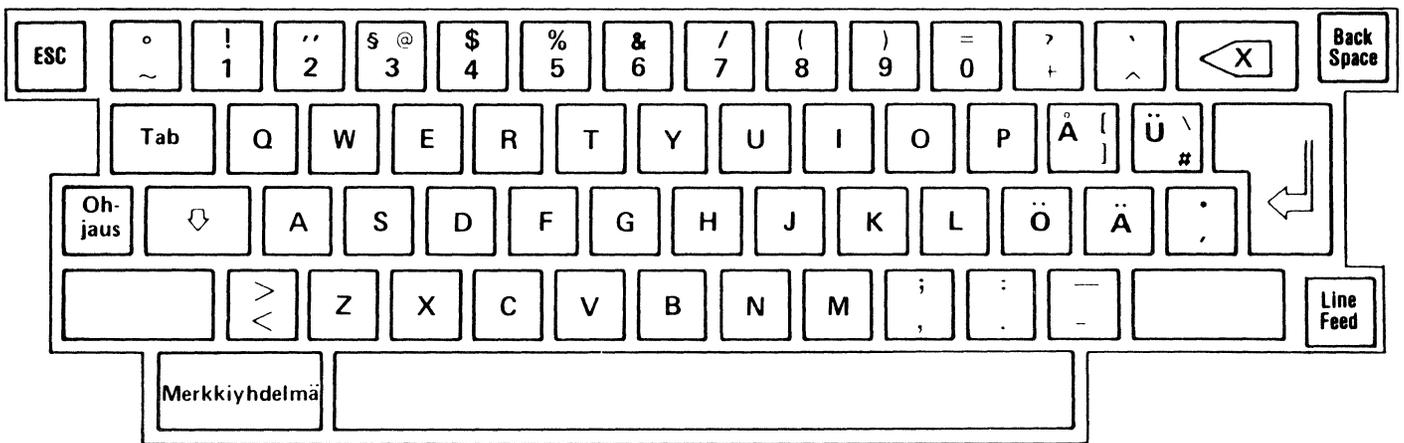
Figure 3-11. FINNISH KEYBOARD
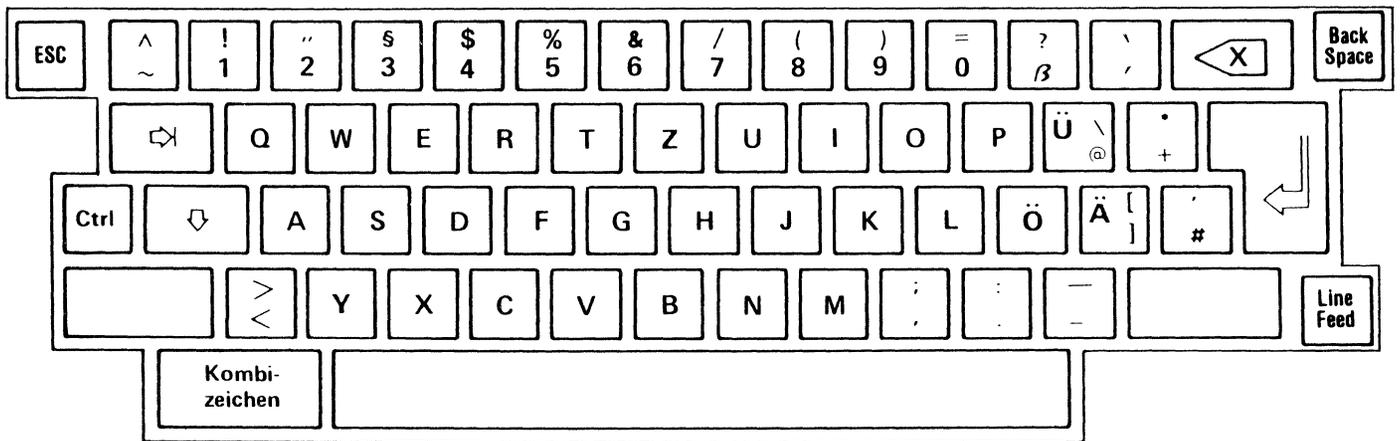
Figure 3-12. GERMAN KEYBOARD
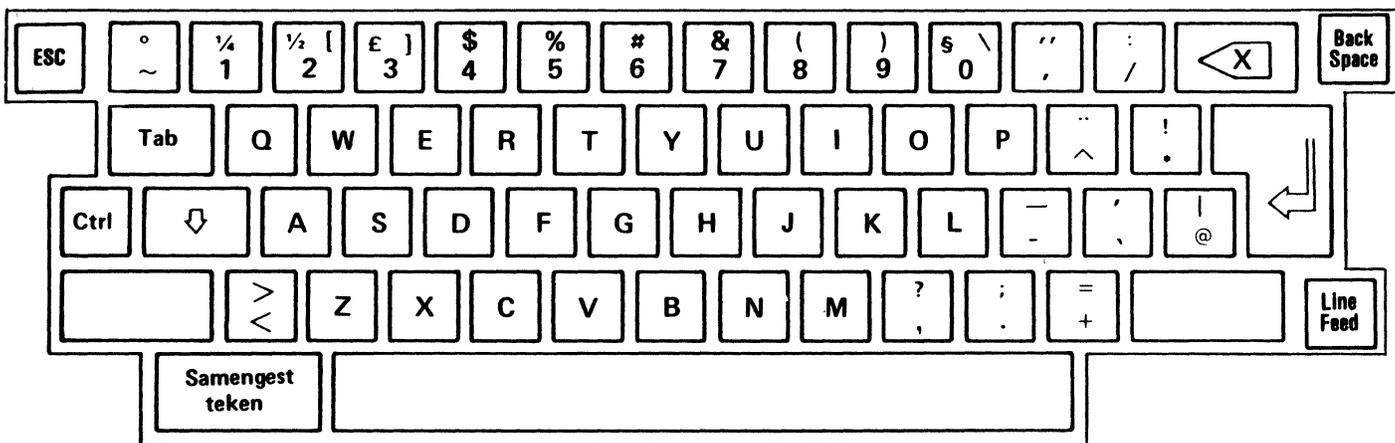
Figure 3-13. DUTCH KEYBOARD
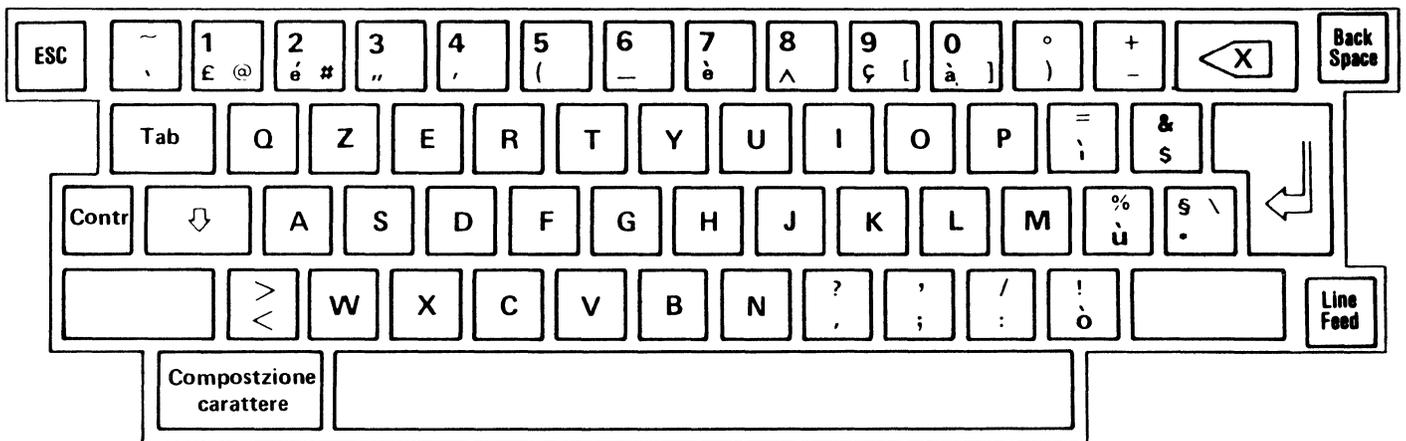
Figure 3-14. ITALIAN KEYBOARD
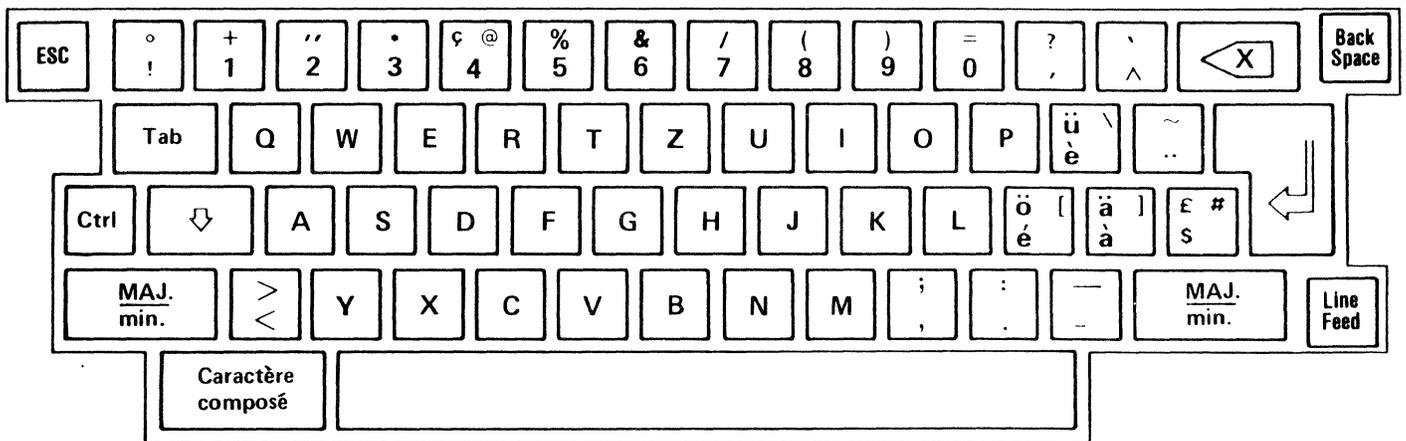
Figure 3-15. SWISS (FRENCH) KEYBOARD
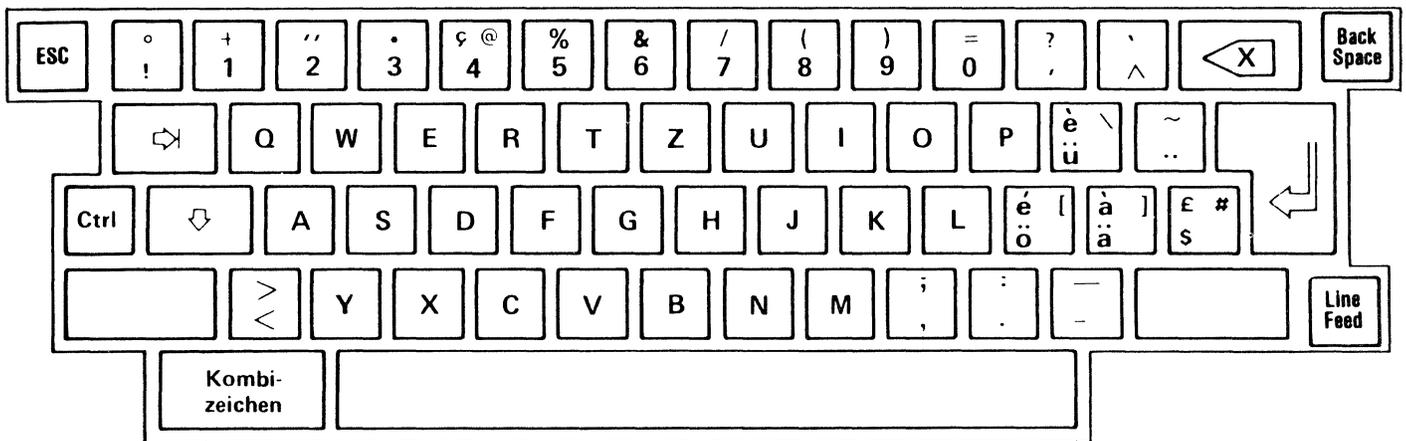
Figure 3-16. SWISS (GERMAN) KEYBOARD
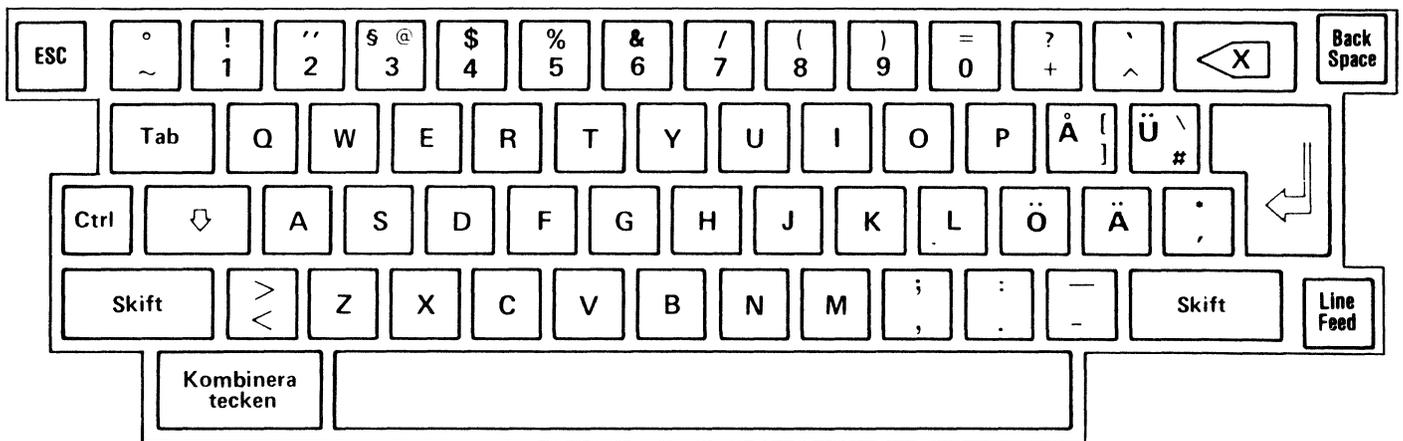
Figure 3-17. SWEDISH KEYBOARD
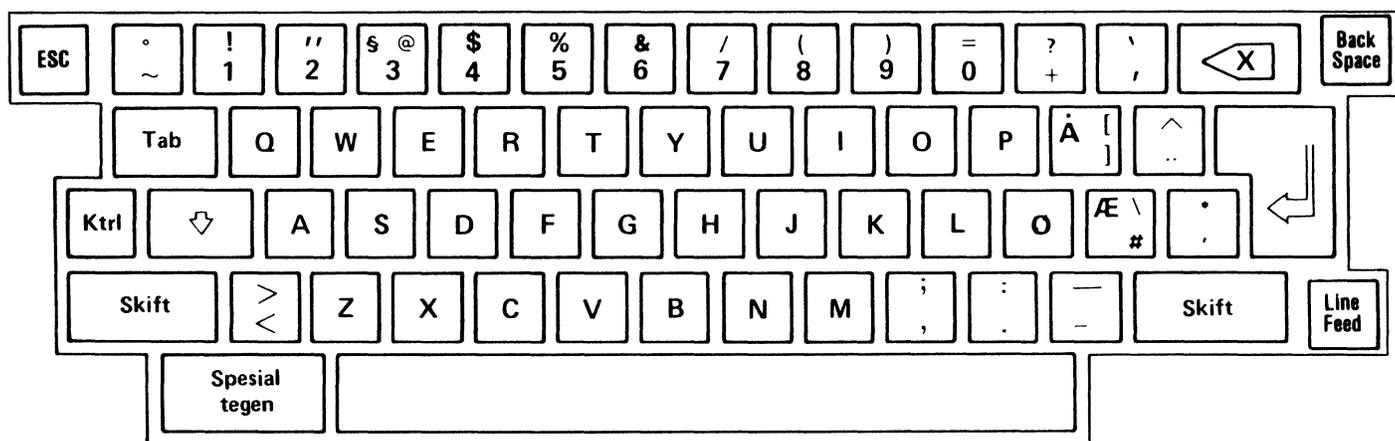
Figure 3-18. NORWEGIAN KEYBOARD
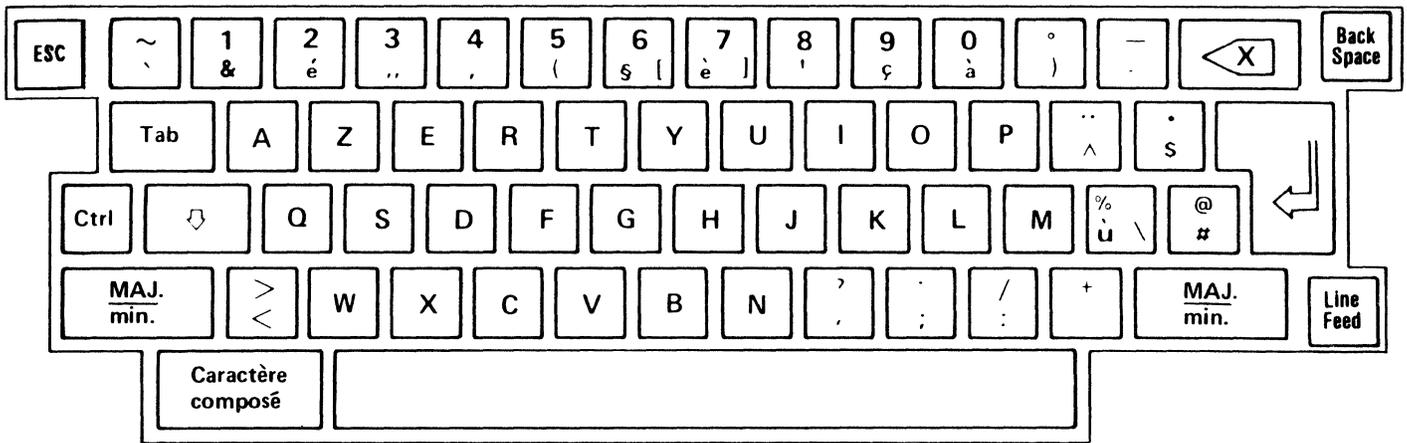
Figure 3-19. FRENCH (BELGIAN) KEYBOARD
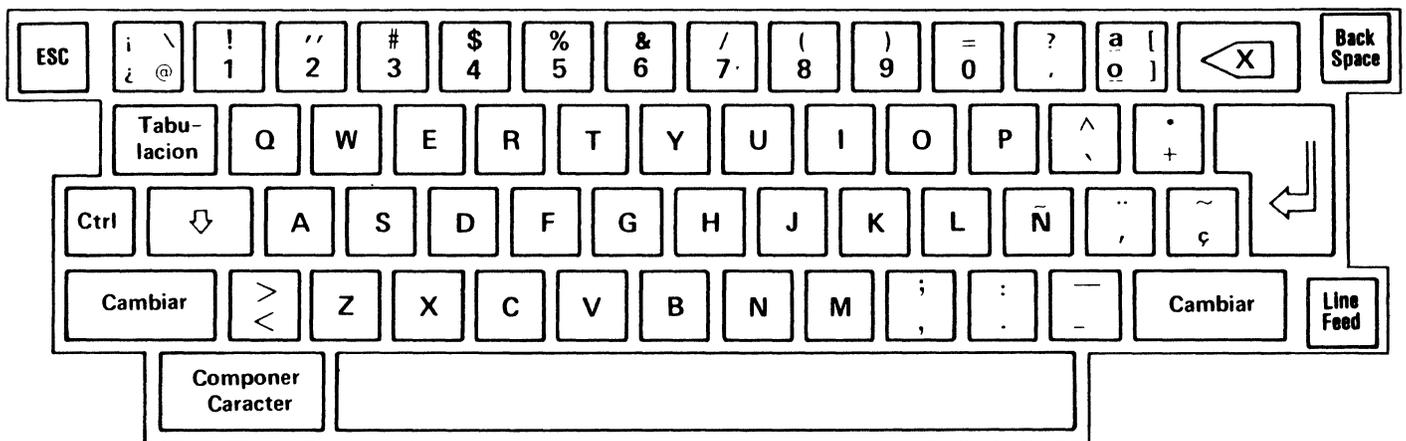
Figure 3-20. SPANISH KEYBOARD

Chapter 4

OPERATION

This chapter contains operator information for the CIT224 operating states, modes of operation, Set-Up mode conditions, printing modes, and compose sequences.

OPERATING STATES

The CIT224 has three operating states which are selectable by the operator from the keyboard: Set-Up, On-Line and Local.

Set-Up

The Set-Up state is used to set the terminal operating features or to inquire into the current conditions. Set-Up is toggled by pressing the SET-UP key.

On-Line

The On-Line state is entered through the Set-Up Directory menu. When set the terminal sends data from the keyboard to the host computer; and receives data from the host displaying it on the terminal screen.

The Communications Set-Up menu offers a choice of a local echo. When ON data entered at the keyboard is sent to the terminal screen as well as to the host computer.

Local

The Local state is entered through the Set-Up Directory menu. When set the host computer is put on "hold." Any data sent by the host computer is put in a buffer and then transmitted to the terminal display screen once the terminal is set to the On-Line state. When in the Local operating state, data entered at the keyboard is sent to the terminal screen only.

MODES OF OPERATION

The CIT224 has four modes of operation that are selectable through the General Set-Up menu. These modes determine the way the terminal responds to commands.

- VT200, 7-Bit Mode
- VT200, 8-Bit Mode
- VT100 Mode
- VT52 Mode

VT200, 7-Bit Mode

This mode provides full use of the CIT224 features and conforms to the standard ANSI command format. It sends 7-bit control codes and characters, and accepts both 7- and 8-bit control codes if 8-bit parity is enabled in the Communications Set-Up menu. All of the character sets of the terminal are supported in this mode.

> NOTE: VT200, 7-Bit mode accepts most VT100 programs, and is the default mode of the CIT224.

VT200, 8-Bit Mode

This mode provides full use of the CIT224 features and conforms to the standard ANSI command format. It sends 8-bit control codes and characters, and accepts both 7- and 8-bit control codes if 8-bit parity is enabled in the Communications Set-Up menu. All of the character sets of the terminal are supported in this mode.

VT100 Mode

This mode conforms to the standard ANSI command format. When the CIT224 is used with application programs requiring strict compliance to DEC VT100 terminals, this mode should be enabled. Only 7-bit control codes are executed. ASCII, Special Graphics and NRC sets are supported in this mode.

VT52 Mode

This mode executes non-ANSI DEC private functions, and restricts programs to existing VT52 application programs.

SET-UP MODES

The CIT224 Set-Up state is used to configure or examine terminal operating features. This section contains information on CIT224 Set-Up features and how to examine or change them.

The terminal utilizes special non-volatile memory (NVR) to "remember" individual feature selections, settings and parameters even after power has been removed. The user may choose to set features either temporarily (not saved after power is turned off), or permanently (until changed by the user). A SAVE operation can be performed in the Set-Up Directory menu.

For convenience, there exists a factory default set of parameters that can easily be restored by selecting the DEFAULT option in the Set-Up Directory menu.

Many Set-Up parameters can also be changed by the host computer. Refer to Chapter 5 for more information on terminal modes.

Set-Up Menus

Eleven Set-Up menus are available in the CIT224 program. The parameters and feature selections are functionally grouped within the Set-Up menus to allow the operator convenient access. The Set-Up mode is entered by pressing the SET-UP key. The terminal immediately enters the Set-Up Directory menu. All other Set-Up menus can be selected through this directory. Once in the Set-Up menus, to return to the directory select the 'TO DIRECTORY' option. Appendix D lists each set-up screen menu.

When the CIT224 is in any of the Set-Up modes, the previous contents of the display are stored internally. If XOFF has been enabled through the Communications Set-Up menu, no incoming data is lost. Upon exiting Set-Up mode, the original contents of the display are restored and XON is transmitted (if Auto XON/XOFF were active at the time Set-Up mode was entered).

Several features are common to all eleven set-up screen menus. These are: the menu title, a terminal identifier, and a status line.

The firmware revision number can be accessed by pressing SHIFT, ENTER in any of the Set-Up modes. The revision is displayed on the status line.

Menu Title. This feature identifies the current menu displayed. The list below indicates the order in which menus are accessed. Specific menus may be accessed directly from the directory in the defined manner.

- Set-Up Directory
- Display Set-Up
- Display Enhancements
- General Set-Up
- General Enhancements
- Communications Set-Up
- Printer Set-Up
- Aux Port Enhancements
- Keyboard Set-Up
- Keyboard Enhancements
- Tab Set-Up

Terminal Identifier. This feature identifies the terminal being used. In this instance, the terminal is a CIT224.

Status Line. The status line displays across the bottom of each Set-Up menu. It consists of five fields which provide messages to the operator indicating the status of certain terminal features. Figure 4-1 shows a typical status line.


```
REPL  MODE  |  PRNTR:   NONE  |          |          |          |
```

Figure 4-1. Set-Up Status Line

The following are the possible status line messages.

Message 1 - Insert/Replace Mode

INS MODE | As new data is entered, the old data from the cursor position to the end of the line shifts right one character. Any characters shifted into the right margin are lost unless autowrap is enabled in the Display Set-Up menu.

REPL MODE | All new data replaces the old characters from the cursor position. (This is the default setting.)

Message 2 - Printer Mode

PRNTR:READY	The printer is ready to receive data.
PRNTR:NOT RDY	The printer is not ready to receive data.
PRNTR:NONE	There is no printer.
PRNTR:AUTO	Auto Print mode is active.
PRNTR:CONTROL	Printer Controller mode is active.
PRNTR:CONCURR	Concurrent Print mode is active.

Message 3 - Modem

MODEM:DSR,DATA   The DSR signal on the communications port is
                       active and the modem is able to send and
                       receive data from the host.

MODEM:NO DSR,DATA   The DSR signal on the communications port is
                       inactive. The modem is not able to send or
                       receive data from the host.

Message 4 - Keyboard Mode Select

<No Display>   Selected by pressing SHIFT, PF3. Indicates
                       data is directed from the keyboard to the
                       communications port exclusively. This is the
                       normal default mode.

KYBD TO AUX   Selected by pressing SHIFT, PF2. Indicates
                       data is directed from the keyboard to the
                       auxiliary port exclusively.

Message 5 - Auxiliary Port Mode

<No Display>   Selected by pressing CTRL, SHIFT, PF4.
                       Disables all special auxiliary input routing.
                       This is the default state.

AUX TO COMMS   Selected in the On-Line operating state by
                       pressing CTRL, SHIFT, PF2. Data received at
                       the auxiliary port is directed to the
                       communications port.

AUX TO DISPLAY   Selected in the On-Line operating state by
                       pressing CTRL, SHIFT, PF3. Data received at
                       the auxiliary port is directed to the display
                       screen.

AUX TO COM,DSP   This selection is a combination of the above
                       two features. Data received at the auxiliary
                       port is directed to both the communications
                       port and the display screen.

Set-Up Field Parameters

The field parameters displayed in each of the Set-Up menus
describe the current status of the features or commands available.
The parameters allow the operator three possible actions:

1. Direct Command

This type of field parameter (which has only one value) displays a command that is performed when the ENTER key is pressed. For example, pressing ENTER when the cursor is on RESET TERMINAL in the Set-Up Directory performs a soft terminal reset.

2. Select Parameter

This type of field parameter contains text that describes the current parameter value selected from two or more possible options. To replace the current value, press the ENTER key and the field advances to the next value.

For example, pressing ENTER when the cursor is on NUMERIC KEYPAD in the General Set-Up menu causes the APPLICATION KEYPAD parameter to display.

3. Enter Parameter

This type of field parameter allows text entries from the keyboard. The following steps describe how to enter text:

A. Advance the field cursor to the desired parameter field using the arrow keys.

B. Press ENTER. The status line at the bottom of the screen disappears and the screen prompts you for a text entry.

C. Type in the desired value.

D. Press ENTER to set the new value.

To correct a typing error, press the <x] (DELETE) key. The character to the left of the cursor is erased. To abort the field without making any changes, press an arrow key to go to another field parameter.

Set-Up Field Cursor

The CIT224 uses a highlighted field cursor in Set-Up mode. It highlights the entire field parameter you want to examine or change. The arrow keys move the field cursor up, down, left or right. When the field cursor is on the last field of a Set-Up screen, the right arrow key (→) returns the cursor to the top left field parameter. Similarly, when the field cursor is on the top left field parameter, the left arrow key (←) moves the cursor to the bottom right field.

Action of the shifted left arrow key, regardless of the cursor's position on the Set-Up screen, displays the previous menu page and places the cursor on the top left field. Pressing SHIFT with the right arrow key displays the next menu page, and places the cursor into the top left field of the displayed page.

Selection of Set-Up Screen Menus

Press the SET-UP key on the keyboard to enter Set-Up mode. The Set-Up Directory menu appears on the screen. Screen menus 'General' through 'Tabs' are entered by pressing the right arrow key to the desired menu, then pressing the ENTER key. To return to the Set-Up Directory menu, place the field cursor over the field parameter 'To Directory' and press ENTER. To exit Set-Up mode, press the SET-UP key again.

SAVE and RECALL Operations

Any changes made in a Set-Up mode are temporary until permanently stored in memory with a SAVE operation. Temporary changes are lost if power is removed, the terminal is reset, a RECAll operation is performed, or factory default conditions are restored.

Save   Control conditions are stored in non-volatile memory (NVR) on a permanent basis by selecting SAVE in the Set-Up Directory menu.

Recall   The user stored permanent Set-Up conditions are automatically restored whenever the terminal is turned on or reset. In addition, a special RECALL operation may be performed to reinstate permanently stored control conditions by selecting RECALL in the Set-Up Directory menu.

Default   The factory established default conditions may be restored by selecting DEFAULT in the Set-Up Directory menu.

SET-UP MODE MENUS

In the following descriptions of the Set-Up screen menus, each menu appears with default values as it would display when the terminal is first turned on. Following the screen menu illustrations are listings of the fields, by default values, which are printed in bold type. The available selections follow the default value along with a short description of the function of that particular feature.

Set-Up Directory Menu

The Set-Up Directory menu is the first menu displayed upon pressing the SET-UP key. It contains field parameters for each of the other Set-Up menus and terminal operating features. The fields are described in the order in which they appear on the screen going from left to right.

```
Set-Up Directory                            CIT224

 Display    General    Comm    Printer    Keyboard    Tabs

 On Line    Clear Display    Clear Comm    Reset Terminal    Recall    Save

 Set-Up=English      North American Keyboard      Default      Exit

 REPL   MODE  |  PRNTR:   NONE  |
```
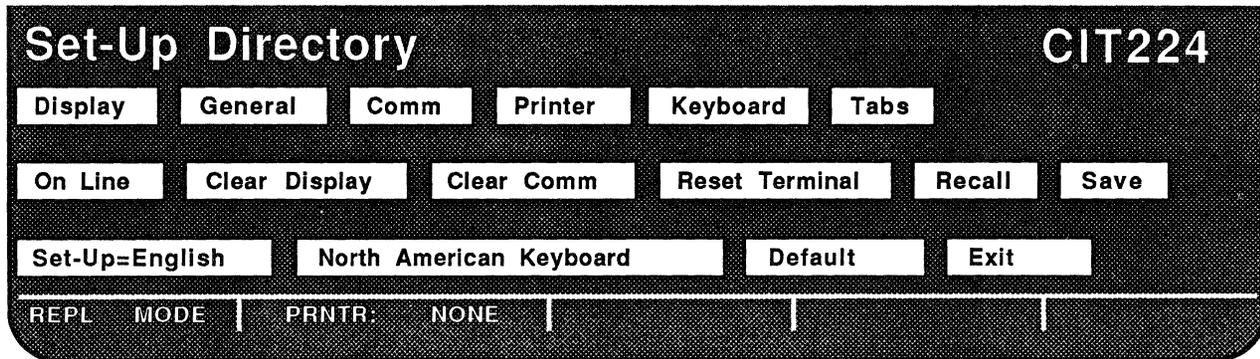
Figure 4-2 . Set-Up Directory Menu

Field:Options--Function

Display--Enters the Display Set-Up menu.

General--Enters the General Set-Up menu.

Comm--Enters the Communications Set-Up menu.

Printer--Enters the Printer Set-Up menu.

Keyboard--Enters the Keyboard Set-Up menu.

Tab--Enters the Tab Set-Up menu.

On-Line:Local--ON-LINE places the terminal in communication with the host computer. LOCAL directs keyboard data to the display screen only; no interaction with the host computer occurs.

Clear Display--Clears the display upon exiting the Set-Up mode. The status line displays the word 'Done' while still in the Set-Up mode.

Clear Comm--Aborts all communications operations and clears all the buffers. Clears any XOFF condition on both ports. XON is sent to the host port.

Reset Terminal--Resets several operating parameters to default conditions. Performs the same function as the Soft Terminal Reset control sequence. (Refer to Table 5-6 in Chapter 5.)

Recall--Resets the terminal to parameters last saved in NVR with the SAVE feature. Clears the display screen.

Save--Saves operator Set-Up mode selections in NVR. This is inhibited when a print operation is in progress.

Set-Up=English:Francais/Deutsch--Provides a choice between three languages in which the Set-Up screen menus are displayed.

North American Keyboard:British/Flemish/Canadian (French)/Danish/ Finnish/German/Dutch/Italian/Swiss (French)/Swiss (German)/Swedish/ Norwegian/French (Belgian)/Spanish--Allows the operator to choose the terminal's operating mode to match the national keyboard used.

Default--Restores the original factory default Set-Up values, clears the display, and locates the cursor to the upper-left corner of the display screen. DEFAULT disconnects communication between the host and the terminal during its operation.

Exit--Exits the Set-Up mode and returns the terminal to normal operations.

Display Set-Up Menu

The Display Set-Up menu contains field parameters to set display features as described below.

Display Set-Up   **CIT224**

| To Next Set-Up | To Directory | 80 Columns | Interpret Controls |

| No Auto Wrap | Smooth Scroll | Light Text, Dark Screen |

| Cursor | Block Cursor Style |

REPL   MODE   PRNTR: NONE
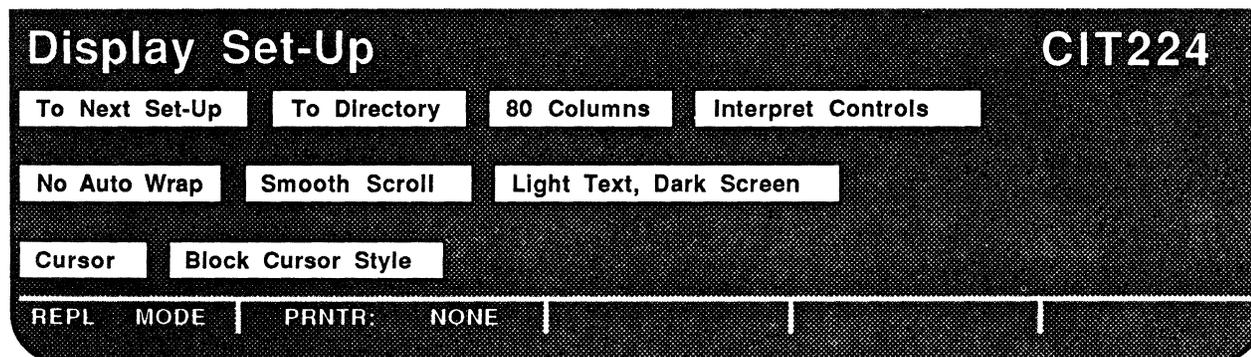
Figure 4-3. Display Set-Up Menu

Field:Options--Function

To Next Set-Up--Advances to the next set-up menu. In this case it is the Display Enhancements menu.

To Directory--Returns the screen to the Set-Up Directory menu.

80 Columns:132 Columns--Selects either an 80 or a 132 column screen width. When a change is entered, the screen immediately converts to the desired width. The current contents of the display are either preserved or lost depending upon the setting of the PRESERVE SCREEN ON COLUMN CHANGE selection in the Display Enhancements menu.

Interpret Controls:Display Controls--The INTERPRET CONTROLS field executes control codes received from the host, but does not display them on the screen. DISPLAY CONTROLS displays control codes, but does not execute them.

No Auto Wrap:Auto Wrap--AUTO WRAP automatically moves the cursor to column one of the next line down when it reaches the end of the display line. NO AUTO WRAP causes the cursor to remain on the last character of the current line. Any received characters overwrite the existing character at that position.

Smooth Scroll:Jump Scroll--SMOOTH SCROLL sets a constant speed at which new lines scroll on to the screen causing a steady, controlled scroll. JUMP SCROLL allows the terminal to display data as fast as possible, giving the effect of a 'jump' scroll.

Light Text,Dark Screen:Dark Text,Light Screen--Sets the video display to either a dark screen with light text (normal) or a light screen with dark text (reverse video).

Cursor:No Cursor--Determines whether or not the cursor is visible.

Block Cursor Style: Underline Cursor Style--Selects either a block or an underline as the cursor.

Display Enhancements Menu

The Display Enhancements menu contains additional field parameters to set display features on the monitor screen.
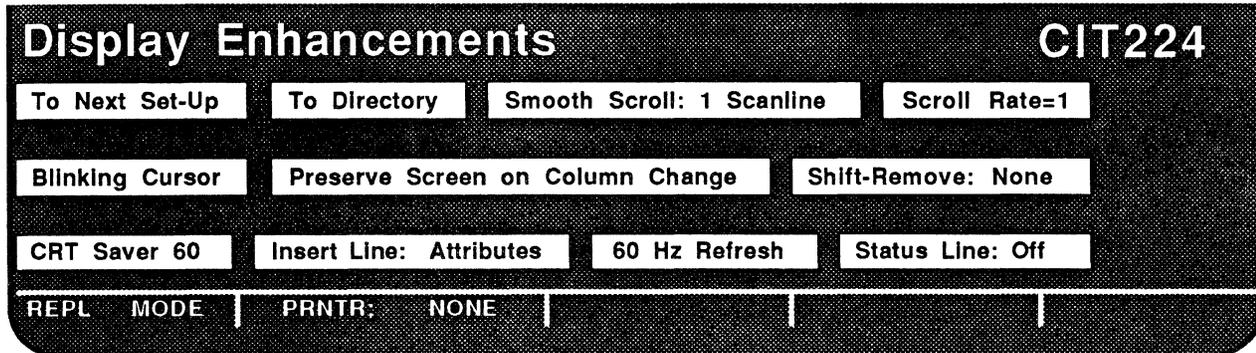
Figure 4-4. Display Enhancements Menu

Field:Option--Function

To Next Set-Up--Advances to the next set-up menu. In this case it is the General Set-Up menu.

To Directory--Returns the screen to the Set-Up Directory menu.

Smooth Scroll-1 Scanline: Smooth Scroll-2 Scanlines--Sets the number of scan lines to either 1 or 2 when in smooth scroll display.

Scroll Rate = 1:1 to 9--Selects the speed of the smooth scroll from 1 to 9, where 1 is the fastest and 9 is the slowest.

Blinking Cursor: Static Cursor--Selects either a blinking or a static cursor.

Preserve Screen on Column Change: Clear Screen on Column Change--Selects whether screen data is preserved or cleared on changing the screen size between 80 and 132 columns.

Shift-Remove None:1-24:1-25:25--Pressing the SHIFT and REMOVE keys clears the screen and/or 25th row status line. If set to NONE, no action is taken when pressing the SHIFT REMOVE keys. 1-24 clears the screen and homes the cursor. 1-25 clears the screen and the 25th row status line, and homes the cursor. 25 clears the 25th row status line only.

CRT Saver 60:Off/10/20/30/40/50--Disables the CRT saver feature, or sets the number of minutes of inactivity before the screen brightness diminishes. Entering a SHIFT, CTRL, or CAPS LOCK key restores the display but does not cancel the initial display.

Insert Line-Attributes:Insert Line-Blank--Allows the operator to select whether an inserted line will have the attributes of the line at which the cursor is positioned, or a blank (no attributes) line.

60 Hz Refresh:50 Hz Refresh--Selects the line rate for the screen refresh to either 60 Hz or 50 Hz.

Status Line Off:Status Line On--When ON a host controlled status line displays on the 25th row of the screen. Data and visual attributes can be written to the status line.

General Set-Up Menu

The General Set-Up menu allows the operator to select various operating parameters as described below.

```
┌─────────────────────────────────────────────────────────────────────────┐
│ General Set-Up                                           CIT224          │
│ ┌─────────────┐ ┌────────────┐ ┌──────────────────────┐ ┌───────────┐   │
│ │ To Next Set-Up │ │ To Directory │ │ VT200 Mode, 7 Bit Controls │ │ VT220 ID │   │
│ └─────────────┘ └────────────┘ └──────────────────────┘ └───────────┘   │
│ ┌───────────────────────────┐ ┌───────────────────────┐ ┌─────────────┐ │
│ │ User Defined Keys Unlocked │ │ User Features Unlocked │ │ Multinational │ │
│ └───────────────────────────┘ └───────────────────────┘ └─────────────┘ │
│ ┌─────────────────┐ ┌───────────────────┐ ┌──────────────┐              │
│ │ Numeric Keypad  │ │ Normal Cursor Keys │ │ No New Line  │              │
│ └─────────────────┘ └───────────────────┘ └──────────────┘              │
│ REPL   MODE  │  PRNTR:    NONE   │              │              │         │
└─────────────────────────────────────────────────────────────────────────┘
```

Figure 4-5. General Set-Up Menu

Field:Options--Function

To Next Set-Up--Advances to the next set-up menu. In this case it is the General Enhancements menu.

To Directory--Returns the screen to the Set-Up Directory menu.

VT200 Mode, 7 Bit Controls:VT200 Mode, 8 Bit Controls/VT52 Mode/VT100 Mode--Selects the operating mode to be used.

1) VT200 Mode, 7 Bit Controls executes standard ANSI functions. It sends 7-bit control codes and characters and accepts both 7- and 8-bit control codes if 8-bit parity is enabled in the Communications Set-Up menu.

2) VT200 Mode, 8 Bit Controls executes standard ANSI functions. It sends 8-bit control codes and characters and accepts both 7- and 8-bit control codes if 8-bit parity is enabled in the Communications Set-Up menu.

3) VT52 Mode executes non-ANSI, DEC private functions and restricts programs to existing VT52 applications programs.

4) VT100 Mode executes standard ANSI functions. This mode is used with application programs requiring strict compliance to CIT-101 or DEC VT100 terminals. Only 7-bit control codes are executed.

VT22Ø ID:VT1ØØ ID:VT1Ø1 ID:VT1Ø2 ID--Selects the response to an inquiry from the host as to what type of terminal is on-line.

User Defined Keys Unlocked: User Defined Keys Locked--UNLOCKED allows the host computer to change UDK's that have been defined from the keyboard. LOCKED prevents the host from changing the UDK's.

User Features Unlocked: User Features Locked--UNLOCKED allows the host to change the following operating parameters. LOCKED prevents the host from changing them.

    Auto Repeat
    Keyboard Lock
    Light/Dark Screen
    Smooth/Jump Scroll
    Tab Stops

    NOTE: Certain application programs are set to have control
           of these features. Select the UNLOCKED parameter to
           conform to such programs.

Multinational: National--MULTINATIONAL selects the 8-bit multinational characters (Tables A-1 and A-2 in Appendix A). NATIONAL selects one of the eleven 7-bit national character sets as chosen from the keyboard field in the Set-Up Directory menu.

    NOTE: On the North American keyboard only the multinational
           character set mode is available.

Numeric Keypad: Application Keypad--In the NUMERIC KEYPAD mode, the keypad generates ASCII characters matching the numeric characters, comma, period and minus sign keys. Control functions are generated by the PF1 through PF4 keys. In the APPLICATION KEYPAD mode, the keypad generates escape sequences of the application software.

Normal Cursor Keys: Application Cursor Keys--NORMAL CURSOR KEYS generates standard ANSI control codes (↑,↓,←,→). APPLICATION CURSOR KEYS allows the application software to control the keys.

No New Line: New Line--In NO NEW LINE mode the RETURN key sends a Carriage Return (CR) to the host. In NEW LINE mode the RETURN key sends both a Carriage Return (CR) and a Line Feed (LF).

General Enhancements Set-Up Menu

     The General Enhancements Set-Up menu offers additional selections
of general operating parameters.

```
┌──────────────────────────────────────────────────────────────────┐
│  General Enhancements Set-Up              CIT224 │
│                                                                    │
│  ┌─────────────────┐  ┌──────────────┐  ┌──────────────────────┐  │
│  │ To Next Set-Up  │  │ To Directory │  │ Form Feed: Line Feed │  │
│  └─────────────────┘  └──────────────┘  └──────────────────────┘  │
│                                                                    │
│  ┌────────────────────┐  ┌────────────────────┐  ┌──────────────────────┐ │
│  │ Erase Extent: Page │  │ Tab Motion: Direct │  │ BS-Underline: Character │ │
│  └────────────────────┘  └────────────────────┘  └──────────────────────┘ │
│                                                                    │
│  ┌──────────────────────┐  ┌──────────────────────┐  ┌───────────────────┐ │
│  │ Parm. Report Flag=0000│  │ Main Rx'd XOFF: Process│  │ Main DTR: Normal │ │
│  └──────────────────────┘  └──────────────────────┘  └───────────────────┘ │
│  ──────────────────────────────────────────────────────────────── │
│   REPL   MODE  │  PRNTR:   NONE  │           │           │        │
└──────────────────────────────────────────────────────────────────┘
```

           Figure 4-6. General Enhancements Set-Up Menu

Field:Options--Function

To Next Set-Up--Advances to the next set-up menu. In this case it is
the Communications Set-Up menu.

To Directory--Returns the screen to the Set-Up Directory menu.

Form Feed-Line Feed:Form Feed-Home & Clear--Selects the response to a
Form Feed (FF) from the host. LINE FEED performs a Line Feed (LF)
action, and HOME & CLEAR clears the screen and homes the cursor.

Erase Extent-Page:Erase Extent-Margins--Sets the area to be erased on
a Clear Screen command: either the entire page or the area defined by
margins.

Tab Motion-Direct:Tab Motion-Spaces--When set to DIRECT a tab causes
the cursor to move to the next tab stop. When set to SPACES, spaces
between stops are filled with the current cursor attribute.

BS-Underline-Character:BS-Underline-Attribute--With CHARACTER enabled,
a <Char><BS><underline> sequence results in erasure of the character
by the underline character. With ATTRIBUTE enabled, the sequence is
automatically converted to a character with the underline attribute
set.

Parm Report Flag = 0000:0001 - 1111--Parameter report flag can be set
to a value between 0000 thru 1111.

Main Rx'd XOFF-Process:Main Rx'd XOFF-Ignore--Controls whether an
incoming XOFF command is ignored or processed.

Main DTR Normal: Switched--Allows the control of Data Terminal Ready (pin 20). NORMAL sets DTR to remain active high while the machine is on, except during a break function. The SWITCHED option switches DTR to negative when the terminal enters local or set-up mode, or during a break function.

Communications Set-Up Menu

The Communications Set-Up menu allows the operator to select the operating parameters that control communications between the host and the terminal.


```
Communications Set-Up                          CIT224

To Next Set-Up   |  To Directory  |  Transmit=4800  |  Receive=Transmit

XOFF at 64  |  8 Bits, No Parity  |  1 Stop Bit  |  No Local Echo

EIA Port, Data Leads Only  |  Disconnect, 2 s Delay  |  Limited Transmit

REPL   MODE  | PRNTR:  NONE  | MODEM:  DSR  DATA |
```

Figure 4-7. Communications Set-Up Menu

Field:Options--Function

To Next Set-Up--Advances to the next set-up menu. In this case it is the Printer Set-Up menu.

To Directory--Returns the screen to the Set-Up Directory menu.

Transmit=4800:75,110,150,300,600,1200,2400,9600,19200--Sets the terminal's transmit speed to equal the host's receive speed.

Receive=Transmit:75,110,150,300,600,1200,2400,4800,9600,19200-- Sets the terminal's receive speed to equal the host's transmit speed.

XOFF at 64:XOFF at 128:No XOFF--Allows the terminal to set the XOFF point at 64 or 128 characters in the receive buffer. NO XOFF disables the automatic XON/XOFF function.

8 Bits, No Parity:8 Bits, Even Parity/8 Bits, Odd Parity/
8 Bits, Even Parity, No Check/8 Bits, Odd Parity, No Check/
7 Bits, No Parity/7 Bits, Even Parity/7 Bits, Odd Parity/
7 Bits, Even Parity, No Check/7 Bits, Odd Parity, No Check/
7 Bits, Mark Parity/7 Bits, Space Parity--Selects word length and parity parameters the terminal uses to communicate with the host.

1 Stop Bit:2 Stop Bits--Selects the number of stop bits in the data word to match the host's communication parameters.

No Local Echo:Local Echo--In LOCAL ECHO mode, all keyboard transmissions are sent to the display screen as well as to the host computer. In NO LOCAL ECHO mode, all keyboard transmissions are sent to the host computer only. The host then may or may not send (echo) the data back to the terminal for display.

EIA Port, Data Leads Only:EIA Port, FDX Modem Control/EIA Port, HDX Modem Control--Selects the configuration of the EIA port when communicating with the host.

    EIA Port, Data Leads Only is selected if the terminal connects
    directly to the host computer through the communications port. If
    the host computer is set for full duplex communications, No Local
    Echo should be set (see above). If it is set for half duplex,
    Local Echo should be enabled.

    FDX Modem Control is selected if a full duplex modem communication
    is used between the host and the terminal.

    HDX Modem Control is selected if a half duplex modem communication
    is used between the host and the terminal.

Disconnect, 2 s Delay:Disconnect, 60 ms Delay--Used in conjunction with the EIA Port FDX and HDX Modem Controls, this feature causes a disconnect between the terminal and the host when the Received Line Signal Detection (RLSD) is lost for either 60 ms or 2 seconds. It is suggested that all countries, except the United Kingdom, use the 2 second delay parameter.

Limited Transmit:Unlimited Transmit--LIMITED TRANSMIT restricts character transmission to 150-180 characters per second, no matter what the baud rate is set to. This reduces the operating system's interrupt burden. UNLIMITED TRANSMIT removes limits to the character transmission speed.

Printer Set-Up Menu

The Printer Set-Up menu allows the operator to select printer operation parameters as described below.

```
┌──────────────────────────────────────────────────────────────┐
│  Printer Set-Up                                    CIT224      │
│                                                               │
│  ┌──────────────┐ ┌──────────────┐ ┌──────────────┐ ┌─────────────────┐ │
│  │ To Next Set-Up │ │ To Directory │ │ Transmit=4800 │ │ Receive=Transmit │ │
│  └──────────────┘ └──────────────┘ └──────────────┘ └─────────────────┘ │
│                                                               │
│  ┌──────────────────┐ ┌──────────────────┐ ┌─────────────┐   │
│  │ Normal Print Mode │ │ 8 Bits, No Parity │ │ 1 Stop Bit │   │
│  └──────────────────┘ └──────────────────┘ └─────────────┘   │
│                                                               │
│  ┌─────────────────┐ ┌─────────────────────┐ ┌──────────────┐ │
│  │ Print Full Page │ │ Print National Only │ │ No Terminator │ │
│  └─────────────────┘ └─────────────────────┘ └──────────────┘ │
│  ┌─────────────────┬─────────────────────┬───────────────────┐ │
│  │ REPL   MODE     │ PRNTR:   NONE        │                   │ │
│  └─────────────────┴─────────────────────┴───────────────────┘ │
└──────────────────────────────────────────────────────────────┘
```

Figure 4-8. Printer Set-Up Menu

Field:Options--Function

To Next Set-Up--Advances to the next set-up menu. In this case it is the Aux Port Enhancements menu.

To Directory--Returns the screen to the Set-Up Directory menu.

Transmit=4800:75,110,150,300,600,1200,2400,9600,19200--Selects the transmit speed to the printer.

Receive=Transmit:75,110,150,300,600,1200,2400,4800,9600,19200-- Determines the speed at which data can be received at the printer port.

Normal Print Mode:Auto Print Mode/Controller Mode/Concurrent Print Mode-- Selects the printer operating mode. (The printer must be connected to the terminal before executing a print command.)

NORMAL PRINT MODE allows the operator to invoke all of the keyboard printing functions (Print Screen, Print Cursor Line, etc.) from the keyboard.

In AUTO PRINT MODE the current line of data is printed when the cursor is moved off the line by an LF, FF, or a VT. With the auto wrap feature on, as the cursor moves off the line, the completed line of data is printed.

In CONTROLLER MODE the host has direct control of the printer. All data received from the host is sent to the printer and is not displayed on the monitor screen.

CONCURRENT PRINT MODE directs data to the monitor screen and to another terminal or printer at the same time.

8 Bits, No Parity:8 Bits, Even Parity/8 Bits, Odd Parity/
8 Bits, Even Parity, No Check/8 Bits, Odd Parity, No Check/
7 Bits, No Parity/7 Bits, Even Parity/7 Bits, Odd Parity/
7 Bits, Even Parity, No check/7 Bits, Odd Parity, No Check/
7 Bits, Mark Parity/7 Bits, Space Parity--Selects the word length and parity parameters used by the printer port.

1 Stop Bit:2 Stop Bits--Selects the number of stop bits in the data word to match the printer's parameters.

Print Full Page:Print Scroll Region--If PRINT FULL PAGE is selected, in a Print Screen operation this option prints the entire screen area without reference to margins. If PRINT SCROLL REGION is selected, only the screen area with predefined margins is printed.

Print National Only:National and Line Drawing:Print Multinational--Specifies the character sets supported by the printer.

NATIONAL ONLY is compatible with printers supporting multinational or national mode character sets.

NATIONAL AND LINE DRAWING is compatible with printers supporting multinational or national mode and line drawing capabilities.

MULTINATIONAL is compatible with printers supporting multinational mode and line drawing sets only.

No Terminator:Terminator = FF--In a Print Page operation this option allows the user to select the Form Feed code (FF) as the final character of a page of text.

Aux Port Enhancements Set-Up Menu

The Aux Port Enhancements Set-Up menu provides auxiliary port selections as described below.

```
Aux Port Enhancements Set-Up                    CIT224

To Next Set-Up    To Directory    Aux Rx'd XOFF: Process    XOFF at 64

Print 2Hi Bottoms    No 2 Wide Line Prefix    Print Features: DEC220

Fill After CR    Print Non-Fill Character    Fill Count=00    Ignore Null

REPL    MODE  |  PRNTR:    NONE  |              |              |
```
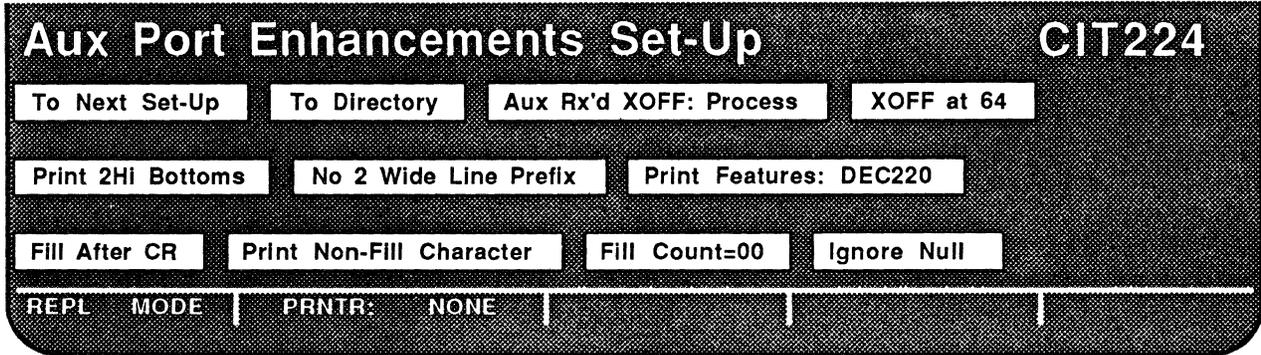
Figure 4-9. Aux Port Enhancements Set-Up Menu

<u>Field:Options--Function</u>

To Next Set-Up--Advances to the next set-up menu. In this case it is the Keyboard Set-Up menu.

To Directory--Returns the screen to the Set-Up Directory menu.

Aux Rx'd XOFF-Process:Aux Rx'd XOFF-Ignore--Enables or disables the processing of XOFF commands received on the Aux port.

XOFF at 64:No XOFF--Allows the terminal to set the XOFF point at 64 characters in the printer buffer. NO XOFF disables the automatic XON/XOFF function at the printer port.

Print 2Hi Bottoms:Do Not Print 2Hi Bottoms--Enables or disables the output of a second copy of data to the Aux port representing the bottom row of a double-high line.

No 2 Wide Line Prefix:2 Wide Line Prefix: SO(^N)--Enables or disables the output of a prefix (^N) to indicate the data following is a double-wide line.

Print Features-DEC220:Print Features-CIT101--Selects the print features of the DEC VT220 or the CIT-101.

Fill After CR:Fill After LF--Enables the output of a selected number of fill characters to be output to the Aux port after transmitting either a CR or an LF code.

Print Non-Fill Character:Suppress Non-Fill Character--Enables or disables the transmission of the fill character selected in the previous field.

Fill Count = ØØ:1 Thru 99--Selects the number of fill characters to be transmitted from Ø to 99.

Ignore Null:Pass Null--Determines how the null character is processed at the auxiliary port when the appropriate print mode has been set (i.e., auto print mode, printer controller mode, etc.). IGNORE NULL causes the receive buffer to ignore null characters while the terminal is in a print mode. PASS NULL causes the null characters to pass through the terminal to the aux port while in the print mode.

> NOTE: In either setting, when 'Display Controls' is selected in the Display Set-Up menu, the '@' character appears in reverse video whenever a null character is received by the terminal.

Keyboard Set-Up Menu

The Keyboard Set-Up menu contains field parameters to select operating features pertinent to the keyboard.

Keyboard Set-Up   **CIT224**

| To Next Set-Up | To Directory | Typewriter Keys | Caps Lock |

| Auto Repeat | Keyclick | Margin Bell | Warning Bell | Break |

| No Auto Answerback | Answerback= | Not Concealed |

REPL   MODE | PRNTR: NONE |

Figure 4-1Ø. Keyboard Set-Up Menu

Field:Options--Function

To Next Set-Up--Advances to the next set-up menu. In this case it is the Keyboard Enhancements menu.

To Directory--Returns the screen to the Set-Up Directory menu.

Typewriter Keys:Data Processing Keys--When TYPEWRITER KEYS is selected the characters on the left side of the keycaps are produced. When DATA PROCESSING KEYS is selected the characters on the right side of the keycaps are produced. This function is for all keyboards except the North American keyboard.

Caps Lock: Shift Lock--CAPS LOCK provides capital letters, numbers and lower characters on double character keys. SHIFT LOCK provides capital letters, special characters above numbers and upper characters on double character keys.

Auto Repeat: No Auto Repeat--AUTO REPEAT enables a key that is held down for .5 seconds or longer to automatically be repeated until that key is released. NO AUTO REPEAT prevents the keys from repeating automatically.

Keyclick: No Keyclick--Selects whether or not a clicking sound is made when a key is pressed.

Margin Bell: No Margin Bell--MARGIN BELL causes a beep tone to occur when the cursor is eight columns from the right margin.

Warning Bell: No Warning Bell--WARNING BELL causes a beep tone to occur if an operating error is detected, or when a CTRL G sequence is received.

Break: No Break--BREAK sends a break signal to the host computer when you press the BREAK key. (The Shift-Break function is not affected by this setting.)

No Auto Answerback: Auto Answerback--When AUTO ANSWERBACK is selected the answerback message (if present) is automatically sent to the host after power-up, or upon receiving an ENQ from the host.

Answerback=--This feature allows the CIT224 terminal to identify itself to the host. The answerback message is entered by the operator during Set-Up and is sent to the host either automatically when the host sends the ASCII ENQ code (Ø5H) to the terminal for request identify, or by pressing the CTRL and BREAK keys simultaneously. The message may consist of a maximum of 3Ø ASCII characters. If auto answerback is on, the answerback message is sent to the host when the terminal is turned on.

Not Concealed: Concealed--NOT CONCEALED causes the answerback message to display on the screen. CONCEALED causes the message to be concealed from view. Once this feature is set to CONCEALED, it cannot be changed to NOT CONCEALED until a new answerback message is generated.

Keyboard Enhancements Set-Up Menu

The Keyboard Enhancements Set-Up menu provides additional keyboard features as described below.

```
┌─────────────────────────────────────────────────────────────────────┐
│  Keyboard Enhancements Set-Up              CIT224                     │
│                                                                       │
│  ┌─────────────┐ ┌─────────────┐ ┌──────────────────────┐ ┌────────────────┐ │
│  │ To Next Set-Up │ │ To Directory │ │ Hold Screen Key Type: VT220 │ │ Auto Repeat=Slow │ │
│  └─────────────┘ └─────────────┘ └──────────────────────┘ └────────────────┘ │
│                                                                       │
│  ┌──────────────────┐ ┌───────────────────────────────┐            │
│  │ UDK F6-F20: Shifted │ │ F6-F20 VT100 Mode: ESC/BS/LF Only │          │
│  └──────────────────┘ └───────────────────────────────┘            │
│                                                                       │
│  ┌──────────────────────────┐ ┌─────────────────────┐ ┌──────────────┐ │
│  │ Compose Key Interlock=None │ │ Decimal Keypad + PF's │ │ UDK: Volatile │ │
│  └──────────────────────────┘ └─────────────────────┘ └──────────────┘ │
│  REPL   MODE  │  PRNTR:   NONE  │              │              │        │
└─────────────────────────────────────────────────────────────────────┘
```
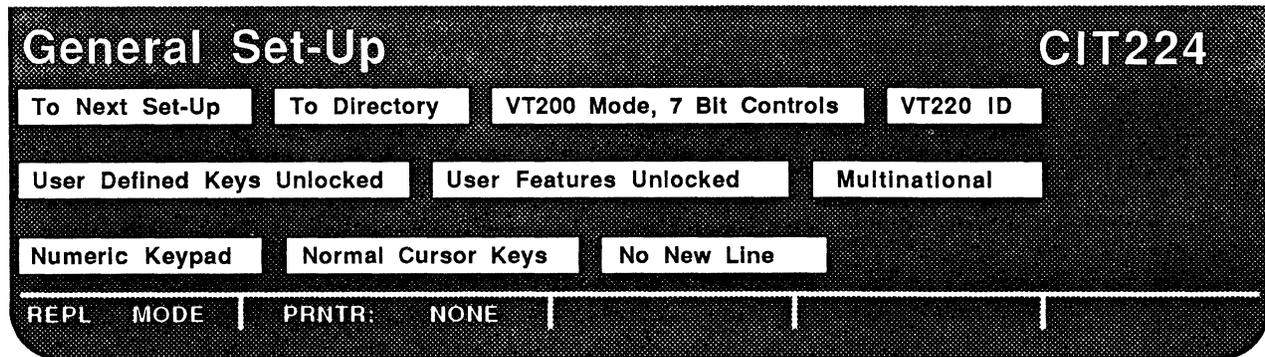
Figure 4-11. Keyboard Enhancements Set-Up Menu

Field:Options--Function

To Next Set-Up--Advances to the next set-up menu. In this case it is the Tab Set-Up menu.

To Directory--Returns the screen to the Set-Up Directory menu.

Hold Screen Key Type-VT220:Hold Screen Key Type-VT52--In VT220 STYLE the HOLD SCREEN key toggles between freezing and releasing the screen. VT52 STYLE selects a scrolling operation to be performed by the HOLD SCREEN key.

Auto Repeat=Slow:Auto Repeat=Fast--Sets the auto repeat feature rate.

UDK F6-F20-Shifted:Unshifted--SHIFTED sets the function keys to generate hard coded sequences when pressed directly. Pressing SHIFT F-KEY generates the user-defined value of the function key. UNSHIFTED does the opposite. Pressing the function key directly generates the user-defined value of the key. Pressing SHIFT F-KEY generates the hard coded value of the key. This selection does not affect the action of the extended function keys F21 - F50.

F6-F20 VT100 Mode-ESC,BS,LF Only:F6-F20--ESC/BS/LF ONLY selects the F11, F12 and F13 keys to generate ESC, BS and LF codes respectively. All other function keys are disabled. F6-F20 directs the F6 through F20 function keys to operate as in VT200 mode.

Compose Key Interlock=None:Control--Selects whether the COMPOSE CHARACTER key is set to function with the CTRL key or alone without having to press another key.

Decimal Keypad + PF's: Hex Keypad--Selects the function of the numeric keypad to operate as a decimal keypad or to generate hexadecimal codes.

UDK-Volatile:NVR--Selects whether user-defined keys are stored permanently in NVR or temporarily in volatile memory. When stored in volatile memory the UDK's are cleared when a RECALL or RESET operation is performed.

> **NOTE:** A SAVE operation must be performed through the Set-Up Directory menu when the NVR option has been selected.

Tab Set-Up Menu

The Tab Set-Up menu displays in ruler fashion the locations of all the currently set tab stop positions and the currently selected screen width, either 80 or 132 columns. Each available column is numbered in repeating groups of 1 through 0 for easy location of the tab stops, which display on the screen as uppercase T's.
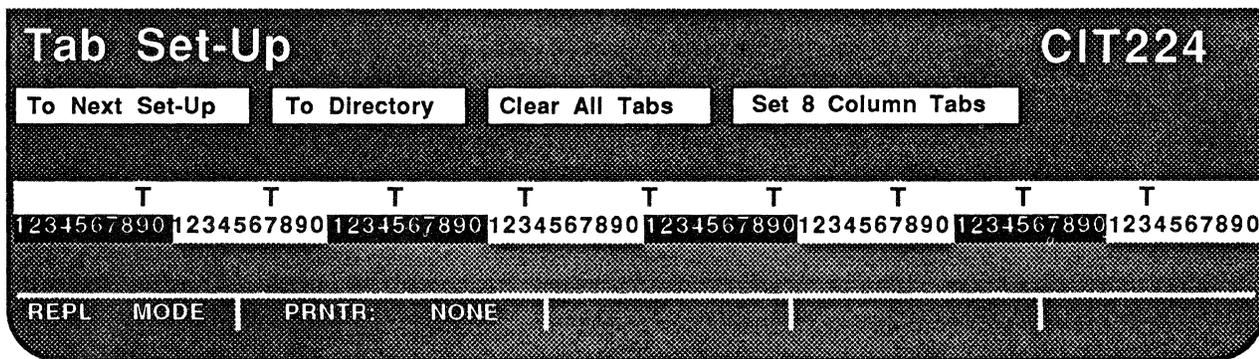
Figure 4-12. Tab Set-Up Menu

Field:Option--Function

To Next Set-Up--Advances to the next set-up menu. In this case it wraps around to the Display Set-Up menu.

To Directory--Returns the screen to the Set-Up Directory menu.

Clear All Tabs--Clears all tab stop fields.

Set 8 Column Tabs--Sets a tab every eighth column automatically, beginning with column nine.

Individual tabs are set or reset utilizing the field cursor. Use the arrow keys or the TAB key to move the cursor. After selecting a tab stop position press the ENTER key. This places a "T" into the blank field. To remove an existing tab field, position the field cursor on the "T" and press the ENTER key. This action removes the tab stop field.

FUNCTION KEY EDITOR PAGE

The Function Key Editor Page permits local programming of the terminal's F6 through F2Ø function keys (F-keys). Pressing an F-key with the CTRL and/or SHIFT keys while the terminal is in Set-Up mode accesses the editor page.

```
Function Key Editor                              CIT224

Current Key Address: F-XX      Key Space Remaining:   XXXXX

+ Current Key Content Display . . . . . . . . . . . . . . . . . . . .◊+

Programmed Keys:
```

Figure 4-13. Function Key Editor Page

Field:Function

Current Key Address--Identifies the current key being loaded.

Key Space Remaining--Identifies the number of bytes available in the entire function key storage area. The field is automatically incremented or decremented as editing takes place.

Current Key Content--Displays the contents of the function key selected within an 8Ø column display field. All data including control codes are displayed. Blinking plus signs (+) at the field boundaries indicate that additional data exists off the screen.

Programmed Keys--Lists other keys currently having programmed sequences.

Operation of Function Key Editor Page

In Set-Up mode the three levels of the user-defined keys are accessed as follows:

            Press SHIFT F-Key   (Keys F6 - F20)
            Press CTRL F-Key   (Keys F21 - F35)
            Press CTRL SHIFT F-Key   (Keys F36 - F50)

- The editor page displays with the cursor on the left margin of the editor line. If an undefined key is being defined, the editor line is blank. If a defined key is being edited, the current contents of the key are displayed.

- Cursor right and left arrow keys move the cursor within the editor window. In the event that the contents of the key are longer than the display window, a blinking '+' symbol appears at the right margin. Continued action of the cursor at the margin causes the window to scroll to bring the additional data into view.

- The window display may be advanced to the end of the string, in either direction, by the use of the CTRL and cursor right or left keys.

- Note that the editor feature is always in an insert mode of operation. Placing the cursor at a position within a text string causes new characters to be inserted.

- Delete functions are managed by the DELETE key. Pressing DELETE causes the character to the left of the cursor to be deleted. SHIFT DELETE causes the character under the cursor to be deleted. CTRL DELETE causes the entire key contents to be deleted.

- The end of a key sequence is indicated by a blinking '◊' (diamond) symbol. When an empty key is selected, the blinking '◊' is displayed at the left margin of the editor window.

- The next function key to be defined is accessed by pressing the appropriate key combination (i.e. CTRL F6 accesses key F21). Action of the SHIFT up-arrow (↑) or SHIFT down-arrow (↓) increments or decrements the current key address field by one.

- To exit the editor page, press the ENTER key, returning the terminal to its last displayed Set-Up menu. Pressing the SET-UP key also exits the program from the editor page and Set-Up mode, returning the terminal to its previous on-line or local operation.

The number of available bytes remaining in the memory is always displayed in the 'Key Space Remaining' field. If the space is exhausted, a bell sounds on each attempt to enter new data. At this point, you may delete the contents of the key to allocate additional space, or exit from the program with all space consumed.

User-defined keys that are loaded through the editor page are saved in NVR if 'UDK:NVR' is selected in the Keyboard Enhancements set-up menu. Optionally, the keys may be protected from host overwrite by the 'User Defined Keys Locked' selection in the General Set-Up menu.

DISPLAY CONTROLS

The 'Interpret Controls/Display Controls' parameter in the Display Set-Up menu allows the operator the option of executing or displaying control codes received from the host computer. In the 'display' state, the control codes are shown as graphic characters.

This mode is accessible only through the set-up menu, it cannot be invoked through an escape sequence or from the host computer. In the Display Controls mode, all control functions are displayed on the screen, and most are prohibited from being executed. The exceptions are:

  · LF, FF, and VT - which display before a CR LF is executed

  · XON and XOFF (DC1 and DC3) - which display after they are executed, if XON/XOFF is enabled.

Table 4-1 shows the CØ, GL, C1 and GR display characters in the Display Controls mode. These characters are loaded in VT2ØØ modes. VT1ØØ and VT52 modes load only the CØ and GL areas of the code table.

Table 4-1. Display Controls Font

ROW	COLUMN 0		COLUMN 1		COLUMN 2		COLUMN 3		COLUMN 4		COLUMN 5		COLUMN 6		COLUMN 7	
0	N_U	00/00	D_L	16/10		32/20	0	48/30	@	64/40	P	80/50	`	96/60	p	112/70
1	S_H	01/01	D₁	17/11	!	33/21	1	49/31	A	65/41	Q	81/51	a	97/61	q	113/71
2	S_X	02/02	D₂	18/12	"	34/22	2	50/32	B	66/42	R	82/52	b	98/62	r	114/72
3	E_X	03/03	D₃	19/13	#	35/23	3	51/33	C	67/43	S	83/53	c	99/63	s	115/73
4	E_T	04/04	D₄	20/14	$	36/24	4	52/34	D	68/44	T	84/54	d	100/64	t	116/74
5	E_Q	05/05	N_K	21/15	%	37/25	5	53/35	E	69/45	U	85/55	e	101/65	u	117/75
6	A_K	06/06	S_Y	22/16	&	38/26	6	54/36	F	70/46	V	86/56	f	102/66	v	118/76
7	B_L	07/07	E_B	23/17	'	39/27	7	55/37	G	71/47	W	87/57	g	103/67	w	119/77
8	B_S	08/08	C_N	24/18	(	40/28	8	56/38	H	72/48	X	88/58	h	104/68	x	120/78
9	H_T	09/09	E_M	25/19	)	41/29	9	57/39	I	73/49	Y	89/59	i	105/69	y	121/79
10	L_F	10/0A	ҫ	26/1A	*	42/2A	:	58/3A	J	74/4A	Z	90/5A	j	106/6A	z	122/7A
11	V_T	11/0B	E_C	27/1B	+	43/2B	;	59/3B	K	75/4B	[	91/5B	k	107/6B	{	123/7B
12	F_F	12/0C	F_S	28/1C	,	44/2C	<	60/3C	L	76/4C	\	92/5C	l	108/6C	|	124/7C
13	C_R	13/0D	G_S	29/1D	-	45/2D	=	61/3D	M	77/4D	]	93/5D	m	109/6D	}	125/7D
14	S_O	14/0E	R_S	30/1E	.	46/2E	>	62/3E	N	78/4E	^	94/5E	n	110/6E	~	126/7E
15	S_I	15/0F	U_S	31/1F	/	47/2F	?	63/3F	O	79/4F	—	95/5F	o	111/6F	D_T	127/7F

├──── C0 CODES ────┤├──────────── GL CODES ────────────┤

KEY

Character	ҫ	26	Decimal
		1A	Hexadecimal

Table 4-1. Display Controls Font (Cont.)

COLUMN 8		COLUMN 9		COLUMN 10		COLUMN 11		COLUMN 12		COLUMN 13		COLUMN 14		COLUMN 15		ROW
8_0	128 / 80	9_0	144 / 90	A_0	160 / A0	°	176 / B0	À	192 / C0	D_0	208 / D0	à	224 / E0	F_0	240 / F0	0
8_1	129 / 81	9_1	145 / 91	¡	161 / A1	±	177 / B1	Á	193 / C1	Ñ	209 / D1	á	225 / E1	ñ	241 / F1	1
8_2	130 / 82	9_2	146 / 92	¢	162 / A2	^{2}	178 / B2	Â	194 / C2	Ò	210 / D2	â	226 / E2	ò	242 / F2	2
8_3	131 / 83	9_3	147 / 93	£	163 / A3	^{3}	179 / B3	Ã	195 / C3	Ó	211 / D3	ã	227 / E3	ó	243 / F3	3
8_4	132 / 84	9_4	148 / 94	A_4	164 / A4	B_4	180 / B4	Ä	196 / C4	Ô	212 / D4	ä	228 / E4	ô	244 / F4	4
8_5	133 / 85	9_5	149 / 95	¥	165 / A5	µ	181 / B5	Å	197 / C5	Õ	213 / D5	å	229 / E5	õ	245 / F5	5
8_6	134 / 86	9_6	150 / 96	A_6	166 / A6	¶	182 / B6	Æ	198 / C6	Ö	214 / D6	æ	230 / E6	ö	246 / F6	6
8_7	135 / 87	9_7	151 / 97	§	167 / A7	·	183 / B7	Ç	199 / C7	Œ	215 / D7	ç	231 / E7	œ	247 / F7	7
8_8	136 / 88	9_8	152 / 98	¤	168 / A8	B_8	184 / B8	È	200 / C8	Ø	216 / D8	è	232 / E8	ø	248 / F8	8
8_9	137 / 89	9_9	153 / 99	©	169 / A9	^{1}	185 / B9	É	201 / C9	Ù	217 / D9	é	233 / E9	ù	249 / F9	9
8_A	138 / 8A	9_A	154 / 9A	ª	170 / AA	º	186 / BA	Ê	202 / CA	Ú	218 / DA	ê	234 / EA	ú	250 / FA	10
8_B	139 / 8B	9_B	155 / 9B	«	171 / AB	»	187 / BB	Ë	203 / CB	Û	219 / DB	ë	235 / EB	û	251 / FB	11
8_C	140 / 8C	9_C	156 / 9C	A_C	172 / AC	¼	188 / BC	Ì	204 / CC	Ü	220 / DC	ì	236 / EC	ü	252 / FC	12
8_D	141 / 8D	9_D	157 / 9D	A_D	173 / AD	½	189 / BD	Í	205 / CD	Ÿ	221 / DD	í	237 / ED	ÿ	253 / FD	13
8_E	142 / 8E	9_E	158 / 9E	A_E	174 / AE	B_E	190 / BE	Î	206 / CE	D_E	222 / DE	î	238 / EE	F_E	254 / FE	14
8_F	143 / 8F	9_F	159 / 9F	A_F	175 / AF	¿	191 / BF	Ï	207 / CF	ß	223 / DF	ï	239 / EF	□	255 / FF	15

|← C1 CODES →|← GR CODES →|

PRINT MODES

The CIT224 supports five print function modes selectable in the Printer Set-Up menu:

> Normal Print Mode
> Auto Print Mode
> Printer Controller Mode
> Concurrent Print Mode
> Local Controller Mode

These modes may also be set from the keyboard through control sequences or from the host, (refer to Chapter 5).

Normal Print Mode

Normal Print Mode, which is the default, allows the operator to execute all of the keyboard printing functions (Print Screen, Print Cursor Line, etc.) from the keyboard.

Auto Print Mode

When Auto Print Mode is selected, the current line of data is printed when the cursor is moved off the line by a line feed (LF), form feed (FF) or vertical tab (VT) which is sent to the printer as the terminating character of the line. With the auto wrap feature on, as the cursor moves off the line, the completed line of data is printed.

The Auto Print Mode can be enabled or disabled by pressing the CTRL and PRINT SCREEN keys simultaneously. The status of the mode is displayed on the status line feature. All normal print functions can be executed in this mode.

Printer Controller Mode

The Printer Controller Mode is selectable by the host computer. In this mode the host communicates directly with the printer, bypassing the terminal. No data is displayed on the monitor screen.

The Printer Controller Mode cannot be entered from the keyboard, except through the Printer Set-Up menu. The status of this mode is displayed on the status line. When in this mode, the use of local printing functions is prohibited.

Concurrent Print Mode

Concurrent Print Mode directs data on any I/O channel input line to the display and auxiliary I/O channel output line concurrently. The terminal must be in the on-line operating state. When invoked, the status of the Concurrent Print Mode is indicated on the status line.

Local Controller Mode

Local Controller Mode is a combination of two set-up features: Local mode - set through the Set-Up Directory menu, and Printer Controller Mode - set through the Printer Set-Up menu.

In this mode the terminal halts communication with the host computer and communicates directly with the printer. All data entered at the keyboard goes to the printer. This feature is used for testing and familiarization purposes, and for setting up printers for operation.

COMPOSE CHARACTER SEQUENCES

The CIT224 provides a compose character function to create characters that are not available on the keyboard. These characters are created through either a two-key or a three-key compose character sequence.

Although the two-key compose sequence is faster than the three-key sequence, there are limitations to the characters that can be generated. The North American keyboard does not allow two-key sequences; however, all keyboards allow the three-key compose sequences.

Compose sequences are divided between 8-bit multinational mode sequences (see Table 4-2) and 7-bit national mode sequences (see Table 4-3). Refer to these tables when doing a compose sequence function.

Three-Key Compose Sequence

The three-key compose character sequence functions as follows:

● Press the COMPOSE CHARACTER key. The COMPOSE LED indicator on the keyboard lights up.

● From Table 4-2 or 4-3 enter the two characters required to create the desired supplemental character.

● The supplemental character is generated and the COMPOSE LED indicator is turned off.

Most compose sequences are not order sensitive, unless otherwise noted in the table.

For example, to create an 'a' with a circumflex accent, press the COMPOSE CHARACTER key, enter 'a' and the circumflex character (^). Since this compose sequence is not order sensitive, it can also be entered as follows: <COMPOSE CHARACTER>, <^>, <a>.

If an invalid sequence is entered, the bell sounds (if the bell has been enabled in the Keyboard Set-Up menu) and the sequence is aborted.

> NOTE: A compose sequence may be aborted by pressing a function key. Under this condition the warning bell does not sound.

Two-Key Compose Sequence

The two-key compose character sequence functions as follows:

● Press one of the following diacritical marks:

> grave accent (`)
> circumflex accent (^)
> acute accent (')
> tilde mark (~)
> diaeresis mark (umlaut) (¨)

● The COMPOSE LED indicator on the keyboard lights up.

● From Table 4-2 or 4-3 enter the character required to create the desired supplemental character.

● The supplemental character is generated and the COMPOSE LED indicator turns off.

For example, to create an 'a' with a circumflex accent, press the key that has the circumflex accent (^) and then enter the 'a'. Because all two-key compose sequences are order sensitive, it is necessary to enter the diacritical mark before the character.

If an invalid sequence is entered, the bell sounds (if the bell has been enabled in the Keyboard Set-Up menu) and the sequence is aborted.

> NOTE: A compose sequence may be aborted by pressing a function key. Under this condition the warning bell does not sound.

Table 4-2. Multinational Mode Compose Sequences

Character		Three-Key Sequence	Two-Key Sequence
"	Quotation Mark	" (sp)	" (sp)
#	Number Sign	+ +	
'	Apostrophe	' (sp)	' (sp)
@	Commercial at	aa or AA	
[	Opening Bracket	((	
\	Backslash	/ / or / <	
]	Closing Bracket	))	
^	Circumflex	^ (sp)	^ (sp)
'	Single Quote	` (sp)	` (sp)
{	Opening Brace	(-	
|	Vertical Line	/ ^	
}	Closing Brace	) -	
~	Tilde	~ (sp)	~ (sp)
¡	Inverted !	! !	
¢	Cent Sign	c / or C / or c | or C |	
£	Pound Sign	l - or L - or l = or L =	
¥	Yen Sign	y - or Y - or y = or Y =	
§	Section Sign	s o or S O or S ! or s ! or s 0 or S 0	
¤	Currency Sign	x o or X O or x 0 or X 0	
©	Copyright Sign	c o or C O or c 0 or C 0	
ª	Feminine Ordinal Indicator	a _ or A _	
«	Angle Quotation Mark Left	< <	
°	Degree Sign	0 ^ or (sp) *	
±	Plus/Minus Sign	+ _	
⁰	Superscript 0	0 ^	
¹	Superscript 1	1 ^	
²	Superscript 2	2 ^	
³	Superscript 3	3 ^	

Table 4-2. Multinational Mode Compose Sequences (Cont.)

Character		Three-Key Sequence	Two-Key Sequence
µ	Micro Sign	/ u or / U (order sensitive)	
¶	Paragraph Sign	p ! or P !	
·	Middle Dot	. ^	
º	Masculine Ordinal Indicator	o _ or O _	
»	Angle Quotation Mark Right	> >	
¼	Fraction one-quarter	1 4 (order sensitive)	
½	Fraction one-half	1 2 (order sensitive)	
¿	Inverted ?	? ?	
À	A grave	A `	` A
Á	A acute	A ´	´ A
Â	A circumflex	A ^	^ A
Ã	A tilde	A ~	~ A
Ä	A umlaut	A ¨	
Å	A ring	A *	
Æ	A E ligature	A E (order sensitive)	
Ç	C Cedilla	C ,	
È	E grave	E `	` E
É	E acute	E ´	´ E
Ê	E circumflex	E ^	^ E
Ë	E umlaut	E ¨	¨ E
Ì	I grave	I `	` I
Í	I acute	I ´	´ I
Î	I circumflex	I ^	^ I
Ï	I umlaut	I ¨	¨ I
Ñ	N tilde	N ~	~ N
Ò	O grave	O `	` O
Ó	O acute	O ´	´ O
Ô	O cirumflex	O ^	^ O
Õ	O tilde	O ~	~ O

Table 4-2. Multinational Mode Compose Sequences (Cont.)

Character		Three-Key Sequence	Two-Key Sequence
Ö	O umlaut	O " or O ¨	¨ O
Œ	O E ligature	O E (order sensitive)	
Ø	O slash	O /	
Ù	U grave	U `	` U
Ú	U acute	U ´	´ U
Û	U circumflex	U ^	^ U
Ü	U umlaut	U " or U ¨	¨ U
Ÿ	Y umlaut	Y " or Y ¨	¨ Y
ß	German small sharp s	ss	
à	a grave	a `	` a
á	a acute	a ´	´ a
â	a circumflex	a ^	^ a
ã	a tilde	a ~	~ a
ä	a umlaut	a ¨	¨ a
å	a ring	a *	
æ	a e ligature	a e (order sensitive)	
ç	c cedilla	c , (comma)	
è	e grave	e `	` e
é	e acute	e ´	´ e
ê	e circumflex	e ^	^ e
ë	e umlaut	e " or e ¨	¨ e
ì	i grave	i `	` i
í	i acute	i ´	´ i
î	i circumflex	i ^	^ i
ï	i umlaut	i " or i ¨	¨ i
ñ	n tilde	n ~	~ n
ò	o grave	o `	` o
ó	o acute	o ´	´ o
ô	o circumflex	o ^	^ o
õ	o tilde	o ~	~ o

Table 4-2. Multinational Mode Compose Sequences (Cont.)

Character		Three-Key Sequence	Two-Key Sequence
ö	o umlaut	o " or o ¨	¨ o
œ	o e ligature	o e (order sensitive)	
ù	u grave	u `	` u
ú	u acute	u ´	´ u
û	u circumflex	u ^	^ u
ü	u umlaut	u " or u ¨	¨ u
ÿ	y umlaut	y " or y ¨	¨ y

To Abort or Restart a Compose Sequence

If the compose mode is entered accidentally, it may be aborted by pressing the <x] (DELETE) key.

If a mistake is made during a compose sequence, you may restart that sequence, or begin a new one, by pressing the COMPOSE CHARACTER key again. The original entry is aborted and the new entry is executed.

Table 4-3. National Mode Compose Sequences

Character	Three-Key Sequence	Two-Key Sequence
British Keyboard		
£ pound sign	I - or L - or I = or L =	
/ backslash	/ <	
Flemish Keyboard		
£ pound sign	L - or I - or L = or I =	
§ section	s ! or S ! or s o or S o or s O or S O or s 0 or S 0	
ù u grave	u `	
è e grave	e `	
French Canadian Keyboard		
à a grave	a `	` a
â a circumflex	a ^	^ a
ç c cedilla	c ,	
ê e circumflex	e ^	^ e
è e grave	e `	` e
î i circumflex	i ^	^ i
ô o circumflex	o ^	^ o
ù u grave	u `	` u
û u circumflex	u ^	^ u
Finnish Keyboard		
# number sign	+ +	
@ commercial at	a a or A A or a A	
Å A ring	A *	
Ü U umlaut	U "	
é e acute	e '	
å a ring	a *	
ü u umlaut	u "	

Table 4-3. National Mode Compose Sequences (Cont.)

Character		Three-Key Sequence	Two-Key Sequence
Danish Keyboard			
#	number sign	+ +	
Ä	A umlaut	A ¨	¨ A
Å	A ring	A *	
Ø	O slash	O /	
Ü	U umlaut	U ¨	¨ U
ä	a umlaut	a ¨	¨ a
å	a ring	a *	
ø	o slash	o /	
ü	u umlaut	u ¨	¨ u
German Keyboard			
Ä	A umlaut	A ¨	
Ü	U umlaut	U ¨	
ä	a umlaut	a ¨	
ü	u umlaut	u ¨	
Dutch Keyboard			
£	pound sign	L - or l - or L = or l =	
¾	three quarters	3 4 (order sensitive)	
ij	i j sign	i j (order sensitive)	
½	one half	1 2 (order sensitive)	
ƒ	florin	f - (order sensitive)	
Italian Keyboard			
£	pound sign	L - or l - or L = or l =	
§	section	s ! or S ! or s o or S o or s O or S O or s 0 or S 0	
à	a grave	a `	` a
ç	c cedilla	c ,	
é	e acute	e '	

Table 4-3. National Mode Compose Sequences (Cont.)

Character		Three-Key Sequence	Two-Key Sequence
Swiss (French) Keyboard			
ä	a umlaut	a ¨	
ç	c cedilla	c ,	
ê	e circumflex	e ^	^ e
î	i circumflex	i ^	^ i
ô	o circumflex	o ^	^ o
ö	o umlaut	o ¨	
û	u circumflex	u ^	^ u
ü	u umlaut	u ¨	
ù	u grave	u `	` u
Swiss (German) Keyboard			
à	a grave	a `	` a
ç	c cedilla	c ,	
ê	e circumflex	e ^	^ e
é	e acute	e ´	
è	e grave	e `	` e
î	i circumflex	i ^	^ i
ô	o circumflex	o ^	^ o
û	u circumflex	u ^	^ u
ù	u grave	u `	` u
Swedish Keyboard			
#	number sign	+ +	
Å	A ring	A *	
É	E acute	E '	
Ü	U umlaut	U "	
å	a ring	a *	
é	e acute	e ´	
ü	u umlaut	u "	

Table 4-3. National Mode Compose Sequences (Cont.)

Character		Three-Key Sequence	Two-Key Sequence
Norwegian Keyboard			
#	number sign	+ +	
Å	A ring	A *	
Ä	A umlaut	A ¨	¨ A
Æ	A E ligature	A E (order sensitive)	
Ü	U umlaut	U ¨	¨ U
ä	a umlaut	a ¨	¨ a
æ	a e ligature	a e (order sensitive)	
å	a ring	a *	
ü	u umlaut	u ¨	¨ u
French/Belgian Keyboard			
£	pound sign	L - or l - or L = or l =	
§	section	s ! or S ! or s o or S o or s O or S O or s 0 or S 0	
è	e grave	e `	
ù	u grave	u '	
Spanish Keyboard			
£	pound sign	L - or l - or L = or l =	
§	section	s ! or S ! or s o or S o or s O or S O or s 0 or S 0	
¡	inverted !	! !	
¿	inverted ?	? ?	
°	degree sign	O ^	

Chapter 5

PROGRAMMER DATA

This chapter describes in detail the standard and private ANSI commands that control the internal workings of the CIT224 video data terminal.

PROGRAMMING FEATURES

The CIT224 is compatible with a DEC VT220. It has four modes of operation that allow it to interact with a variety of application programs. These include the DEC VT200 7-bit and 8-bit control modes, VT100, and VT52 modes. In addition, the terminal accepts private CIT224, CIT-220+, CIT-101e and CIT-101 control sequences.

All standard 7-bit control characters are supported on the CIT224. In addition, a set of 8-bit control characters is available. These 8-bit control characters can be used directly when in 8-bit VT200 mode. By using the ANSI-defined 7-Bit Code Extension Technique, 8-bit control characters can also be used in VT100 or 7-bit VT200 modes.

Besides these single-byte control characters, multi-byte control code strings can also be used. ESCAPE SEQUENCES are multi-byte control code strings that begin with the 7-bit ESCAPE control character. In addition to escape sequences, the CIT224 supports CONTROL SEQUENCE INTRODUCERS and DEVICE CONTROL STRINGS. These control functions begin with 8-bit control codes. Equivalent 7-bit sequences can be constructed, allowing all three types of control functions to be used either in 7-bit or 8-bit modes.

The graphic character sets of the CIT224 include "hard" (EPROM-resident) sets, eleven National Replacement Character (NRC) sets, and a "soft" (RAM-resident) character set that can be defined by the user.

These enhancements greatly expand the capabilities of the CIT224 and allow you to use programs written for other terminals as well. The features discussed here are described in greater detail in the following pages.

TERMINOLOGY

In this manual, the term control codes refers to the one-byte non-displayable characters stored in the C0 and C1 areas. Escape sequences, control sequence introducers and device control strings are referred to collectively as control functions or control sequences.

ENTERING COMMANDS

The control sequence introducer (CSI) is entered on the keyboard by pressing the Escape key <ESC> and then the left bracket key <[>.

Occasionally escape sequences and control codes appear with a space between the characters. This space should not be entered as part of the sequence; it is there for the sake of clarity only. For example, to enter the following sequence:

CSI 5n

press the ESC and [keys, followed by the 5 key and the lowercase n key.

Be careful to distinguish between:

· an upper- or lowercase character,
· a number one (1) or a lowercase letter L (l),
· a zero (Ø) or an uppercase letter O.

When entering a sequence with the CTRL key, hold the CTRL key down while pressing the second key.

Parameters are either numeric (Pn) or selective (Ps). If a location in the list is left blank or specified as zero (Ø) the default is used.

Command Structure

ANSI standard control sequences are identified in this chapter as:

CSI   or   ESC [

Private control sequences that follow ANSI standards are identified as:

CSI?   or   ESC [?

OPERATING STATES

The CIT224 is provided with a selection of three operating states as described below:

SET-UP   To enter this operating state, press the top-row function key labeled SET-UP. The terminal's software options are displayed and can be examined, changed, or enabled in this state. Set-Up options are discussed in Chapter 4.

ON-LINE   Selectable in Set-Up, the ON-LINE state is used to
                   communicate directly with the host. Keyboard entries are
                   transmitted to the host, and data is received from the
                   host and displayed on the screen according to the
                   communications protocol.

LOCAL   Selectable in Set-Up, LOCAL takes the terminal off-line.
                   Commands entered on the keyboard are sent to the
                   terminal screen only. Data sent from the host is put in
                   a buffer until the terminal is placed back on-line.

MODES OF OPERATION

     The CIT224 has four modes of operation that are either selectable
from the keyboard through the General Set-Up Screen, or from the host
computer by control sequences, (see 'Set Operating Modes' later in
this chapter). Below is a description of each of the four modes.

VT200,   The terminal responds to standard ANSI commands and is
7-BIT Mode   compatible with VT200 7-bit programs. It sends 7-bit
                   characters and control codes within an 8-bit
                   communications environment. Most VT100 programs can be
                   run in this mode. If 8-bit parity is selected in the
                   Communications Set-Up menu, both 7- and 8-bit control
                   codes are recognized by the terminal. ASCII, multi-
                   national characters (European), the NRC sets, and
                   Special Graphics characters can be accessed. (Default
                   mode)

VT200,   The terminal responds to standard ANSI commands and is
8-BIT Mode   compatible with VT200 8-bit programs. It sends 8-bit
                   characters and control codes within an 8-bit
                   communications environment. If 8-bit parity is selected
                   in the Communications Set-Up menu, both 7- and 8-bit
                   control codes are recognized by the terminal. ASCII,
                   multinational characters (European), the NRC sets, and
                   Special Graphics characters can be accessed.

VT100 Mode   The terminal responds to standard ANSI commands and
                   restricts use of the keyboard to 7-bit characters and
                   control codes. When the CIT224 is used with application
                   programs requiring strict compliance to CIT-101 or DEC
                   VT100 terminals, this mode should be enabled. ASCII,
                   the NRC sets, and Special Graphics characters can be
                   accessed.

VT52 Mode   The terminal responds to non-ANSI, DEC private
                   commands. The keyboard is restricted to VT52 keys, and
                   only 7-bit characters and control codes are allowed.
                   This mode is selected when strict compatibility to VT52
                   application programs is required. ASCII, U.K. National
                   and Special Graphics characters can be accessed.

CHARACTER ENCODING

In ANSI mode the CIT224 is software compatible with American National Standards Institute (ANSI) and International Organization for Standardization (ISO) standards contained in the following documents:

ANSI X3.32 -- 1973   Graphic Representation of the Control
                            Characters of American National Code for
                            Information Interchange

ANSI X3.41--1974   Code Extension Techniques for use with
                            the 7-Bit Coded Character Set of American
                            National Standard Code for Information
                            Interchange

ANSI X3.4 -- 1977   American National Standard Code for
                            Information Interchange (ASCII)

ANSI X3.64 -- 1979   Additional Controls for Use with American
                            National Standard Code for Information
                            Interchange

ISO 646 -- 1977   7-Bit Coded Character Set for Information
                            Processing Interchange

ISO Draft International   7-Bit and 8-Bit Coded Character Sets --
Standard 2022.2   Code Extension Techniques

ISO Draft International   Additional Control Functions for
Standard 6429.2   Character Imaging Devices

7- AND 8-BIT CHARACTER OPERATION

The CIT224 can function in 7- or 8-bit modes. Seven-bit operation permits use of the standard 128 ASCII characters ranging from 00H to 7FH, as illustrated in the ASCII Code Table in Appendix A. In 8-bit mode an additional 128 characters, from 80H to FFH, are available. Refer to Table A-2 in Appendix A.

The hexadecimal code for each control and graphic character given is annotated with an uppercase H, e.g. for the escape code this is 1BH.

CONTROL CODES

Control codes are single-byte codes that initiate, modify, or terminate a control operation. In Table 5-1 below, columns zero and one (7-bit) and eight and nine (8-bit) represent the control codes used in this manual.

Code 20H is a space. DEL (7FH) is ignored, and codes which have no corresponding character are displayed as a checkered flag.

Table 5-1. Control Codes

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE	SP							DCS	/////					
1	SOH	DC1								PU1						
2	STX	DC2								PU2						
3	ETX	DC3								STS						
4	EOT	DC4							IND	CCH						
5	ENQ	NAK							NEL	MW						
6	ACK	SYN							SSA	SPA						
7	BEL	ETB							ESA	EPA						
8	BS	CAN							HTS							
9	HT	EM							HTJ							
A	LF	SUB							VTS							
B	VT	ESC							PLD	CSI						
C	FF	FS							PLU	ST						
D	CR	GS							RI	OSC						
E	SO	RS							SS2	PM						
F	SI	US						DEL	SS3	APC						/////

|◄ C0 Codes ►|◄ GL Characters ►|◄ C1 Codes ►|◄ GR Characters ►|

|◄ 7-Bit Code Table (VT52, VT100 Modes) ►|

|◄ 8-Bit Code Table (VT200 7-Bit and VT200 8-Bit Modes) ►|
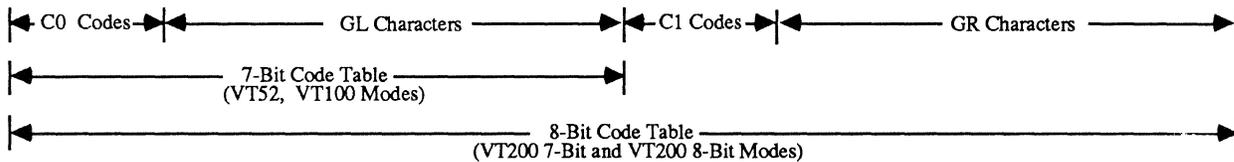
Control Zero (C0)

Codes 00H to 1FH are called Control Zero (C0) control codes, are non-displayed and execute special functions. These codes are generated by pressing CTRL simultaneously with the appropriate key chosen from among the standard characters. C0 control codes supported by the CIT224 are listed in Table 5-2 together with their functions, their Hex values, the keys used to produce the codes, and a description of each action.

The 8-bit code table has the same C0 area, except that four bits instead of three are used to represent the control characters. When in 7-bit modes, this most significant bit is ignored or assumed to be zero, so that the bit combinations (and the functions performed by them) are the same whether in 7-bit or 8-bit modes.

Table 5-2. Supported C0 Control Codes

C0 Code	Function	Hex Value	Key*	Description
NUL	Null	00H	SPACE	Ignored upon receipt
ENQ	Enquiry	05H	E	Transmits the answerback message
BEL	Bell	07H	G	Sounds the audible tone (bell) if the warning bell is enabled
BS	Back Space	08H	H	Back space, unless at left margin
HT	Horizontal Tab	09H	I	Moves cursor to next tab stop or to right margin if there are no tab stops. Does not advance the cursor to the next line.
LF	Line Feed	0AH	J	Causes a linefeed or a new line, depending on New Line Mode
VT	Vertical Tab	0BH	K	Same as LF
FF	Form Feed	0CH	L	Same as LF
CR	Carriage Return	0DH	M	Moves cursor to left margin on the same line
SO (LS1)	Shift Out (Locking Shift G1)	0EH	N	Invokes G1 character set into GL when G1 is properly designated.
SI (LS0)	Shift In (Locking Shift G0)	0FH	O	Invokes G0 character set into GL when G0 is properly designated.
DC1 (XON)	Device Control 1	11H	Q	Resumes transmission if XON/XOFF mode is enabled.
DC3 (XOFF)	Device Control 3	13H	S	Halts transmission of all codes except XON and XOFF if XON/XOFF mode is enabled.
CAN	Cancel	18H	X	Terminates a sequence without executing it; CAN is not displayed.

Table 5-2. Supported C0 Control Codes (Cont.)

C0 Code	Function	Hex Value	Key*	Description
SUB	Substitute	1AH	Z	Same as CAN, except displays a reverse question mark as the error character.
ESC	Escape	1BH	[	Introduces an escape sequence. The codes that follow it are executed. Terminates any escape, control, or device control sequence.
DEL	Delete	7FH		Ignored. May not be used as a fill character.

* The CTRL key is held down while the indicated key is pressed.

Control One (C1)

The 8-bit code table has an area designated as C1, or CONTROL ONE, control characters (80H to 9FH). These represent additional non-displayable functions that can be performed. Since these control characters are 8-bit, they can be used directly only when in 8-bit mode. However, by using an ANSI-defined method of code extension, described below, these control characters are also available when in 7-bit modes.

The C1 codes are generated by pressing the ESC key and then the appropriate key chosen from among the standard characters. C1 control codes supported by the CIT224 are listed in Table 5-3 together with their functions, their Hex values, the keys used to produce the codes, and a description of each action.

Table 5-3. Supported C1 Control Codes

C1 Code	Function	Hex Value	Keys*	Description
IND	Index	84H	ESC D	Moves the cursor down one line in the current column. At the bottom margin, scrolls the screen up.
NEL	Next Line	85H	ESC E	Moves the cursor to the first column on the next line. At the bottom margin, scrolls the screen up.
HTS	Horizontal Tab Set	88H	ESC H	Places a horizontal tab stop at the current cursor position.
RI	Reverse Index	8DH	ESC M	Moves cursor up one line in the current column. At top margin, scrolls the screen down.
SS2	Single Shift G2	8EH	ESC N	Invokes the G2 character set into GL for the next character received.
SS3	Single Shift G3	8FH	ESC O	Invokes the G3 character set into GL for the next character received.
DCS	Device Control String	90H	ESC P	The opening delimiter of a device control string.
CSI	Control Sequence Introducer	9BH	ESC [	The opening delimiter of a control sequence.
ST	String Terminator	9CH	ESC \	The closing delimiter of a device control string.

* This is the 7-bit code extension equivalent described below.

7-Bit Code Extension Technique

By using an ANSI-defined method of code extension called the 7-Bit
Code Extension Technique, 8-bit control codes can be made into 7-bit
equivalents.

The 7-Bit Code Extension Technique can be generalized as follows:

Express any 8-bit C1 control code as a 7-bit control
sequence by making the first character an ESC (1B) and
subtracting 40 (hexadecimal) from the hexadecimal
equivalent of the 8-bit control code.

For example:

C1 control code = ESC + [Hex value of 8-bit control code - 40H]

```
        CSI = ESC + [9BH - 40H]
            = ESC + 5BH
            = ESC [
```

In applications programs, the 8-bit transmitted control code
should be used since one less byte is used, thus gaining processing
speed. This requires that you be functioning in 8-bit mode.

New programs should use the appropriate sequence to choose the
mode (compatibility level) so that both 7-bit and 8-bit control codes
are accepted.

CONTROL SEQUENCES

Control codes and graphic characters can be put together in multi-byte ANSI-defined sequences to perform many functions. Together they form Escape Sequences, Control Sequences, and Device Control Strings.

Escape Sequence

An ESCAPE SEQUENCE is a series of ASCII graphics characters that performs a control function. The first character of an escape sequence is the Escape (ESC, 1BH) C0 control code. An example follows.

ESC(0

This is an escape sequence that designates the Special Graphics character set into the G0 character set area.

Control Sequence

A CONTROL SEQUENCE is a series of ASCII graphics characters that performs a control function. It begins with the Control Sequence Introducer (CSI, 9BH) C1 control code. An example follows.

CSI5i

This is a control sequence that activates Printer Controller Mode.

By using the 7-Bit Code Extension Technique, CSI (9BH) can also be expressed as ESC [(1BH 5BH). For example, the following sequences lock the keyboard:

CSI2h   (9BH,32H,68H)   (for 8-bit mode only)

ESC[2h   (1BH,5BH,32H,68H)   (for 7-bit and 8-bit modes)

Device Control Strings

DEVICE CONTROL STRINGS are sequences that define function keys or load a soft character set. The format for a device control sequence is:

DCS Data ST

The Opening Delimiter is the C1 control code DCS (90H). It can also be expressed as 7-bit ESC P (1BH 50H).

The data being transmitted follows the DCS. For example, commands to program the programmable function keys might follow the DCS.

The String Terminator, or closing delimiter, is the 8-bit C1 character ST (9CH). ST can also be expressed as 7-bit ESC \ (1BH 5CH).

Device control strings are used to program user-defined keys (such as programmable function keys F6 through F20), and to define "soft" down-line loadable character sets. More detailed information on these functions is included later in this chapter.

GRAPHIC CHARACTERS

GRAPHIC CHARACTERS are characters, other than control codes, that have a visual representation display on the screen. There are Graphic Left (GL) and Graphic Right (GR) characters.

Graphic Left

On the 7-bit code table, the last six columns (positions 21H through 7EH) are designated as GL, or GRAPHIC LEFT graphic characters. By factory default, the Graphic Left area contains the ASCII Graphics character set. (See Appendix A.)

The 8-bit code table contains the same GL area except that four bits instead of three are used to represent the characters. By ignoring the most significant bit, or assuming it to be zero, the bit combinations in this GL area are the same in both 7-bit and 8-bit modes.

Graphic Right

The 8-bit code table also contains an area designated as GR or GRAPHIC RIGHT. By factory default, the GR area contains the Supplemental Graphics character set. (See Appendix A.)

This GR graphic character area can be used as an auxiliary character set for use in applications. It is possible to "load" different character sets into the GL or GR areas for special applications needs. The next section describes the terminal's character sets and how to load them into GR and/or GL.

Together, the GL and GR graphic character sets correspond to the Multinational Character Set.

Character Set Repertoire

The graphic repertoire of the CIT224 consists of the following character sets:

> ASCII Graphics
> Supplemental Graphics
> Special Graphics
> National Replacement Character (NRC) Sets
> "Soft" Down-Line Loadable Characters

Appendix A illustrates the character sets.

ASCII Graphics. ASCII Graphics are compatible with the left half of the 7-bit Multinational Character Set. Columns zero and one (C0 codes) are ASCII control codes, and columns two through seven (GL codes) are the ASCII Graphics Set.

Supplemental Graphics. Supplemental Graphics are compatible with the Graphic Right (GR) area on the 8-bit code table as described above. Columns eight and nine (C1 codes) are the 8-bit control codes, and columns ten through fifteen (GR codes) are the Supplemental Graphics Set. This character set is not operable in VT52 and VT100 modes.

Special Graphics. Special Graphics emulates the VT100 Line Drawing Character Set. It is comprised mostly of ASCII graphics characters along with line segments and various symbols. This character set allows the user to combine both text and graphics characters within one mode. Columns six and seven of this set are redefinable through the CIET private command for downline loading character sets.

National Replacement Character (NRC) Sets. The NRC sets include eleven 7-bit national character sets that are available in the terminal's 7-bit modes. The 'National' parameter in the General Set-Up menu must be selected before accessing these character sets. They are accessed one at a time, depending on the keyboard option selected in the Set-Up Directory menu.

Keyboard Option	NRC Set
British	British
Flemish	French
Canadian (French)	French Canadian
Danish	Norwegian/Danish
Finnish	Finnish
German	German
Dutch	Dutch
Italian	Italian

Keyboard Option	NRC Set
Swiss (French)	Swiss
Swiss (German)	Swiss
Swedish	Swedish
Norwegian	Norwegian/Danish
French (Belgian)	French
Spanish	Spanish

Soft Character Set. The "soft" down-line-loadable character set provides for 94 user-defined characters. When in either of the VT200 modes, this character set can be defined and loaded into either GR or GL. See the section titled '"Soft" Character Sets' later in this chapter.

Loading Character Sets

Although ASCII graphics is the default character set in GL, and Supplemental Graphics in GR, you may "load" an alternate character set into GL or GR. To load graphic sets properly, perform the following steps:

1. DEFINE your character or graphics set (for "soft" down-line loadable characters or Special Graphics set).

2. DESIGNATE specific character sets as G0, G1, G2, or G3. Any character set may be assigned to any of the set designators available. (Refer to Table 5-4.)

3. INVOKE your designated graphics sets into GL and/or GR sets for the next character using single shift commands, or permanently using locking shift commands.

    NOTE: G0 cannot be assigned to GR.

The "soft" down-line loadable character set is the only graphics set that must be defined. Columns six and seven of the Special Graphics set are the only redefinable characters/graphics of the remaining graphics sets. Figure 5-1 illustrates the reloading process.
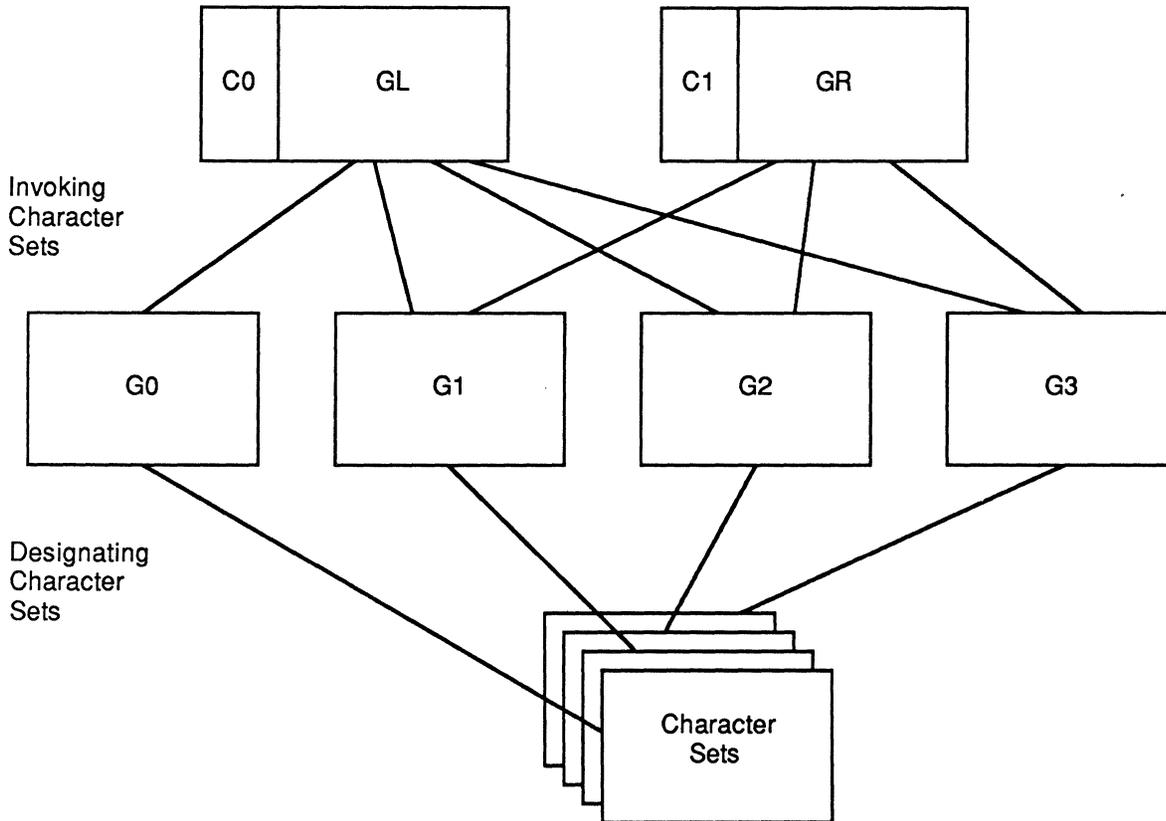
Figure 5-1. Reloading Character Sets

Designate Character Sets. To designate character sets into GØ, G1, G2, or G3 use the control sequences listed below in Table 5-4. A character set is reassigned by entering another control sequence from the table below, or by resetting the terminal.

Table 5-4. Designating Character Sets

CHARACTER SET	DESIGNATE AS:	CONTROL SEQUENCE
ASCII	G0 G1 G2 G3	ESC(B ESC)B ESC*B ESC+B
Supplemental	G0 G1 G2 G3	ESC(< ESC)< ESC*< ESC+<
Special Graphics	G0 G1 G2 G3	ESC(0 ESC)0 ESC*0 ESC+0
NRC Sets		
British	G0 G1	ESC(A ESC)A
Dutch	G0 G1	ESC(4 ESC)4
Finnish	G0 G1	ESC(C or ESC(5 ESC)C or ESC)5
French	G0 G1	ESC(R ESC)R
French Canadian	G0 G1	ESC(Q ESC)Q
German	G0 G1	ESC(K ESC)K
Italian	G0 G1	ESC(Y ESC)Y
Norwegian/Danish	G0 G1	ESC(E or ESC(6 ESC)E or ESC)6
Spanish	G0 G1	ESC(Z ESC)Z

Table 5-4. Designating Character Sets (Cont.)

CHARACTER SET	DESIGNATE AS:	CONTROL SEQUENCE
Swedish	GØ	ESC(H or ESC(7
	G1	ESC)H or ESC)H
Swiss	GØ	ESC(=
	G1	ESC)=
Soft Character Set	GØ	ESC(name
	G1	ESC)name
	G2	ESC*name
	G3	ESC+name

A soft character set is designated by a soft font name. A maximum of three characters are used to name the soft font. The first two characters are optional and in the ASCII code range 2ØH - 3FH. The final character is required and in the range 4ØH - 7EH. Examples of soft font names are given below:

sp @   Defines the soft character set as an unregistered character set. This is the recommended default value.

B   Defines the soft character set as the ASCII character set.

"#h   Defines the soft character set as unregistered character set "#h.

Invoking a Character Set. Character sets that have been designated as GØ, G1, G2, or G3 can be invoked into GL or GR by using the control sequences listed below in Table 5-5.

Table 5-5. Invoking Character Sets

CONTROL SEQUENCE	ACTION
ESCN or SS2 (8EH)	Single shift G2 into GL (VT2ØØ mode only)
ESCO or SS3 (8FH)	Single shift G3 into GL (VT2ØØ mode only)
SI (ØFH)	Invoke GØ into GL (Default)
SO (ØEH)	Invoke G1 into GL
ESC~	Invoke G1 into GR (VT2ØØ mode only)
ESCn	Invoke G2 into GL (VT2ØØ mode only)
ESC}	Invoke G2 into GR (VT2ØØ mode only)
ESCo	Invoke G3 into GL (VT2ØØ mode only)
ESC¦	Invoke G3 into GR (VT2ØØ mode only)

The single shift commands invoke a graphic set only for the next character, while the remaining commands lock the graphics sets in place until another control sequence is entered.

"Soft" Character Sets

When in either of the VT2ØØ modes, up to 94 characters may be created and down-line loaded into a "soft" character set. In addition, it is possible to redefine the graphics display characters in the Special Graphics character set. A special buffer is allocated for holding the character definitions.

The soft character set and the special graphics are loaded into volatile RAM. Therefore when the terminal is turned off, the character sets are lost.

There are two methods for defining and downline loading soft character sets: the CIET method and the DEC compatible method. The CIET method is required when defining a matrix area larger than 7 x 1Ø. Special graphics can only be redefined using the CIET method.

Defining a Character Set using the CIET Method. The character cell size is 10 x 16; however when defining a character, the maximum number of columns and rows available are 7 x 16 when the 25th row status line is OFF, and 7 x 15 when the 25th row status line is ON.

For contiguous line drawing graphics, use a matrix of 8 x 16 pixels. The trailing dot of each 8-wide matrix is repeated to create the 9th and 10th dot of each character cell displayed.

> **NOTE:** If the 25th row status line is ON, graphic characters will not form contiguous lines.

The following steps outline the procedure to define a soft character set through the CIET method.

1. Define characters on a matrix of 7 x 15 (25th row status line ON), or 7 x 16 (25th row status line OFF). Always leave the top row empty.

   In the example below, a capital 'T' is being defined.

```
o o o o o o o  ┐
● ● ● ● ● ● ●  │
o o o ● o o o  │
o o o ● o o o  │
o o o ● o o o  │
o o o ● o o o  │
o o o ● o o o  │
o o o ● o o o  ├  16 Pixels
o o o ● o o o  │
o o o ● o o o  │
o o o ● o o o  │
o o o o o o o  │
o o o o o o o  │
o o o o o o o  │
o o o o o o o  │
o o o o o o o  ┘

└───────┬───────┘
      7 Pixels
```

Figure 5-2. "Soft" Character on 7 x 16 Matrix

2. Create binary string from each row.

   Each row (or scan line) is converted into a binary string by assigning a value of zero if the pixel is empty and one if the pixel is full.

3. Create an 8-digit binary number.

Each 7-bit binary string must be completed to contain eight bits.
To complete the binary number, add a value of Ø (zero) to the end
of each row.

4. Convert binary strings to hexadecimal values.

The 8-digit binary number is converted to its equivalent
hexadecimal value by grouping the first four digits and finding
the hex equivalent. Then group the last four digits and find their
hex equivalent.

If less than 15 lines are specified for a given cell, the
remaining bottom scan lines are blank.

Figure 5-3 illustrates the conversion process described above.

```
O O O O | O O O  =  ØØØØ ØØØØ  =  ØØH
● ● ● ● | ● ● ●  =  1111 111Ø  =  FEH
O O O ● | O O O  =  ØØØ1 ØØØØ  =  1ØH
O O O ● | O O O  =  ØØØ1 ØØØØ  =  1ØH
O O O ● | O O O  =  ØØØ1 ØØØØ  =  1ØH
O O O ● | O O O  =  ØØØ1 ØØØØ  =  1ØH
O O O ● | O O O  =  ØØØ1 ØØØØ  =  1ØH
O O O ● | O O O  =  ØØØ1 ØØØØ  =  1ØH
O O O ● | O O O  =  ØØØ1 ØØØØ  =  1ØH
O O O ● | O O O  =  ØØØ1 ØØØØ  =  1ØH
O O O ● | O O O  =  ØØØ1 ØØØØ  =  1ØH
O O O O | O O O
O O O O | O O O
O O O O | O O O
O O O O | O O O
O O O O | O O O
```

Figure 5-3. CIET Conversion Process

The CIET private command may also be used to program DEC
compatible characters using 1Ø scan lines only.

Defining Special Graphics. The graphics display characters located in
columns six and seven of the Special Graphics code table (Appendix A,
Table A-4) may be redefined using the steps described above. A matrix
of 8 x 16 is used to form contiguous lines when defining line drawing
characters.

Down-Line Loading Each Character using the CIET Method. A device control string is used to down-line load the soft character set. The format of the string is as follows:

DCS Pfn;Pcn;Pe w <name> <data> ST

where:

DCS   is the ANSI device control string command. In 7-bit mode use ESC P.

Pfn   is the soft font buffer index. The terminal has one font buffer, therefore valid entries are zero or one.

Pcn   is the starting character index. The valid range is 33 to 127 decimal.

             NOTE: If loading line drawing characters in the Special Graphics Character Set, the range is from 0 to 31 decimal.

Pe   is the erase control parameter.

          0 = Clear entire font before loading
          1 = Clear only characters loaded in this command

w   is the command terminator.

<name>   is the soft font name. A maximum of three characters, where the first two are optional and in the range 21H - 2FH, and the final is required and in the range 30H - 7EH.

<data>   is the font matrix description. Each scan line is described as two hex digits which represent 8 bits, 1 bit for each displayed pixel. The intermediate character ";" skips to the next cell in the font.

ST   is the ANSI string terminator. In 7-bit mode, ESC \ is used.

An example of the font load command is:

DCS 0 ; 42 ; 0 w %&P 00FE10101010101010101010;23B5;;55555566 ST

where:

      DCS   is the ANSI device control string introducer.

      Ø   is the soft font buffer index.

      42   is the starting character index. The first
                    character to be loaded is at 42 decimal (2A Hex).

      Ø   implies clear the entire font before loading.

      w   is the command terminator.

      %&P   is the font name, to be used in later ANSI
                    character generator select commands.

    ØØFE1Ø1Ø1Ø1Ø1Ø1Ø1Ø1Ø1Ø1Ø   is the matrix for the character at
                    location 42 decimal (2AH). Note that only 11 scan
                    lines are specified, all other lines default as
                    blanks.

      23B5   is the matrix for the character at location 43
                    decimal (2BH).

                    Note the character at location 44 decimal (2CH) is
                    not specified. Since Pe cleared the entire font,
                    the location contains the default character, a
                    reverse question mark. If Pe had been one, then the
                    contents of location 2CH would be unchanged by this
                    command.

      55555566   is the matrix for the character at location 45
                    decimal (2DH).

      ST   is the ANSI device control string terminator.

Defining a Character Set using the DEC Compatible Method. The
character cell size is 8 x 1Ø; however when defining a character, the
maximum number of columns and rows available are 7 x 1Ø. The following
steps outline the procedure to define a soft character set.

1.   Define characters on a matrix of 7 x 1Ø pixels.

     A normal terminal character cell is a matrix of 7 x 1Ø pixels. The
     terminal ignores characters defined beyond its normal size.

In the example below, the ohm symbol is being defined.

```
        o o o o o o o ─┐
        o o o o o o o  │
        o o ● ● ● o o   │
        o ● o o o ● o   │
        ● o o o o o ●   ├─ 10 Pixels
        o ● o o o ● o   │
        o o ● o ● o o   │
        ● ● o o o ● ●   │
        o o o o o o o   │
        o o o o o o o ─┘

        └──────┬──────┘

           7 Pixels
```
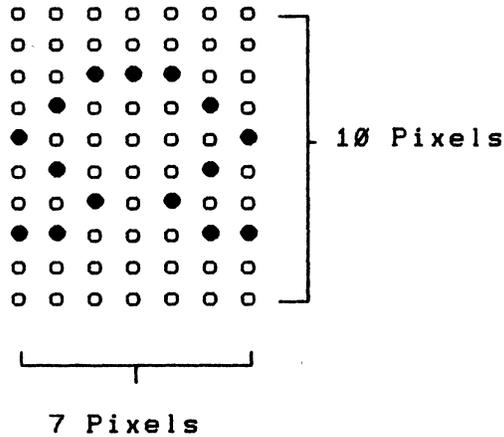
Figure 5-4. "Soft" Character on 7 x 10 Matrix

2. Divide matrix into "sixels".

    After the soft character has been established, divide the
    character into columns of six bits each using the format shown
    below.

```
           1   2   3   4   5   6   7

     b0    o   o   o   o   o   c   o
     b1    o   o   o   o   o   o   o
     b2    o   o   ●   ●   ●   o   o
     b3    o   ●   o   o   o   ●   o
     b4    ●   o   o   o   o   o   ●
     b5    o   ●   o   o   o   ●   o
     ────────────────────────────────
     b0    o   o   ●   o   ●   o   o
     b1    ●   ●   o   o   o   ●   ●
     b2    o   o   o   o   o   o   o
     b3    o   o   o   o   o   o   o

           9  10  11  12  13  14  15
```

Figure 5-5. Example of a Divided Matrix

The column numbers (1-7 and 9-15) list the order that the columns
are sent to the terminal. Columns 1-7 consist of 1 x 6 vertical
columns called "sixels." The most significant bit is at the bottom
of each column and the least significant bit is at the top.
Columns 9-15 contain only four bits each. The two most significant
bits (five and six) are ignored or assumed to be zero (0).

3. Create binary string from sixels.

    After dividing the character matrix into sixels, convert the
    sixels into their binary values by reading from the bottom to the
    top and assigning a value of zero if the pixel is empty and one if
    the pixel is full.

4. Create an 8-digit binary number.

    Each 4- and 6-digit binary number must be completed to contain
    eight bits. To complete the binary number, precede the top column
    sixels with the binary value of 01. Precede the bottom column
    sixels with the binary value of 0100.

5. Convert binary strings to hexadecimal values.

    When an 8-digit binary string has been created from the sixel,
    convert that binary number to the equivalent hexadecimal value by
    grouping the first four digits and finding the hex equivalent.
    Then group the last four digits and find their hex equivalent.

6. Subtract Hex offset 1.

    Subtract a hexadecimal 1 offset from the hexadecimal value.

7. Convert to equivalent ASCII characters.

    Use the ASCII 7-Bit Code Table in Appendix A to convert the
    hexadecimal values to their equivalent ASCII characters.

    Figure 5-6 illustrates the conversion process described above.

$01010000B = 50H - 1 = 4FH = 'O'$

$01101000B = 68H - 1 = 67H = 'g'$

$01000100B = 44H - 1 = 43H = 'C'$

$01000100B = 44H - 1 = 43H = 'C'$

$01000100B = 44H - 1 = 43H = 'C'$

$01101000B = 68H - 1 = 67H = 'g'$

$01010000B = 50H - 1 = 4FH = 'O'$

$01000010B = 42H - 1 = 41H = 'A'$

$01000010B = 42H - 1 = 41H = 'A'$

$01000001B = 41H - 1 = 40H = '@'$

$01000000B = 40H - 1 = 3FH = '?'$

$01000001B = 41H - 1 = 40H = '@'$

$01000010B = 42H - 1 = 41H = 'A'$

$01000010B = 42H - 1 = 41H = 'A'$
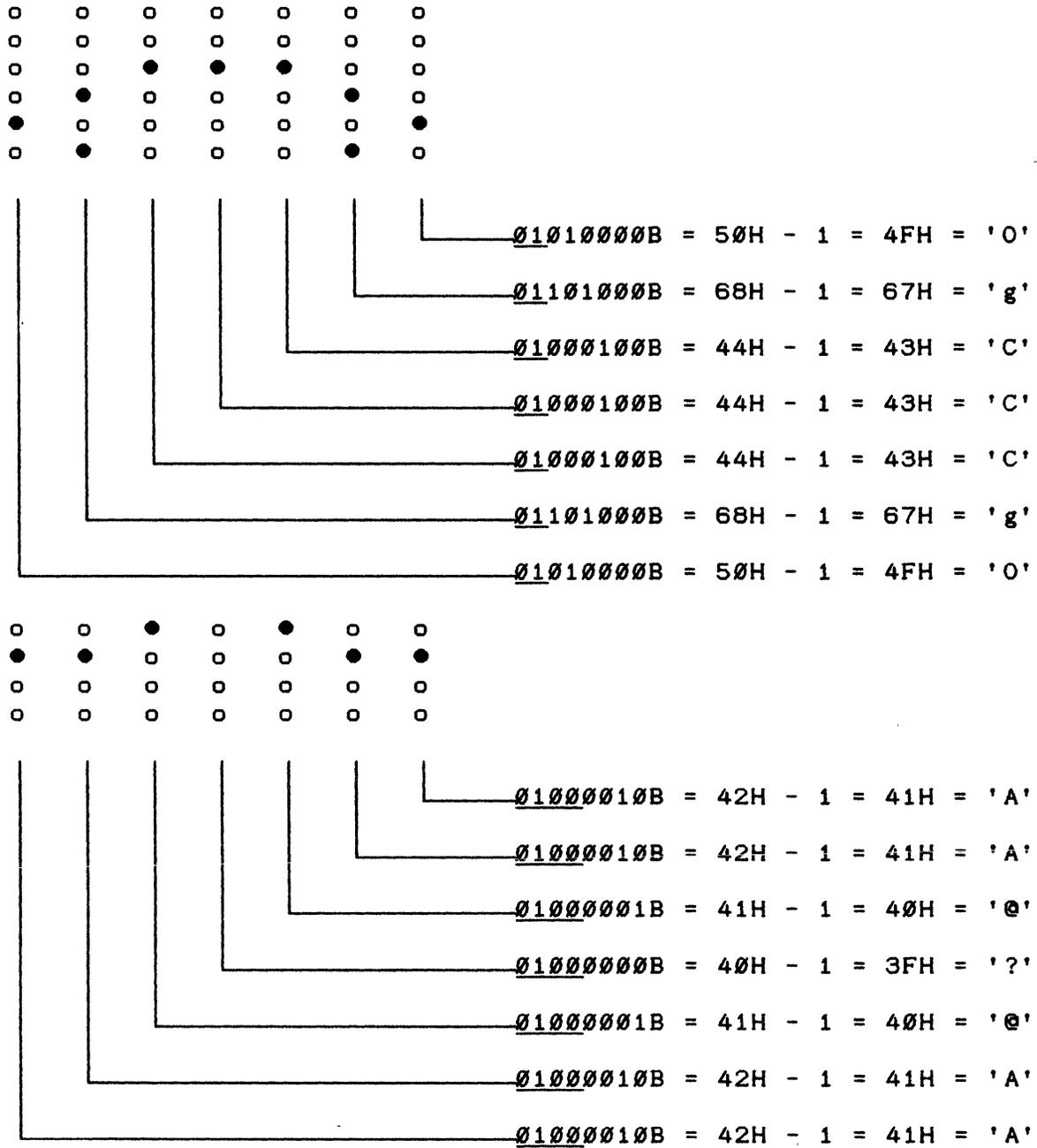
NOTE: The underlined bits are fixed.

Figure 5-6. DEC Compatible Conversion Process

Down-Line Loading Each Character using the DEC Compatible Method. A device control string is used to down-line load the soft character set. The format of the string is as follows:

DCS   Pfn;Pcn;Pe;Pcms;Pw;Pt { name Sxbp1;Sxbp2;...;Sxbp94 ST

where:

DCS   Marks the beginning of the command. In 7-bit mode, use ESC P.

Pfn   Specifies which font buffer to load. The terminal has one font buffer, therefore valid entries are zero and one.

Pcn   Specifies the character in the font buffer to be the first one loaded. For example, 1 refers to column 2, row 1 (21H), and 94 refers to column 7, row 14 (7EH). All succeeding characters are loaded in sequence.

Pe   Specifies which characters are erased from the font buffer before loading begins.

             0 = Erase ALL characters in this soft character set (Default)
             1 = Erase only characters that are being reloaded
             2 = Erase all font buffers

Pcms   Defines the size of the matrix cell.

             0 = 7 x 10 (Default)
             2 = 5 x 10
             3 = 6 x 10
             4 = 7 x 10

Pw   Specifies the screen width.

             0 = 80 columns (Default)
             1 = 80 Columns
             2 = 132 Columns

Pt   Specifies whether the font is a text font or a full-cell font. A full-cell font can address the pixels in a cell individually, while text fonts may not.

             0 = Text (Default)
             1 = Text
             2 = Full-Cell (not used)

{   Signals the end of the parameter characters and starts a download function.

name   Defines the character(s) that will be the name of
              the soft character set. This name is used later to
              invoke the character set. (Refer to "Designate
              Character Set" earlier in this chapter.)

Sxbp1...   These represent the sixel bit patterns that were
              created through the "Defining a Character Set"
              process. Each group of ASCII characters is
              separated by a semi-colon. Bit patterns are
              represented as follows:

                  bp/bp

              The first bp is the upper half of the converted
              pixel, and the second bp is the lower half. They
              are separated by a slash (/) character.

ST   Marks the end of the character set definition. In
              7-bit mode, ESC \ is used.

The following example defines the '!' character code as an ohm
symbol. (The character must be designated and invoked before
proceeding with this sequence.)

    DCS Ø ; 1 ; 1 ; Ø ; Ø ; Ø { sp @ O g C C C g O / A A @ ? @ A A ST

The DCS process may be aborted when it receives an ESC argument.
In addition, CTRL X (CAN) and CTRL Z (SUB) control characters always
abort the DCS process, regardless of when they are entered.

When the terminal is processing an escape command of any other
form, imbedded single character control codes are executed, and then
the escape processor continues.

Clear Character Set. A soft character set can be cleared with the
following command:

    DCS 1;1;2 { sp @ ST

It can also be cleared in Set-up through the Recall or Default
functions. A hard reset also clears the character set.

CONTROL SEQUENCE FUNCTIONS

The CIT224 has two modes of software compatibility: ANSI mode and VT52 mode. Control sequences are divided according to whether they are ANSI or VT52.

This section describes and specifies the control functions that are performed when a valid control sequence is received by the terminal. Together with the CØ and C1 control characters and the control sequences used to define, designate, and invoke character sets, these transmitted codes represent the capabilities of the CIT224.

The control sequences are divided into functional groups. The mnemonics within each group are in alphabetical order. Where applicable, the 8-bit representation is shown rather than the 7-bit equivalent.

Set Operating Modes

The CIT224 has four major operating modes: VT2ØØ 7-bit, VT2ØØ 8-bit, VT1ØØ and VT52. These modes can be invoked using Set-Up or by using the control sequences listed below.

Operating mode sequences should be inserted in the beginning of each program that requires a special mode or proper operation, or that needs automatic conversion from 8-bit to 7-bit or vice versa. The mode should usually be reset to the standard operating mode at the end of the program.

Set VT2ØØ 7-Bit Mode.

CSI62;1"p

Sets the terminal for VT2ØØ, 7-bit compatibility. If 8-bit parity is selected, both 7- and 8-bit control codes are accepted by the terminal. All of the character sets of the CIT224 are accessible in this mode. This is the factory default mode.

Set VT2ØØ 8-Bit Mode.

CSI62"p   or
CSI62;Ø"p   or
CSI62;2"p

Sets the terminal for VT2ØØ, 8-bit compatibility. If 8-bit parity is selected, both 7- and 8-bit control codes are accepted by the terminal. All of the character sets of the CIT224 are accessible in this mode.

Set VT100 Mode.

CSI61"p

Sets the terminal for VT100 compatibility. This mode is restricted to 7-bit control codes. User-defined keys may be accessed if set through the Keyboard Enhancements Set-Up menu. All of the character sets of the CIT224 are accessible, except the Supplemental Character set.

Set VT52 Mode.

CSI?2l

Resets the terminal to respond to private DEC VT52 sequences only. This mode is restricted to 7-bit control codes.

Set C1 Control Code Transmission.

ESCspF

Translates 8-bit C1 control codes to their equivalent 7-bit codes for transmission to the host. This sequence is valid in VT200 mode only.

ESCspG

Does not translate 8-bit C1 control codes into their equivalent 7-bit codes. C1 control codes remain 8-bit upon transmission to the host. This sequence is valid in VT200 mode only.

Terminal Modes

The CIT224 has a variety of features that offer the user a choice of one of two states at any one time. These two state features are called terminal modes and have a "set" or asserted state and a "reset" or base state. For some terminal modes the set state is an "on" condition and the reset state is an "off" condition. For other terminal modes the set state is one "on" condition and the reset state is another "on" condition.

Many of these terminal modes are also selectable through Set-Up, and can be "locked" by the operator, preventing the host computer from changing the condition.

> **NOTE:** The last character in all of the reset modes listed in this section is a lowercase letter "L" (Hex value 6CH).

Several features may be set at the same time using a string in the following format:

        CSIPs;Ps;Psh   or   CSIPs;Ps;Psl   (ANSI SEQUENCES)

        CSI?Ps;Psl   or   CSI?Ps;Psh   (PRIVATE SEQUENCES)

where Ps is the selective parameter(s) that follows CSI or CSI ? and precedes the final characters h or l.

    For example:

            CSI4;20h

places the terminal in insert mode and causes a received LF, FF or VT code to move the cursor to the first position on the next line.

    NOTES: Sequences ending with l cannot be in the same string
            with sequences ending with h.

            Private sequences, (denoted by the ? as the second
            character) cannot be mixed with ANSI-standard
            sequences.

Auto Repeat Mode.

    Set Auto Repeat Mode   CSI?8h
    Reset Auto Repeat Mode   CSI?8l

    In the set state, any key (except HOLD SCREEN, PRINT SCREEN, SET-UP, DATA/TALK, BREAK, CTRL, SHIFT, COMPOSE CHARACTER, and RETURN) when held down for more than 1/2 second automatically repeats until that key is released. In the reset state, no keys repeat.

Auto Wrap Mode.

    Set Auto Wrap Mode   CSI?7h
    Reset Auto Wrap Mode   CSI?7l

    In the set state, any characters received when the cursor is at the right margin are moved to the start of the next line. A scroll is performed if necessary and allowed. In the reset state, any character received when the cursor is at the right margin replaces the character at that position. The tab character does not move the cursor to the next line.

Character Insert/Replace Mode.

    Set Insert Mode   CSI4h
    Reset Replace Mode   CSI4l

    When Insert mode is set, characters are added to the line at the
cursor position with remaining characters shifted right. Any
characters shifted into the margin are lost, unless auto wrap mode is
set. When reset to Replace mode the added characters replace the
character at the cursor position.

Character Set Mode.

    Set National Mode   CSI?42h
    Reset Multinational Mode   CSI?42l

    In National Mode 7-bit characters of the NRC sets are generated.
In Multinational mode 8-bit characters from the Supplemental Character
Set and 7-bit characters from the ASCII character set are generated.

Column Mode.

    Set to 132 Column Mode   CSI?3h
    Reset to 80 Column Mode   CSI?3l

    In the set state, the screen displays 132 columns. In the reset
state the screen displays 80 columns. These sequences erase the screen
and move the cursor to the home position. The scrolling region is set
for full screen (24 lines), unless maintain screen bit is set.

Cursor Key Application Mode.

    Set Cursor Key Application Mode   CSI?1h
    Reset to Cursor Key Mode   CSI?1l

    This mode is effective only when the terminal is in ANSI mode.
With Cursor Key Application Mode set, the four cursor control keys
send special user interpretable functions. When in the reset state,
the cursor control keys send ANSI cursor control commands. Refer to
Table 3-2 in Chapter 3.

Cursor Origin Mode.

    Set Cursor Origin Mode   CSI?6h
    Reset Cursor Origin Mode   CSI?6l

    In the set state, the cursor home position is the upper left
character position within set margins, and screen addresses are
relative to that position. The cursor cannot go beyond the scrolling
region.

In the reset state the cursor home position is the upper left character position of the display, regardless of where margins are set. The cursor is moved out of the scrolling region through the cursor position control sequence. This mode does not affect the Erase within Screen control sequences.

Keyboard Action Mode.

    Set Keyboard Action Mode   CSI2h
    Reset Keyboard Action Mode   CSI2l

The set state disables the keyboard and prevents data entry. The 'WAIT' LED lights up and keyclick is disabled. The keyboard can be enabled by performing a reset in Set-Up mode; or the host can send the reset mode command CSI2l to unlock the keyboard (unless it has been locked by an XOFF).

Keypad Application Mode.

    Set Keypad Application Mode   ESC =
    Reset Keypad Numeric Mode   ESC >

In Keypad Application Mode, the numeric keypad transmits the appropriate ANSI or VT52 mode control sequences as selected. In Keypad Numeric Mode, the numeric keypad transmits numeric characters, a comma, period and minus sign. The PF1 through PF4 keys generate control functions.

Line Feed-New Line Mode.

    Set New Line Mode   CSI2Øh
    Reset Line Feed Mode   CSI2Øl

In the New Line mode, a line feed (LF), form feed (FF), or vertical tab (VT) code causes the active position to be moved to the first position on the next line. The RETURN key generates a carriage return (CR) followed by a line feed (LF) each time it is pressed. The ENTER key generates the same code as RETURN when the numeric keypad is in Keypad Numeric Mode.

In the Line Feed Mode (reset mode), a line feed (LF), form feed (FF), or vertical tab (VT) code causes the active position to be moved to the next line, but remain in the same column position. The RETURN key generates a carriage return (CR) code only. The ENTER key generates the same code as RETURN when the numeric keypad is in Keypad Numeric Mode.

Print Extent Mode.

Set Print Extent Mode	CSI?19h
Reset Print Extent Mode	CSI?19l

When set, the entire screen is printed during a print screen. When reset, only the scrolling region is printed.

Print Form Feed Mode.

Set Print Form Feed Mode	CSI?18h
Reset Print Form Feed Mode	CSI?18l

When set, the form feed (FF) character is selected as the print termination character. A form feed is performed after a print screen function. When reset, the printer does not perform a form feed.

Screen Mode.

Set Reverse Screen Mode	CSI?5h
Reset Normal Screen Mode	CSI?5l

In the set state the screen is reversed, displaying dark characters on a light background. In the reset state the screen displays light characters on a dark background. This feature may be locked by the user in Set-Up.

Scrolling Mode.

Set Smooth Scroll Mode	CSI?4h
Reset Jump Scroll Mode	CSI?4l

In the set state the display scrolls smoothly at a maximum rate of six lines per second. The parameters for the scrolling rate (1 or 2 lines) or speed can be set in Set-Up mode. (Refer to the Display Enhancements menu in Chapter 4.)

In the reset state the new lines are added to the display as fast as they are received, thus causing a 'jump' affect.

Send-Receive Mode.

Set Send-Receive Mode	CSI12h
Reset Send-Receive Mode	CSI12l

When set, characters are sent directly to the host from the keyboard and are displayed only when sent back (or echoed) from the host. When reset, characters transmitted to the host are displayed on the screen automatically.

Text Cursor Enable Mode.

| Set Visible Cursor Mode | CSI?25h |
| Reset Invisible Cursor Mode | CSI?25l |

In the set state the cursor is visible, and in the reset state the cursor is invisible.

Cursor Control Sequences

The CIT224 supports a variety of cursor commands that position the cursor, scroll the display up and down, and select a variety of cursor styles.

Relative Cursor Positioning.

Move Cursor Up	CSIPnA
Move Cursor Down	CSIPnB
Move Cursor Right (forward)	CSIPnC
Move Cursor Left (backward)	CSIPnD

Pn is the number of rows or columns to move the cursor. The default value is 1. If no value for Pn is entered, the cursor moves one row or one column as appropriate. When the cursor reaches any margin (left, right, top, or bottom) it will stop there.

Direct Cursor Positioning.

Position Cursor	CSIPn;PnH
	or
	CSIPn;Pnf

Directly positions the cursor at the location given. The first Pn specifies the row number and the second Pn specifies the column number where the cursor is to be positioned. Default values are each 1. The home position may be the first row, first column. (The set/reset state of the Cursor Origin Mode affects the line and column numbers.)

Scroll Direction.

| Index | ESC D (IND, 84H) |
| Reverse Index | ESC M (RI, 8DH) |

Index moves the cursor down one line without changing the column position. Reverse Index moves the cursor up one line in the same column. These moves cause scrolling when the top or bottom margins are encountered.

Next Line.

Next Line   ESC E   (NEL, 85H)

Moves the cursor to the first position on the next line down. When the cursor reaches the bottom margin, the screen scrolls up.

Save and Restore Cursor and Attributes.

Save Cursor and Attributes   ESC 7
Restore Cursor and Attributes   ESC 8

Saves and restores the cursor position, video attributes, and the following states of the cursor: wrap flag, origin mode, selective erase and character set shift.

Tabulation

Horizontal tabulation stops may be individually set or cleared at the current cursor position or cleared altogether.

Set Horizontal Tab.

Set Tab Stop   ESC H   (HTS, 88H)

Sets a tab stop at the current column position.

Clear Tab(s).

Clear Tab Stops   CSIPsg

                          Ps = Ø   Clear Tab Stop at current column
                               3   Clear all Tab Stops

The default value is Ø. If no value is entered, the tab is cleared at the current column position.

Width/Height Line Commands

These commands allow the user to select double- or single-height and double- or single-width characters on a line at a time basis. Double-width decreases the number of characters on a line by 5Ø%. The cursor determines which line is affected by these commands.

Double-height, double-width top   ESC#3
Double-height, double-width bottom   ESC#4
Single-height, single-width (normal)   ESC#5
Single-height, double-width   ESC#6

```
Double-height, single-width top        ESC#:
Double-height, single-width bottom      ESC#;
```

These commands change the line the cursor is on to the indicated
format. Full double-height characters require that the same line be
repeated with the first line in the top format and the second line in
the bottom format.

Changing a line to double-width causes any characters to the right
of the center of the screen to be lost. If the cursor is to the left
of center screen, its position does not change; if it is to the right
of center screen, the cursor moves to the right margin.

When lines on the screen are moved by scrolling, the attribute
moves with the line.

If a line is erased with an Erase within Screen command (CSIJ),
the line attribute returns to the normal setting of single-height,
single-width.

Select Graphic Rendition

Select Graphic Rendition (SGR) affects the visual attributes of
the characters displayed. The SGR sequences, for example, allow you to
display blinking, underlined or reverse video characters.

```
Set Graphic Rendition               CSIPs;Ps;Psm
```

Valid parameters (Ps) are:

```
Ø  = All attributes off
1  = Bold intensity
4  = Underline
5  = Blinking
7  = Negative (reverse) image
22 = Normal intensity
24 = Not underlined
25 = Not blinking
27 = Positive (normal) image
```

The default value is zero (Ø). If no value is entered, all
characters received will be normal video with no other attributes set.
The current attribute settings apply to all succeeding characters
displayed until new attributes are set.

When using the SGR command, you may select one or several graphic
attributes by entering several parameters in the string separated by a
semicolon (;) (3BH). When selecting a single parameter, no semicolon
is needed. For example, to select reverse image only, enter the
following:

```
CSI7m
```

When using several SGR parameters, they are executed in sequence. For example, if both the blinking and the bold attributes are invoked, the characters that follow will first blink, and then blink in bold:

CSI5;1m

Editing Commands

Editing commands are used to insert and delete characters and lines of characters. The cursor position remains constant when executing these commands.

NOTE: Pn is an ASCII-coded numeric variable. If Pn is not entered or is zero, then Pn assumes the value of one.

Insert/Delete Line.

Insert Line   CSIPnL
Delete Line   CSIPnM

The insert sequence inserts Pn lines starting at the active position. Any data below the active position moves down, and the cursor moves to column one. Any data moved off the screen is lost. If the cursor is outside the defined scrolling region, the command is ignored.

The delete sequence deletes Pn lines starting at the active position. The data below the deleted lines scroll up and blank lines are added to the bottom of the screen. The cursor moves to column one. The terminal ignores the command if the cursor is outside the defined scrolling region.

Insert/Delete Character.

Insert Character   CSIPn@
Delete Character   CSIPnP

The insert character command adds Pn blank spaces at the cursor position. Data on the line shifts to the right starting at the cursor position. Any characters that go beyond the right margin are lost. A Pn value of zero or one adds one blank character. If Pn is not entered, a value of one is assumed.

The delete character command deletes Pn characters, starting at the cursor position. The characters to the right of the cursor shift to the left, and a space is inserted at the right margin for each character that is deleted. A Pn value of zero or one deletes one blank character. If Pn is not entered, a value of one is assumed.

Erase Control Sequences

The CIT224 supports a variety of erase commands that can erase characters from the cursor to the beginning or end of the current line, or entire display or scrolling region. Any characters that are erased are lost. The cursor remains at its current position when erasing characters or lines.

Character attributes are erased with the character unless the Selective Erase Attribute (non-erasable character) is on. The control sequences for erasing within the screen and line are grouped with the attributes protected and unprotected. The following commands describe the various erase sequences.

Set Erase Character.

Set Erase Character   CSIPns
                                           or
                                           CSI>Pns

Selects a specific character (Pn = decimal value of character) used to erase fields. The default value is a space.

Erase Character(s).

Character(s)   CSIPnX

Erases the character at the active position and other following characters, according to the parameter (Pn). The active position is unchanged. A numeric parameter of Ø or 1 indicates that one character is erased. A numeric parameter (Pn) indicates that (Pn) characters are erased. For VT2ØØ mode only.

Selective Erase Attribute.

CSIPs"q

Ps = Ø   Attribute off (erasable)
     1   Non-erasable character (attribute on)
     2   Erasable character (attribute off)

When the Selective Erase Attribute is on, any characters typed remain intact when the Erase within Line or Erase within Screen commands are entered. Enter the command with a Ps value of 1 at the beginning of the data string to be protected. At the end of the protected text, enter the command with a Ps value of Ø or 2 to turn the attribute off. (VT2ØØ modes only)

Erase Screen/Line: Attributes Protected.

The following sequences erase "erasable" characters, but do not affect video character attributes or video line attributes set through Select Graphic Rendition sequences described earlier in this chapter. If a parameter value is not entered, the sequence defaults to zero. (VT200 modes only)

Erase within Screen.

CSI?PsJ   Valid parameters (Ps) are:

                 0 = Erase from cursor to end of screen
                 1 = Erase from top of screen to cursor
                 2 = Erase entire screen

Erase within Line.

CSI?PsK   0 = Erase from cursor to end of line
                 1 = Erase from start of line to cursor
                 2 = Erase entire line   *

Erase Screen/Line: Attributes Unprotected.

The following sequences erase characters and return line attributes to single-height, single-width. Video attributes set through Select Graphic Rendition sequences are lost. If a parameter value is not entered, the sequence defaults to zero.

Erase within Screen.

CSIPsJ   Valid parameters (Ps) are:

                 0 = Erase from cursor to end of screen
                 1 = Erase from top of screen to cursor
                 2 = Erase entire screen

Erase within Line.

CSIPsK   0 = Erase from cursor to end of line
                 1 = Erase from start of line to cursor
                 2 = Erase entire line

Scrolling Region

The scrolling region control sequence affects the size of the scrolling area. The area is defined by setting top and bottom margins as follows:

Set Scrolling Region   CSIPn;Pnr

The first parameter value is the top margin and the second is the bottom. The default is the entire screen. Note that the topmost display line is designated line 1.

The bottom margin must be at least one greater than the top margin. If the bottom parameter is out of range, that is, with a number greater than 24, the entire command is ignored.

Print Commands

The CIT224 printing functions are selectable via control sequences. When the terminal prints characters on the screen, it ignores terminal and printer tab stops and accepts space characters. The terminal transmits a CR and LF, VT, or FF at the end of each line.

The printer status should be checked using the printer status report (DSR) before selecting a print operation. Refer to Reports later in this chapter.

Print Cursor Line.

Print the cursor line   CSI?1i

The line with the active position is printed. The active position does not move.

Print Screen.

Print Screen   CSIi   or   CSIØi

The entire screen (or the defined scrolling region) is printed as defined by the Print Extent Mode. Depending on the setting of the Print Form Feed Mode, either a form feed is added to the data printed by the Print Screen command, or nothing is added.

Auto Print Mode.

Auto Print On   CSI?5i
Auto Print Off   CSI?4i

When Auto Print Mode is on, a line on the screen is printed when the cursor is moved to the next line by a FF, LF, VT, or autowrap. In autowrap mode, as the cursor moves off the line the completed line of data is printed.

When Auto Print is disabled, the terminal defaults to normal print mode.

Printer Controller Mode.

    Printer Controller On   CSI5i
    Printer Controller Off   CSI4i

When Printer Controller is on, the host computer has direct control of the printer. All characters received by the terminal are sent directly to the printer (except NULL, XON, XOFF, DEL, CSI5i and CSI4i); they are not written to the screen. In this mode, keyboard entries can still be transmitted to the host.

The Printer Controller Mode can be entered from Auto Print Mode.

CIET Private Printer Commands.

The following CIET Private Printer commands are blocked (will not have any effect) while in the DEC printer mode.

            ESC#0   -   Enter Auto Auxiliary Mode
            ESC#1   -   Exit Auto Auxiliary or Concurrent Print Mode
            ESC#2   -   Output cursor line to Auxiliary
            ESC#7   -   Output page to Auxiliary

            ESC0   -   Enter Concurrent Auxiliary Mode
            ESC1   -   Enter Auxiliary Control Mode
            ESC2   -   Exit Auxiliary Control Mode

This block is toggled by the set-up feature 'CIT101 or DEC220' Print Features field in the Aux Port Enhancements menu (see Chapter 4).

Note that the equivalent DEC printer commands (for example; 'CSI?5i' for Enter Auto Auxiliary Mode) WILL ALWAYS be accepted regardless of the set-up feature setting. ONLY those CIET commands listed above are blocked, and only in the 'DEC220' printer command mode.

25TH ROW STATUS LINE

The CIT224 supports a selectable host controlled status line displayed as a 25th display row. This status line is controlled completely by the host computer and is used as an independent data line. Data and visual attributes may be written to this line beginning at a specified column number. However, line attributes for variable character sizes are not allowed within the status line.

To enable the 25th row status line feature, select 'Status Line On' in the Display Enhancements Set-Up menu.

The format to write data to the status line is as follows:

```
DCS Pn1;Pn2;Pn3;PnN Q Data ST        (8-bit mode)
ESC P Pn1;Pn2;Pn3;PnN Q Data ESC \   (7-bit mode)
```

where:

Pn1   specifies extent that the status line is cleared.

                    None = Clear entire line (default)
                       Ø = Clear entire line
                       1 = Clear line beginning where defined

            NOTE: A CTRL REMOVE key combination clears the
                    status line also.

Pn2   represents the beginning column number in the status
                line. The range is 1 to 80/132. The default is 1.

Pn3,PnN   represents the byte or bytes describing the video
                attributes to be written.

Q   represents a terminator

Data   Data to be written, represented by Hex pairs, where two
                ASCII characters in the range Ø through 9 and A through
                F represent one binary number. The binary number is used
                as an absolute character address:

                    ØØ through 1F displays the CØ control set
                    2Ø through 7F displays GL characters
                    8Ø through 9F displays the C1 control set
                    AØ through FF displays GR characters

An example of a status line control sequence is shown below.

```
DCS Ø;1;7;4 Q 48656C6C6F2C2Ø49276D2Ø612Ø434954323234 ST
```

where:

```
            Ø = clear entire status line
            1 = start at column 1
            7 = reverse image
            4 = underline
            Q = terminator
Data string = 'Hello, I'm a CIT224'
         ST = DCS terminator
```

The length of the data string is determined by the mode of the terminal, either 8Ø or 132 columns. Data strings in excess of this length will be overwritten in the last character position. The current cursor position and attributes are saved on entry to the status line routine and restored on exit.

USER-DEFINED KEYS (UDK'S)

An added feature of the CIT224 is the capability to program function keys with user-defined key sequences. Function keys F6 through F2Ø are programmed through User-Defined Key (UDK) device control strings, or through the Function Key Editor page in Set-Up mode (see Chapter 4). This feature is available in VT2ØØ modes and may be accessed in VT1ØØ mode through the 'F6-F2Ø VT1ØØ Mode' parameter in the Keyboard Enhancements menu. UDK's are not operable in VT52 mode.

A total of 45 user-defined key sequences may be accessed through the use of the SHIFT, CTRL, and CTRL & SHIFT keys combined with the physical function keys F6 through F2Ø. These combinations provide the following extensions:

```
SHIFT F-Key:        F6 - F2Ø
CTRL  F-Key:        F21 - F35
CTRL SHIFT F-Key:   F36 - F5Ø
```

The extended keys F21 through F5Ø do not provide default sequences and do not output codes if they are not specifically programmed.

The function keys have a total of 256 bytes of volatile memory available that can be allotted to one key or several keys. Once that space is used up, no more function keys may be redefined until some space is made available. The amount of space available for redefinition of keys is monitored by the host computer and the Function Key Editor Page.

To free up space, you may:

· redefine a key definition with a shorter sequence,
· clear a key with a UDK device control string, or
· clear all UDK's by setting the 'UDK' parameter in the Keyboard Enhancements Set-Up menu to 'Volatile', and then do a hard reset or Recall operation.

NOTE: If power to the terminal is turned off, UDK key
definitions are lost if they have not been saved
through the 'UDK:NVR' field in the Keyboard
Enhancements menu.

The format for down-line loading a user-defined key device control
string is as follows:

```
DCS Pc;P1 | Kyn/stn;...;Kyn/stn ST        (8-bit mode)
ESC P Pc;P1 | Kyn/stn;...;Kyn/stn ESC \   (7-bit mode)
```

where:

DCS   indicates the beginning of the device control string. In
                7-bit mode it is expressed as ESC P.

Pc   (Clear Parameter) specifies whether or not all function
                keys will be cleared when down-line loading the keys. Valid
                entries are:

                Ø or
                none = Clear all keys before loading each specific key as
                       it is encountered in the DRCS.

                   1 = Clear only values where new values are defined. This
                       redefines some keys without the necessity of
                       reloading all of them.

                If the parameter is set to 1, keys are cleared and loaded
                in turn. If the remaining total byte capacity of all the
                keys is less than the bytes required by the new data being
                entered, your key loading sequence may fail because of
                insufficient space. To avoid this problem, load the key
                whose old data content is greatest before any others.

P1   (Lock Parameter) specifies whether or not key values are
                locked after they are loaded. It is separated from the
                Clear Parameter by a semicolon (;). Valid entries are:

                Ø or
                none = Lock the keys against future redefinition

                   1 = Do not lock the keys against redefinition

                If the keys are locked, they must be unlocked in Set-up
                ('User Defined Keys Unlocked,' General Set-Up menu) before
                another device control string can change their definitions.

                The Vertical Bar designates this as a control string (as
                opposed to a control function for defining soft character
                sets).

Kyn/stn   (Key Definition String) consists of a Kyn (key number),
               a slash (/), and an Stn (string parameter). Kyn is the
               value of the function key to be redefined. Stn is the data,
               expressed in hexadecimal values, to be transmitted by the
               function key.

               Valid entries for Kyn values are:

Key	Kyn Value	Key	Kyn Value	Key	Kyn Value
F6	17	F21	37	F36	57
F7	18	F22	38	F37	58
F8	19	F23	39	F38	59
F9	20	F24	40	F39	60
F10	21	F25	41	F40	61
F11	23	F26	43	F41	63
F12	24	F27	44	F42	64
F13	25	F28	45	F43	65
F14	26	F29	46	F44	66
HELP	28	F30	48	F45	68
DO	29	F31	49	F46	69
F17	31	F32	51	F47	71
F18	32	F33	52	F48	72
F19	33	F34	53	F49	73
F20	34	F35	54	F50	74

               The string parameters (Stn's) are hexadecimal pairs in the
               range of 30H through 39H (0-9), 41H through 46H (A-F) and
               61H through 66H (a-f). When these hex values are combined,
               they represent an 8-bit quantity. Several definitions can
               be entered in one key by separating each value with a
               semicolon.

ST   (String Terminator) (9CH) signals the end of the DCS
               string. In 7-bit mode, this is expressed as ESC \.

     When a Device Control String is used to program user-defined keys,
and encounters an ESC character in an 8-bit environment, the DCS
process is aborted. In addition, the CTRL X (CAN) and CTRL Z (SUB)
control codes always abort the DCS process, regardless of when they
are entered.

     When the terminal is processing an escape command of any other
form, imbedded single character control codes are executed, and then
the escape processor continues.

     An aborted down-load process locks the keys and saves the
parameters already loaded. The balance of the sequence is sent to the
screen. If an invalid DCS hex pair is encountered in the string, the
down-load process is aborted.

Examples:

To clear keys, send the following string:

DCS0;1¦ST

The default value of each key is empty (blank). When the keys are cleared, they are set back to the empty condition.

To lock keys, send the following string:

DCS1;0¦ST

Keys should be locked to prevent a breach of security at the terminal and in the computer system.

To define key F10 to display the word "TERMINAL" when pressed, and to do this without clearing values in any other keys, the string would begin:

DCS1;1¦21/

The 21 after the vertical bar (¦) identifies key F10 as the key to be redefined. The encoding for "TERMINAL" (in Hex) is:

```
            54 45 52 4D 49 4E 41 4C
    T  _____|  |  |  |  |  |  |  |
    E  _____|  |  |  |  |  |  |
    R  _____|  |  |  |  |  |
    M  _____|  |  |  |  |
    I  _____|  |  |  |
    N  _____|  |  |
    A  _____|  |
    L  _____|
```
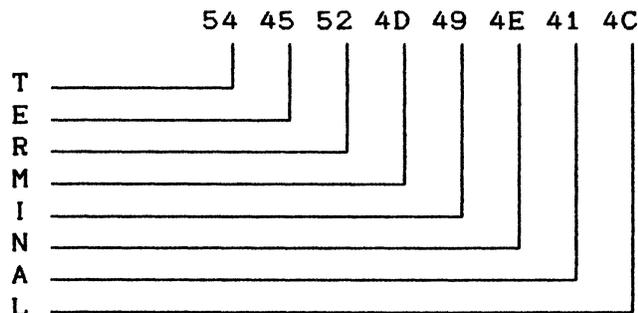
Thus, after the slash character (/), continue with this string:

5445524D494E414CST

The ST (9CH) specifies the end of the string.

By finding the hexadecimal equivalent of any of the control functions discussed earlier in this chapter, a function key could perform those functions by down-line loading the control sequence.

REPORTS

A report is a character sequence sent from the terminal to the host in response to a request from the host computer. Terminal identification, parameters and status are transmitted in the reports. The response of the terminal depends on the terminal ID set-up parameter in the General Set-Up menu.

Request Device Attributes   CSI c or CSI Ø c

    Response with Attributes (VT22Ø ID)   CSI ? n;n;...n c

n is the parameter for specific attributes. The terminal's default response is:

    CSI ? 62;1;2;6;7;8;9 c

where 62 = Service class 2 terminal
      1 = 132 column mode
      2 = Printer port
      6 = Selective erase
      7 = Soft character set
      8 = User-defined keys
      9 = Supports 7-bit NRC sets

If the terminal ID is set to something other than VT22Ø, the following responses apply.

    Response (VT1ØØ ID)   ESC[?1;2 c

    Response (VT1Ø1 ID)   ESC[?1;Ø c

    Response (VT1Ø2 ID)   ESC[?6 c

Request Secondary Device Attributes   CSI > c or CSI > Ø c

    Response with Attributes   CSI > 1;Pv;Po c

where 1 = Terminal ID code
     Pv = Firmware version
     Po = Options installed

An example follows:

    CSI>1;2Ø;Øc

which means: I am a VT22Ø, version 2.Ø, and have no options.

NOTE: If Printer Controller mode is set, the following requests
        go to the printer rather than to the terminal. However,
        the printer is not able to respond to the request.

Request for Terminal Status   CSI 5n

    Response that terminal is OK   CSI 0n
    Response that terminal is not OK   CSI 3n

Request for Cursor Position   CSI 6n

    Response with cursor position   CSI Pv;Ph R

where Pv = The vertical position (line number)
      Ph = The horizontal position (column number)

Request for Printer Status   CSI ?15n

    Response :

        Printer is ready   CSI ?10n
        Printer is not ready   CSI ?11n
        There is no printer   CSI ?13n

NOTE: Before a print command is entered it is necessary to
        determine the printer status.

Request for UDK Status   CSI ?25n

    Response:

        UDK keys are unlocked   CSI ?20n
        UDK keys are locked   CSI ?21n

Request for Keyboard Language   CSI ?26n

    Response: CSI ?27;Pn n

where Pn =   1   North American
             2   British
             3   Flemish
             4   Canadian (French)
             5   Danish
             6   Finnish
             7   German
             8   Dutch
             9   Italian

```
        10   Swiss (French)
        11   Swiss (German)
        12   Swedish
        13   Norwegian
        14   French (Belgian)
        15   Spanish
```

<u>Request for Terminal Parameters</u>   CSI\<so1\>x

<u>Parameter</u>	<u>Value</u>	<u>Meaning</u>
\<so1\>	Ø or none	This sequence is a report request and the terminal may send unsolicited reports. An unsolicited report is sent when the terminal exits SET-UP mode.
	1	This sequence is a report request and the terminal may send reports only when requested (default condition when the terminal is powered on).

Response:

CSI\<so1\>;\<par\>;\<nbits\>;\<xspeed\>;\<rspeed\>;\<clkmul\>;\<flag\>x

<u>Parameter</u>	<u>Value</u>	<u>Meaning</u>
\<so1\>	2	This message is an unsolicited report.
	3	This message is a report sent on request.
\<par\>	1	Parity is not set.
	4	Parity is odd.
	5	Parity is even.
\<nbits\>	1	Serial data characters are 8 bits long.
	2	Serial data characters are 7 bits long.
\<xspeed\>	8	Transmit rate is 75 Baud.
	16	Transmit rate is 110 Baud.
	32	Transmit rate is 150 Baud.
	48	Transmit rate is 300 Baud.
	56	Transmit rate is 600 Baud.
	64	Transmit rate is 1200 Baud.
	88	Transmit rate is 2400 Baud.
	104	Transmit rate is 4800 Baud.
	112	Transmit rate is 9600 Baud.
	120	Transmit rate is 19200 Baud.

<rspeed>	8	Receive rate is 75 Baud.
	16	Receive rate is 110 Baud.
	32	Receive rate is 150 Baud.
	48	Receive rate is 300 Baud.
	56	Receive rate is 600 Baud.
	64	Receive rate is 1200 Baud.
	88	Receive rate is 2400 Baud.
	104	Receive rate is 4800 Baud.
	112	Receive rate is 9600 Baud.
	120	Receive rate is 19200 Baud.

<clkmul>   1   Bit rate multiplier is 16.

<flags> 0000 to 1111   Decimal encoded binary value as set by
                         the parameter report flag through the
                         General Enhancements Set-Up menu.

<u>Request Identification</u>   ESC Z

This sequence is used in some applications programs. A primary DA
response is generated to the host upon receipt at the terminal.
However, it is not recommended that this sequence be used.

RESETTING THE TERMINAL

The terminal may be reset to its initial power-on state through a
'hard' reset escape sequence. To reset values stored in volatile
memory, a 'soft' reset escape sequence is available.

Resets can also be performed through the Set-Up Directory menu.
'Reset Terminal' performs a 'soft' reset, and 'Recall' performs a
'hard' reset.

Hard Terminal Reset

ESCc

The Hard Terminal Reset command (also called Reset-To-Initial
State [RIS]) returns the terminal to the initial power-on state. This
command can be entered from the terminal or from the host computer.
Any values changed in Set-Up or through a programming command are
returned to the values stored in non-volatile memory, or to the
terminal default values.

Turning the terminal off and then on again also performs a hard
terminal reset. The reset also performs the following functions:

· Disconnects the communications line
· Clears UDK's (UNLESS SAVED IN NVR)
· Clears any soft character set
· Homes the cursor and clears the screen
· Sets the video attributes to normal

• Sets the Selective Erase Attribute to non-selective erasable
• Sets all character sets to the default

The ESCc sequence should be used with caution since parity and baud rates set after power-up are stored in temporary volatile memory and will be lost.

Soft Terminal Reset

         CSI!p

The Soft Terminal Reset command replaces certain values that have been changed in Set-Up or by a programming command as listed in Table 5-6. Some replacement values vary depending on the terminal mode. Soft reset values ignore any values stored in non-volatile memory.

A soft reset can be invoked by the host using the control sequence, but only when the terminal is in VT200 mode.

Table 5-6.   Soft Reset States

SOFT RESET STATE		
Function/Mode	Reset State	Saved in NVR
Autowrap	Off	Yes
Character Sets	Terminal mode default set(s)	No
Cursor	Visible	Yes
Cursor Attributes *		No
Position	Home	
Character Sets	Terminal Mode Default	
Selective Erase Attribute	Off	
Visual Attributes	Normal	
Origin Mode	Normal	
Character Shift	Power-up Defaults	
Cursor Key Mode	Normal	No
Insert/Replace	Replace	No
Keyboard Lock	Unlocked	No
Keypad Mode	Numeric	No
Multinational/ National **	Multinational	Yes
Origin Mode	Absolute	No
Scrolling Margins	Top: 1, Bottom: 24	No
Selective Erase Attributes	Normal (Erasable)	No
Video Attributes	Normal	No

* Applies to subsequent restore cursor commands only.

** This mode is not reset by the 'Reset Terminal' parameter
in the Set-Up Directory menu.

SELF-TEST DIAGNOSTICS

The CIT224 contains self-test diagnostic firmware which may be
used to verify terminal operation and to assist in isolating
malfunctions. The basic self-test is automatically performed whenever
the terminal is turned on or reset. Diagnostic tests may be initiated
either by the operator or the host computer.

The Field Service manual should be consulted for detailed
instructions in the use of these commands.

Specific self-tests are initiated by receiving the control
sequence:

        CSI4;Ps;...;Psy

where Ps is a parameter chosen for the desired test(s) as follows:

Parameter	Functions Tested
1	Same as power up: ROM, NVR, RAM
2*	Dual Channel loop back; Communications Channel to Auxiliary Channel
4**	EIA loop back
8	Continuous testing of selected functions

 * Requires Dual Port Loop Back Connector
** Requires EIA Loop Back Connector

To perform more than one diagnostic at a time, separate the
parameters by a semicolon. The tests are not always executed in the
order in which they are entered.

Error Messages

The diagnostics indicate detected errors to the user in the form
of an on-screen message in the upper left corner of the display. At
the same time, a coded message is provided by three of the LED
indicators (HOLD SCREEN, CAPS LOCK and COMPOSE), if an error is
detected in the power-up self-test.

When the executed test is passed the screen displays the message,
"PASSED". When the executed test detects an error, the screen displays
the message, "FAILED - n", where 'n' is a numeric index. Following are
explanations of error messages.

NUMERIC INDEX	MESSAGE

Test 1:

1   ROM Checksum Error - Reports an error that occurred when the checksum stored for each program ROM (or PROM) in the main program memory was compared against the checksum computed by the diagnostic.

2   RAM Read/Write Error - Indicates that an error was detected during various read and write operations performed throughout the two 16K RAM banks in the unit.

3   NVR Checksum Error - Indicates a fault in the Non-Volatile RAM (NVR) circuitry detected by comparing the checksum stored in NVR at the time of the last SAVE operation with the checksum computed by the diagnostic. It may mean that one or more SET-UP bits or features may be altered or unstable.

Test 2:

4   Comm UART Not Ready to Transmit - The Universal Asynchronous Receiver Transmitter (UART) for the Communications channel transmit ready signal is not in the ready state.

5   Aux UART Not Ready to Transmit - The UART for the Auxiliary Channel transmit ready signal is not in the ready state.

6   No Received Data on Aux - Indicates that no data was received by the Auxiliary Channel following a transmission from the Communications Channel.

7   Data Error on Send from Comm to Aux - Indicates that data from the Communications Channel was not transmitted successfully or not received successfully by the Auxiliary Channel.

8   No Received Data on Comm - Indicates that no data was received by the Communications Channel following a transmission from the Auxiliary Channel.

9   Data Error on Send from Aux to Comm - Indicates that data from the Auxiliary Channel was not transmitted successfully or not received successfully by the Communication Channel.

Test 4:

A   EIA Test - Error on CA/CB - Indicates an error in the Ready to Send (RTS)/Clear to Send (CTS) signals.

B   EIA Test - Error on CD/CC - Indicates an error in the Data Terminal Ready (DTR)/Data Set Ready (DSR) signals.

The LED error codes are as follows:

Keyboard Indicator	Problem
HOLD SCREEN LED	Blinks if ROM error
CAPS LOCK LED	Blinks if RAM error
COMPOSE LED	Blinks if NVR error

Screen Alignment

Fill Screen with E's	ESC#8
Fill Screen with Character Assortment	ESC#9

The first control sequence fills the display with the uppercase E character, while the second control sequence repeats an assortment of characters utilizing a variety of character attributes. These commands are used for alignment and test purposes.

VT52 MODE ESCAPE SEQUENCES

The CIT224 control sequences defined below are valid in the VT52 mode of operation. CØ control codes are accepted, though some are ignored. The C1 control codes and ANSI mode control functions are not accepted. All user-defined keys are inoperable.

The auxiliary keypad control codes that are supported in VT52 mode are defined in Appendix B.

Cursor Control Sequences

Move Cursor Up	ESC A
Move Cursor Down	ESC B
Move Cursor Right	ESC C
Move Cursor Left	ESC D

Moves the cursor one row up or down, or one column left or right, as specified. The cursor does not move beyond the margin limits.

Move Cursor Home	ESC H

Moves the cursor to the home position at the upper left corner of the display.

Position Cursor	ESC Yrc

Positions the cursor to a specified row (r) and column (c). The row and column values are sent in ASCII code plus Hex 1FH. For example, row 2, column 2 is Hex 21H (1FH+2), or ESCY!!.

Erase Control Sequences

Erase to End of Line	ESC K
Erase to End of Page	ESC J

Erase the screen from the cursor to the end of the line or page as indicated.

Graphics Mode

Enter Special Graphics Mode	ESC F
Exit Special Graphics Mode	ESC G

Use the Special Graphic Character Set when in graphics mode.

Keypad Application Mode

    Enter Keypad Application Mode   ESC =
    Exit Keypad Application Mode   ESC >

    Use the special applications control sequences from the auxiliary
keypad.

Bidirectional Auxiliary Port Control

    Output Cursor Line to Printer   ESC V
    Enter Printer Controller Mode   ESC W
    Exit Printer Controller Mode   ESC X
    Output Full Screen to Printer   ESC]
    Enter Auto Print Mode   ESC ^
    Exit Auto Print Mode   ESC _

Scroll

    Reverse Line Feed   ESC I

    Moves the cursor up one row in the same column. If the cursor is
at the top margin, a scroll down is performed.

ANSI Mode

    Enter ANSI Mode   ESC <

    Exits VT52 mode and enters ANSI mode.

Request Identity

    Identify Terminal Type   ESC Z

    Requests the terminal identification.

Appendix A

CODE TABLES

		0		1		2		3		4		5		6		7	
COLUMN																	
R O W	0	NUL	0 / 0	DLE	16 / 10	SP	32 / 20	0	48 / 30	@	64 / 40	P	80 / 50	`	96 / 60	p	112 / 70
	1	SOH	1 / 1	DC1 (XON)	17 / 11	!	33 / 21	1	49 / 31	A	65 / 41	Q	81 / 51	a	97 / 61	q	113 / 71
	2	STX	2 / 2	DC2	18 / 12	"	34 / 22	2	50 / 32	B	66 / 42	R	82 / 52	b	98 / 62	r	114 / 72
	3	ETX	3 / 3	DC3 (XOFF)	19 / 13	#	35 / 23	3	51 / 33	C	67 / 43	S	83 / 53	c	99 / 63	s	115 / 73
	4	EOT	4 / 4	DC4	20 / 14	$	36 / 24	4	52 / 34	D	68 / 44	T	84 / 54	d	100 / 64	t	116 / 74
	5	ENQ	5 / 5	NAK	21 / 15	%	37 / 25	5	53 / 35	E	69 / 45	U	85 / 55	e	101 / 65	u	117 / 75
	6	ACK	6 / 6	SYN	22 / 16	&	38 / 26	6	54 / 36	F	70 / 46	V	86 / 56	f	102 / 66	v	118 / 76
	7	BEL	7 / 7	ETB	23 / 17	'	39 / 27	7	55 / 37	G	71 / 47	W	87 / 57	g	103 / 67	w	119 / 77
	8	BS	8 / 8	CAN	24 / 18	(	40 / 28	8	56 / 38	H	72 / 48	X	88 / 58	h	104 / 68	x	120 / 78
	9	HT	9 / 9	EM	25 / 19	)	41 / 29	9	57 / 39	I	73 / 49	Y	89 / 59	i	105 / 69	y	121 / 79
	10	LF	10 / A	SUB	26 / 1A	*	42 / 2A	:	58 / 3A	J	74 / 4A	Z	90 / 5A	j	106 / 6A	z	122 / 7A
	11	VT	11 / B	ESC	27 / 1B	+	43 / 2B	;	59 / 3B	K	75 / 4B	[	91 / 5B	k	107 / 6B	{	123 / 7B
	12	FF	12 / C	FS	28 / 1C	,	44 / 2C	<	60 / 3C	L	76 / 4C	\	92 / 5C	l	108 / 6C	|	124 / 7C
	13	CR	13 / D	GS	29 / 1D	–	45 / 2D	=	61 / 3D	M	77 / 4D	]	93 / 5D	m	109 / 6D	}	125 / 7D
	14	SO	14 / E	RS	30 / 1E	.	46 / 2E	>	62 / 3E	N	78 / 4E	^	94 / 5E	n	110 / 6E	~	126 / 7E
	15	SI	15 / F	US	31 / 1F	/	47 / 2F	?	63 / 3F	O	79 / 4F	_	95 / 5F	o	111 / 6F	DEL	127 / 7F

|——— CO CODES ———|——————— GL CODES (ASCII GRAPHICS) ———————|

KEY

Character	ESC	27	Decimal
		1B	Hex

Table A-1. 7-Bit Code Table (ASCII Graphics)

COLUMN								
8	9	10	11	12	13	14	15	ROW
128 80	DCS 144 90	160 A0	· 176 B0	À 192 C0	208 D0	à 224 E0	240 F0	0
129 81	PU1 145 91	¡ 161 A1	± 177 B1	Á 193 C1	Ñ 209 D1	á 225 E1	ñ 241 F1	1
130 82	PU2 146 92	¢ 162 A2	² 178 B2	Â 194 C2	Ò 210 D2	â 226 E2	ò 242 F2	2
131 83	STS 147 93	£ 163 A3	³ 179 B3	Ã 195 C3	Ó 211 D3	ã 227 E3	ó 243 F3	3
IND 132 84	CCH 148 94	164 A4	180 B4	Ä 196 C4	Ô 212 D4	ä 228 E4	ô 244 F4	4
NEL 133 85	MW 149 95	¥ 165 A5	µ 181 B5	Å 197 C5	Õ 213 D5	å 229 E5	õ 245 F5	5
SSA 134 86	SPA 150 96	166 A6	¶ 182 B6	Æ 198 C6	Ö 214 D6	æ 230 E6	ö 246 F6	6
ESA 135 87	EPA 151 97	§ 167 A7	· 183 B7	Ç 199 C7	OE 215 D7	ç 231 E7	œ 247 F7	7
HTS 136 88	152 98	¤ 168 A8	184 B8	È 200 C8	Ø 216 D8	è 232 E8	ø 248 F8	8
HTJ 137 89	153 99	© 169 A9	¹ 185 B9	É 201 C9	Ù 217 D9	é 233 E9	ù 249 F9	9
VTS 138 8A	154 9A	ª 170 AA	º 186 BA	Ê 202 CA	Ú 218 DA	ê 234 EA	ú 250 FA	10
PLD 139 8B	CSI 155 9B	« 171 AB	» 187 BB	Ë 203 CB	Û 219 DB	ë 235 EB	û 251 FB	11
PLU 140 8C	ST 156 9C	172 AC	¼ 188 BC	Ì 204 CC	Ü 220 DC	ì 236 EC	ü 252 FC	12
RI 141 8D	OSC 157 9D	173 AD	½ 189 BD	Í 205 CD	Ÿ 221 DD	í 237 ED	ÿ 253 FD	13
SS2 142 8E	PM 158 9E	174 AE	190 BE	Î 206 CE	222 DE	î 238 EE	254 FE	14
SS3 143 8F	APC 159 9F	175 AF	¿ 191 BF	Ï 207 CF	ß 223 DF	ï 239 EF	255 FF	15

|← C1 CODES →|← GR CODES (SUPPLEMENTAL GRAPHICS) →|

KEY

Character | ESC | 27 Decimal | 1B Hex

Table A-2. 8-Bit Code Table (Supplemental Graphics)

COLUMN

ROW	0		1		2		3		4		5		6		7	
0	NUL	0 / 0	DLE	16 / 10	SP	32 / 20	0	48 / 30	@	64 / 40	P	80 / 50	♦	96 / 60	SCAN3	112 / 70
1	SOH	1 / 1	DC1 (XON)	17 / 11	!	33 / 21	1	49 / 31	A	65 / 41	Q	81 / 51	▬	97 / 61	SCAN5	113 / 71
2	STX	2 / 2	DC2	18 / 12	"	34 / 22	2	50 / 32	B	66 / 42	R	82 / 52	H_T	98 / 62	SCAN7	114 / 72
3	ETX	3 / 3	DC3 (XOFF)	19 / 13	#	35 / 23	3	51 / 33	C	67 / 43	S	83 / 53	FF	99 / 63	SCAN9	115 / 73
4	EOT	4 / 4	DC4	20 / 14	$	36 / 24	4	52 / 34	D	68 / 44	T	84 / 54	C_R	100 / 64	⊢	116 / 74
5	ENQ	5 / 5	NAK	21 / 15	%	37 / 25	5	53 / 35	E	69 / 45	U	85 / 55	LF	101 / 65	⊣	117 / 75
6	ACK	6 / 6	SYN	22 / 16	&	38 / 26	6	54 / 36	F	70 / 46	V	86 / 56	0	102 / 66	⊥	118 / 76
7	BEL	7 / 7	ETB	23 / 17	'	39 / 27	7	55 / 37	G	71 / 47	W	87 / 57	±	103 / 67	⊤	119 / 77
8	BS	8 / 8	CAN	24 / 18	(	40 / 28	8	56 / 38	H	72 / 48	X	88 / 58	N_L	104 / 68	|	120 / 78
9	HT	9 / 9	EM	25 / 19	)	41 / 29	9	57 / 39	I	73 / 49	Y	89 / 59	V_T	105 / 69	≤	121 / 79
10	LF	10 / A	SUB	26 / 1A	*	42 / 2A	:	58 / 3A	J	74 / 4A	Z	90 / 5A	⌟	106 / 6A	≥	122 / 7A
11	VT	11 / B	ESC	27 / 1B	+	43 / 2B	;	59 / 3B	K	75 / 4B	[	91 / 5B	⌐	107 / 6B	π	123 / 7B
12	FF	12 / C	FS	28 / 1C	,	44 / 2C	<	60 / 3C	L	76 / 4C	\	92 / 5C	⌐	108 / 6C	≠	124 / 7C
13	CR	13 / D	GS	29 / 1D	–	45 / 2D	=	61 / 3D	M	77 / 4D	]	93 / 5D	⌞	109 / 6D	£	125 / 7D
14	SO	14 / E	RS	30 / 1E	.	46 / 2E	>	62 / 3E	N	78 / 4E	^	94 / 5E	+	110 / 6E	·	126 / 7E
15	SI	15 / F	US	31 / 1F	/	47 / 2F	?	63 / 3F	O	79 / 4F	(BLANK)	95 / 5F	SCAN1	111 / 6F	DEL	127 / 7F

├──────── CO CODES ────────┤├──────── GL CODES ────────┤
(SPECIAL GRAPHICS)

KEY

Character	ESC	27	Decimal
		1B	Hex

Table A-3. Special Graphics

COLUMN	0	1	2	3	4	5	6	7
0	NUL 00/00	DLE 16/10	SP 32/20	0 48/30	@ 64/40	P 80/50	` 96/60	p 112/70
1	SOH 01/01	DC1 (XON) 17/11	! 33/21	1 49/31	A 65/41	Q 81/51	a 97/61	q 113/71
2	STX 02/02	DC2 18/12	" 34/22	2 50/32	B 66/42	R 82/52	b 98/62	r 114/72
3	ETX 03/03	DC3 (XOFF) 19/13	£ 35/23	3 51/33	C 67/43	S 83/53	c 99/63	s 115/73
4	EOT 04/04	DC4 20/14	$ 36/24	4 52/34	D 68/44	T 84/54	d 100/64	t 116/74
5	ENQ 05/05	NAK 21/15	% 37/25	5 53/35	E 69/45	U 85/55	e 101/65	u 117/75
6	ACK 06/06	SYN 22/16	& 38/26	6 54/36	F 70/46	V 86/56	f 102/66	v 118/76
7	BEL 07/07	ETB 23/17	' 39/27	7 55/37	G 71/47	W 87/57	g 103/67	w 119/77
8	BS 08/08	CAN 24/18	(40/28	8 56/38	H 72/48	X 88/58	h 104/68	x 120/78
9	HT 09/09	EM 25/19	) 41/29	9 57/39	I 73/49	Y 89/59	i 105/69	y 121/79
10	LF 10/0A	SUB 26/1A	* 42/2A	: 58/3A	J 74/4A	Z 90/5A	j 106/6A	z 122/7A
11	VT 11/0B	ESC 27/1B	+ 43/2B	; 59/3B	K 75/4B	[91/5B	k 107/6B	{ 123/7B
12	FF 12/0C	FS 28/1C	, 44/2C	< 60/3C	L 76/4C	\ 92/5C	l 108/6C		124/7C
13	CR 13/0D	GS 29/1D	- 45/2D	= 61/3D	M 77/4D	] 93/5D	m 109/6D	} 125/7D
14	SO 14/0E	RS 30/1E	. 46/2E	> 62/3E	N 78/4E	^ 94/5E	n 110/6E	~ 126/7E
15	SI 15/0F	US 31/1F	/ 47/2F	? 63/3F	O 79/4F	_ 95/5F	o 111/6F	DEL 127/7F

ROW

|← CO CODES →|← GL CODES →|

KEY

Character	£	35 Decimal
		23 Hexadecimal

Table A-4. British NRC Set
(British Keyboard)

		0		1		2		3		4		5		6		7	
		COLUMN															
ROW	0	NUL	00 00	DLE	16 10	SP	32 20	0	48 30	à	64 40	P	80 50	`	96 60	p	112 70
	1	SOH	01 01	DC1 (XON)	17 11	!	33 21	1	49 31	A	65 41	Q	81 51	a	97 61	q	113 71
	2	STX	02 02	DC2	18 12	"	34 22	2	50 32	B	66 42	R	82 52	b	98 62	r	114 72
	3	ETX	03 03	DC3 (XOFF)	19 13	£	35 23	3	51 33	C	67 43	S	83 53	c	99 63	s	115 73
	4	EOT	04 04	DC4	20 14	$	36 24	4	52 34	D	68 44	T	84 54	d	100 64	t	116 74
	5	ENQ	05 05	NAK	21 15	%	37 25	5	53 35	E	69 45	U	85 55	e	101 65	u	117 75
	6	ACK	06 06	SYN	22 16	&	38 26	6	54 36	F	70 46	V	86 56	f	102 66	v	118 76
	7	BEL	07 07	ETB	23 17	'	39 27	7	55 37	G	71 47	W	87 57	g	103 67	w	119 77
	8	BS	08 08	CAN	24 18	(	40 28	8	56 38	H	72 48	X	88 58	h	104 68	x	120 78
	9	HT	09 09	EM	25 19	)	41 29	9	57 39	I	73 49	Y	89 59	i	105 69	y	121 79
	10	LF	10 0A	SUB	26 1A	*	42 2A	:	58 3A	J	74 4A	Z	90 5A	j	106 6A	z	122 7A
	11	VT	11 0B	ESC	27 1B	+	43 2B	;	59 3B	K	75 4B	°	91 5B	k	107 6B	é	123 7B
	12	FF	12 0C	FS	28 1C	,	44 2C	<	60 3C	L	76 4C	ç	92 5C	l	108 6C	ù	124 7C
	13	CR	13 0D	GS	29 1D	-	45 2D	=	61 3D	M	77 4D	§	93 5D	m	109 6D	è	125 7D
	14	SO	14 0E	RS	30 1E	.	46 2E	>	62 3E	N	78 4E	^	94 5E	n	110 6E	¨	126 7E
	15	SI	15 0F	US	31 1F	/	47 2F	?	63 3F	O	79 4F	_	95 5F	o	111 6F	DEL	127 7F

|← CO CODES →|← GL CODES →|

KEY

Character	§	93	Decimal
		5D	Hexadecimal

Table A-5. French NRC Set
(Flemish and French/Belgian Keyboards)

		| 0		1		2		3		4		5		6		7	
		COLUMN															
R O W	0	NUL	00 00	DLE	16 10	SP	32 20	0	48 30	à	64 40	P	80 50	ô	96 60	p	112 70
	1	SOH	01 01	DC1 (XON)	17 11	!	33 21	1	49 31	A	65 41	Q	81 51	a	97 61	q	113 71
	2	STX	02 02	DC2	18 12	"	34 22	2	50 32	B	66 42	R	82 52	b	98 62	r	114 72
	3	ETX	03 03	DC3 (XOFF)	19 13	#	35 23	3	51 33	C	67 43	S	83 53	c	99 63	s	115 73
	4	EOT	04 04	DC4	20 14	$	36 24	4	52 34	D	68 44	T	84 54	d	100 64	t	116 74
	5	ENQ	05 05	NAK	21 15	%	37 25	5	53 35	E	69 45	U	85 55	e	101 65	u	117 75
	6	ACK	06 06	SYN	22 16	&	38 26	6	54 36	F	70 46	V	86 56	f	102 66	v	118 76
	7	BEL	07 07	ETB	23 17	'	39 27	7	55 37	G	71 47	W	87 57	g	103 67	w	119 77
	8	BS	08 08	CAN	24 18	(	40 28	8	56 38	H	72 48	X	88 58	h	104 68	x	120 78
	9	HT	09 09	EM	25 19	)	41 29	9	57 39	I	73 49	Y	89 59	i	105 69	y	121 79
	10	LF	10 0A	SUB	26 1A	*	42 2A	:	58 3A	J	74 4A	Z	90 5A	j	106 6A	z	122 7A
	11	VT	11 0B	ESC	27 1B	+	43 2B	;	59 3B	K	75 4B	â	91 5B	k	107 6B	é	123 7B
	12	FF	12 0C	FS	28 1C	,	44 2C	<	60 3C	L	76 4C	ç	92 5C	l	108 6C	ù	124 7C
	13	CR	13 0D	GS	29 1D	-	45 2D	=	61 3D	M	77 4D	ê	93 5D	m	109 6D	è	125 7D
	14	SO	14 0E	RS	30 1E	.	46 2E	>	62 3E	N	78 4E	î	94 5E	n	110 6E	û	126 7E
	15	SI	15 0F	US	31 1F	/	47 2F	?	63 3F	O	79 4F	—	95 5F	o	111 6F	DEL	127 7F

|← CO CODES →|← GL CODES →|

KEY

Character	ç	92
		5C

Decimal
Hexadecimal

**Table A-6. French Canadian NRC Set
(French Canadian Keyboard)**

ROW	COLUMN 0		COLUMN 1		COLUMN 2		COLUMN 3		COLUMN 4		COLUMN 5		COLUMN 6		COLUMN 7	
0	NUL	00 / 00	DLE	16 / 10	SP	32 / 20	0	48 / 30	Ä	64 / 40	P	80 / 50	ä	96 / 60	p	112 / 70
1	SOH	01 / 01	DC1 (XON)	17 / 11	!	33 / 21	1	49 / 31	A	65 / 41	Q	81 / 51	a	97 / 61	q	113 / 71
2	STX	02 / 02	DC2	18 / 12	"	34 / 22	2	50 / 32	B	66 / 42	R	82 / 52	b	98 / 62	r	114 / 72
3	ETX	03 / 03	DC3 (XOFF)	19 / 13	#	35 / 23	3	51 / 33	C	67 / 43	S	83 / 53	c	99 / 63	s	115 / 73
4	EOT	04 / 04	DC4	20 / 14	$	36 / 24	4	52 / 34	D	68 / 44	T	84 / 54	d	100 / 64	t	116 / 74
5	ENQ	05 / 05	NAK	21 / 15	%	37 / 25	5	53 / 35	E	69 / 45	U	85 / 55	e	101 / 65	u	117 / 75
6	ACK	06 / 06	SYN	22 / 16	&	38 / 26	6	54 / 36	F	70 / 46	V	86 / 56	f	102 / 66	v	118 / 76
7	BEL	07 / 07	ETB	23 / 17	'	39 / 27	7	55 / 37	G	71 / 47	W	87 / 57	g	103 / 67	w	119 / 77
8	BS	08 / 08	CAN	24 / 18	(	40 / 28	8	56 / 38	H	72 / 48	X	88 / 58	h	104 / 68	x	120 / 78
9	HT	09 / 09	EM	25 / 19	)	41 / 29	9	57 / 39	I	73 / 49	Y	89 / 59	i	105 / 69	y	121 / 79
10	LF	10 / 0A	SUB	26 / 1A	*	42 / 2A	:	58 / 3A	J	74 / 4A	Z	90 / 5A	j	106 / 6A	z	122 / 7A
11	VT	11 / 0B	ESC	27 / 1B	+	43 / 2B	;	59 / 3B	K	75 / 4B	Æ	91 / 5B	k	107 / 6B	æ	123 / 7B
12	FF	12 / 0C	FS	28 / 1C	,	44 / 2C	<	60 / 3C	L	76 / 4C	Ø	92 / 5C	l	108 / 6C	ø	124 / 7C
13	CR	13 / 0D	GS	29 / 1D	-	45 / 2D	=	61 / 3D	M	77 / 4D	Å	93 / 5D	m	109 / 6D	å	125 / 7D
14	SO	14 / 0E	RS	30 / 1E	.	46 / 2E	>	62 / 3E	N	78 / 4E	Ü	94 / 5E	n	110 / 6E	ü	126 / 7E
15	SI	15 / 0F	US	31 / 1F	/	47 / 2F	?	63 / 3F	O	79 / 4F	—	95 / 5F	o	111 / 6F	DEL	127 / 7F

← CO CODES → ← GL CODES →

KEY

Character		Decimal
	Æ	91
		5B

Character / Æ / 91 Decimal / 5B Hexadecimal

Table A-7. Norwegian/Danish NRC Set
(Norwegian and Danish Keyboards)

ROW	COLUMN 0		COLUMN 1		COLUMN 2		COLUMN 3		COLUMN 4		COLUMN 5		COLUMN 6		COLUMN 7	
0	NUL	00 / 00	DLE	16 / 10	SP	32 / 20	0	48 / 30	@	64 / 40	P	80 / 50	é	96 / 60	p	112 / 70
1	SOH	01 / 01	DC1 (XON)	17 / 11	!	33 / 21	1	49 / 31	A	65 / 41	Q	81 / 51	a	97 / 61	q	113 / 71
2	STX	02 / 02	DC2	18 / 12	"	34 / 22	2	50 / 32	B	66 / 42	R	82 / 52	b	98 / 62	r	114 / 72
3	ETX	03 / 03	DC3 (XOFF)	19 / 13	#	35 / 23	3	51 / 33	C	67 / 43	S	83 / 53	c	99 / 63	s	115 / 73
4	EOT	04 / 04	DC4	20 / 14	$	36 / 24	4	52 / 34	D	68 / 44	T	84 / 54	d	100 / 64	t	116 / 74
5	ENQ	05 / 05	NAK	21 / 15	%	37 / 25	5	53 / 35	E	69 / 45	U	85 / 55	e	101 / 65	u	117 / 75
6	ACK	06 / 06	SYN	22 / 16	&	38 / 26	6	54 / 36	F	70 / 46	V	86 / 56	f	102 / 66	v	118 / 76
7	BEL	07 / 07	ETB	23 / 17	'	39 / 27	7	55 / 37	G	71 / 47	W	87 / 57	g	103 / 67	w	119 / 77
8	BS	08 / 08	CAN	24 / 18	(	40 / 28	8	56 / 38	H	72 / 48	X	88 / 58	h	104 / 68	x	120 / 78
9	HT	09 / 09	EM	25 / 19	)	41 / 29	9	57 / 39	I	73 / 49	Y	89 / 59	i	105 / 69	y	121 / 79
10	LF	10 / 0A	SUB	26 / 1A	*	42 / 2A	:	58 / 3A	J	74 / 4A	Z	90 / 5A	j	106 / 6A	z	122 / 7A
11	VT	11 / 0B	ESC	27 / 1B	+	43 / 2B	;	59 / 3B	K	75 / 4B	Ä	91 / 5B	k	107 / 6B	ä	123 / 7B
12	FF	12 / 0C	FS	28 / 1C	,	44 / 2C	<	60 / 3C	L	76 / 4C	Ö	92 / 5C	l	108 / 6C	ö	124 / 7C
13	CR	13 / 0D	GS	29 / 1D	-	45 / 2D	=	61 / 3D	M	77 / 4D	Å	93 / 5D	m	109 / 6D	å	125 / 7D
14	SO	14 / 0E	RS	30 / 1E	.	46 / 2E	>	62 / 3E	N	78 / 4E	Ü	94 / 5E	n	110 / 6E	ü	126 / 7E
15	SI	15 / 0F	US	31 / 1F	/	47 / 2F	?	63 / 3F	O	79 / 4F	_	95 / 5F	o	111 / 6F	DEL	127 / 7F

← CO CODES → ← GL CODES →

KEY

Character	Ä	91	Decimal
		5B	Hexadecimal

Table A-8. Finnish NRC Set
(Finnish Keyboard)

ROW	COLUMN 0		COLUMN 1		COLUMN 2		COLUMN 3		COLUMN 4		COLUMN 5		COLUMN 6		COLUMN 7	
0	NUL	00 / 00	DLE	16 / 10	SP	32 / 20	0	48 / 30	§	64 / 40	P	80 / 50	`	96 / 60	p	112 / 70
1	SOH	01 / 01	DC1 (XON)	17 / 11	!	33 / 21	1	49 / 31	A	65 / 41	Q	81 / 51	a	97 / 61	q	113 / 71
2	STX	02 / 02	DC2	18 / 12	"	34 / 22	2	50 / 32	B	66 / 42	R	82 / 52	b	98 / 62	r	114 / 72
3	ETX	03 / 03	DC3 (XOFF)	19 / 13	#	35 / 23	3	51 / 33	C	67 / 43	S	83 / 53	c	99 / 63	s	115 / 73
4	EOT	04 / 04	DC4	20 / 14	$	36 / 24	4	52 / 34	D	68 / 44	T	84 / 54	d	100 / 64	t	116 / 74
5	ENQ	05 / 05	NAK	21 / 15	%	37 / 25	5	53 / 35	E	69 / 45	U	85 / 55	e	101 / 65	u	117 / 75
6	ACK	06 / 06	SYN	22 / 16	&	38 / 26	6	54 / 36	F	70 / 46	V	86 / 56	f	102 / 66	v	118 / 76
7	BEL	07 / 07	ETB	23 / 17	'	39 / 27	7	55 / 37	G	71 / 47	W	87 / 57	g	103 / 67	w	119 / 77
8	BS	08 / 08	CAN	24 / 18	(	40 / 28	8	56 / 38	H	72 / 48	X	88 / 58	h	104 / 68	x	120 / 78
9	HT	09 / 09	EM	25 / 19	)	41 / 29	9	57 / 39	I	73 / 49	Y	89 / 59	i	105 / 69	y	121 / 79
10	LF	10 / 0A	SUB	26 / 1A	*	42 / 2A	:	58 / 3A	J	74 / 4A	Z	90 / 5A	j	106 / 6A	z	122 / 7A
11	VT	11 / 0B	ESC	27 / 1B	+	43 / 2B	;	59 / 3B	K	75 / 4B	Ä	91 / 5B	k	107 / 6B	ä	123 / 7B
12	FF	12 / 0C	FS	28 / 1C	,	44 / 2C	<	60 / 3C	L	76 / 4C	Ö	92 / 5C	l	108 / 6C	ö	124 / 7C
13	CR	13 / 0D	GS	29 / 1D	-	45 / 2D	=	61 / 3D	M	77 / 4D	Ü	93 / 5D	m	109 / 6D	ü	125 / 7D
14	SO	14 / 0E	RS	30 / 1E	.	46 / 2E	>	62 / 3E	N	78 / 4E	^	94 / 5E	n	110 / 6E	ß	126 / 7E
15	SI	15 / 0F	US	31 / 1F	/	47 / 2F	?	63 / 3F	O	79 / 4F	_	95 / 5F	o	111 / 6F	DEL	127 / 7F

|← CO CODES →|← GL CODES →|

KEY

Character	ß	126 / 7E	Decimal / Hexadecimal

Table A-9. German NRC Set
(German Keyboard)

		COLUMN													
		0		1		2		3		4		5		6		7
ROW	0	NUL	00 00	DLE	16 10	SP	32 20	0	48 30	¾	64 40	P	80 50	`	96 60	p	112 70
	1	SOH	01 01	DC1 (XON)	17 11	!	33 21	1	49 31	A	65 41	Q	81 51	a	97 61	q	113 71
	2	STX	02 02	DC2	18 12	"	34 22	2	50 32	B	66 42	R	82 52	b	98 62	r	114 72
	3	ETX	03 03	DC3 (XOFF)	19 13	£	35 23	3	51 33	C	67 43	S	83 53	c	99 63	s	115 73
	4	EOT	04 04	DC4	20 14	$	36 24	4	52 34	D	68 44	T	84 54	d	100 64	t	116 74
	5	ENQ	05 05	NAK	21 15	%	37 25	5	53 35	E	69 45	U	85 55	e	101 65	u	117 75
	6	ACK	06 06	SYN	22 16	&	38 26	6	54 36	F	70 46	V	86 56	f	102 66	v	118 76
	7	BEL	07 07	ETB	23 17	'	39 27	7	55 37	G	71 47	W	87 57	g	103 67	w	119 77
	8	BS	08 08	CAN	24 18	(	40 28	8	56 38	H	72 48	X	88 58	h	104 68	x	120 78
	9	HT	09 09	EM	25 19	)	41 29	9	57 39	I	73 49	Y	89 59	i	105 69	y	121 79
	10	LF	10 0A	SUB	26 1A	*	42 2A	:	58 3A	J	74 4A	Z	90 5A	j	106 6A	z	122 7A
	11	VT	11 0B	ESC	27 1B	+	43 2B	;	59 3B	K	75 4B	ij	91 5B	k	107 6B	¨	123 7B
	12	FF	12 0C	FS	28 1C	,	44 2C	<	60 3C	L	76 4C	½	92 5C	l	108 6C	f	124 7C
	13	CR	13 0D	GS	29 1D	-	45 2D	=	61 3D	M	77 4D			93 5D	m	109 6D	¼	125 7D
	14	SO	14 0E	RS	30 1E	.	46 2E	>	62 3E	N	78 4E	^	94 5E	n	110 6E	´	126 7E
	15	SI	15 0F	US	31 1F	/	47 2F	?	63 3F	O	79 4F	—	95 5F	o	111 6F	DEL	127 7F

|← —— C0 CODES —— →|← —————— GL CODES —————— →|

KEY

Character	£	35	Decimal
		23	Hexadecimal

Table A-1Ø. Dutch NRC Set
(Dutch Keyboard)

		COLUMN							
ROW		0	1	2	3	4	5	6	7
	0	NUL 00/00	DLE 16/10	SP 32/20	0 48/30	§ 64/40	P 80/50	ù 96/60	p 112/70
	1	SOH 01/01	DC1 (XON) 17/11	! 33/21	1 49/31	A 65/41	Q 81/51	a 97/61	q 113/71
	2	STX 02/02	DC2 18/12	" 34/22	2 50/32	B 66/42	R 82/52	b 98/62	r 114/72
	3	ETX 03/03	DC3 (XOFF) 19/13	£ 35/23	3 51/33	C 67/43	S 83/53	c 99/63	s 115/73
	4	EOT 04/04	DC4 20/14	$ 36/24	4 52/34	D 68/44	T 84/54	d 100/64	t 116/74
	5	ENQ 05/05	NAK 21/15	% 37/25	5 53/35	E 69/45	U 85/55	e 101/65	u 117/75
	6	ACK 06/06	SYN 22/16	& 38/26	6 54/36	F 70/46	V 86/56	f 102/66	v 118/76
	7	BEL 07/07	ETB 23/17	' 39/27	7 55/37	G 71/47	W 87/57	g 103/67	w 119/77
	8	BS 08/08	CAN 24/18	(40/28	8 56/38	H 72/48	X 88/58	h 104/68	x 120/78
	9	HT 09/09	EM 25/19	) 41/29	9 57/39	I 73/49	Y 89/59	i 105/69	y 121/79
	10	LF 10/0A	SUB 26/1A	* 42/2A	: 58/3A	J 74/4A	Z 90/5A	j 106/6A	z 122/7A
	11	VT 11/0B	ESC 27/1B	+ 43/2B	; 59/3B	K 75/4B	° 91/5B	k 107/6B	à 123/7B
	12	FF 12/0C	FS 28/1C	, 44/2C	< 60/3C	L 76/4C	ç 92/5C	l 108/6C	ò 124/7C
	13	CR 13/0D	GS 29/1D	- 45/2D	= 61/3D	M 77/4D	é 93/5D	m 109/6D	è 125/7D
	14	SO 14/0E	RS 30/1E	. 46/2E	> 62/3E	N 78/4E	^ 94/5E	n 110/6E	ì 126/7E
	15	SI 15/0F	US 31/1F	/ 47/2F	? 63/3F	O 79/4F	_ 95/5F	o 111/6F	DEL 127/7F

|← CO CODES →|←——— GL CODES ———→|

KEY

Character	£	35	Decimal
		23	Hexadecimal

Table A-11. Italian NRC Set
(Italian Keyboard)

		COLUMN							
		0	1	2	3	4	5	6	7
R O W	0	NUL 00/00	DLE 16/10	SP 32/20	0 48/30	à 64/40	P 80/50	ô 96/60	p 112/70
	1	SOH 01/01	DC1 (XON) 17/11	! 33/21	1 49/31	A 65/41	Q 81/51	a 97/61	q 113/71
	2	STX 02/02	DC2 18/12	" 34/22	2 50/32	B 66/42	R 82/52	b 98/62	r 114/72
	3	ETX 03/03	DC3 (XOFF) 19/13	ù 35/23	3 51/33	C 67/43	S 83/53	c 99/63	s 115/73
	4	EOT 04/04	DC4 20/14	$ 36/24	4 52/34	D 68/44	T 84/54	d 100/64	t 116/74
	5	ENQ 05/05	NAK 21/15	% 37/25	5 53/35	E 69/45	U 85/55	e 101/65	u 117/75
	6	ACK 06/06	SYN 22/16	& 38/26	6 54/36	F 70/46	V 86/56	f 102/66	v 118/76
	7	BEL 07/07	ETB 23/17	' 39/27	7 55/37	G 71/47	W 87/57	g 103/67	w 119/77
	8	BS 08/08	CAN 24/18	(40/28	8 56/38	H 72/48	X 88/58	h 104/68	x 120/78
	9	HT 09/09	EM 25/19	) 41/29	9 57/39	I 73/49	Y 89/59	i 105/69	y 121/79
	10	LF 10/0A	SUB 26/1A	* 42/2A	: 58/3A	J 74/4A	Z 90/5A	j 106/6A	z 122/7A
	11	VT 11/0B	ESC 27/1B	+ 43/2B	; 59/3B	K 75/4B	é 91/5B	k 107/6B	ä 123/7B
	12	FF 12/0C	FS 28/1C	, 44/2C	< 60/3C	L 76/4C	ç 92/5C	l 108/6C	ö 124/7C
	13	CR 13/0D	GS 29/1D	- 45/2D	= 61/3D	M 77/4D	ê 93/5D	m 109/6D	ü 125/7D
	14	SO 14/0E	RS 30/1E	. 46/2E	> 62/3E	N 78/4E	î 94/5E	n 110/6E	û 126/7E
	15	SI 15/0F	US 31/1F	/ 47/2F	? 63/3F	O 79/4F	è 95/5F	o 111/6F	DEL 127/7F

|← —— CO CODES —— →|← ———————— GL CODES ———————— →|

KEY

Character	ù	35 Decimal
		23 Hexadecimal

Table A-12. Swiss NRC Set
(Swiss/French and Swiss/German Keyboards)

ROW	COLUMN 0		COLUMN 1		COLUMN 2		COLUMN 3		COLUMN 4		COLUMN 5		COLUMN 6		COLUMN 7	
0	NUL	00 / 00	DLE	16 / 10	SP	32 / 20	0	48 / 30	É	64 / 40	P	80 / 50	é	96 / 60	p	112 / 70
1	SOH	01 / 01	DC1 (XON)	17 / 11	!	33 / 21	1	49 / 31	A	65 / 41	Q	81 / 51	a	97 / 61	q	113 / 71
2	STX	02 / 02	DC2	18 / 12	"	34 / 22	2	50 / 32	B	66 / 42	R	82 / 52	b	98 / 62	r	114 / 72
3	ETX	03 / 03	DC3 (XOFF)	19 / 13	#	35 / 23	3	51 / 33	C	67 / 43	S	83 / 53	c	99 / 63	s	115 / 73
4	EOT	04 / 04	DC4	20 / 14	$	36 / 24	4	52 / 34	D	68 / 44	T	84 / 54	d	100 / 64	t	116 / 74
5	ENQ	05 / 05	NAK	21 / 15	%	37 / 25	5	53 / 35	E	69 / 45	U	85 / 55	e	101 / 65	u	117 / 75
6	ACK	06 / 06	SYN	22 / 16	&	38 / 26	6	54 / 36	F	70 / 46	V	86 / 56	f	102 / 66	v	118 / 76
7	BEL	07 / 07	ETB	23 / 17	'	39 / 27	7	55 / 37	G	71 / 47	W	87 / 57	g	103 / 67	w	119 / 77
8	BS	08 / 08	CAN	24 / 18	(	40 / 28	8	56 / 38	H	72 / 48	X	88 / 58	h	104 / 68	x	120 / 78
9	HT	09 / 09	EM	25 / 19	)	41 / 29	9	57 / 39	I	73 / 49	Y	89 / 59	i	105 / 69	y	121 / 79
10	LF	10 / 0A	SUB	26 / 1A	*	42 / 2A	:	58 / 3A	J	74 / 4A	Z	90 / 5A	j	106 / 6A	z	122 / 7A
11	VT	11 / 0B	ESC	27 / 1B	+	43 / 2B	;	59 / 3B	K	75 / 4B	Ä	91 / 5B	k	107 / 6B	ä	123 / 7B
12	FF	12 / 0C	FS	28 / 1C	,	44 / 2C	<	60 / 3C	L	76 / 4C	Ö	92 / 5C	l	108 / 6C	ö	124 / 7C
13	CR	13 / 0D	GS	29 / 1D	-	45 / 2D	=	61 / 3D	M	77 / 4D	Å	93 / 5D	m	109 / 6D	å	125 / 7D
14	SO	14 / 0E	RS	30 / 1E	.	46 / 2E	>	62 / 3E	N	78 / 4E	Ü	94 / 5E	n	110 / 6E	ü	126 / 7E
15	SI	15 / 0F	US	31 / 1F	/	47 / 2F	?	63 / 3F	O	79 / 4F	_	95 / 5F	o	111 / 6F	DEL	127 / 7F

|← CO CODES →|← GL CODES →|

KEY

Character | É | 64 Decimal / 40 Hexadecimal

Table A-13. Swedish NRC Set
(Swedish Keyboard)

		COLUMN							
		0	1	2	3	4	5	6	7
ROW	0	NUL 00 00	DLE 16 10	SP 32 20	0 48 30	§ 64 40	P 80 50	` 96 60	p 112 70
	1	SOH 01 01	DC1 (XON) 17 11	! 33 21	1 49 31	A 65 41	Q 81 51	a 97 61	q 113 71
	2	STX 02 02	DC2 18 12	" 34 22	2 50 32	B 66 42	R 82 52	b 98 62	r 114 72
	3	ETX 03 03	DC3 (XOFF) 19 13	£ 35 23	3 51 33	C 67 43	S 83 53	c 99 63	s 115 73
	4	EOT 04 04	DC4 20 14	$ 36 24	4 52 34	D 68 44	T 84 54	d 100 64	t 116 74
	5	ENQ 05 05	NAK 21 15	% 37 25	5 53 35	E 69 45	U 85 55	e 101 65	u 117 75
	6	ACK 06 06	SYN 22 16	& 38 26	6 54 36	F 70 46	V 86 56	f 102 66	v 118 76
	7	BEL 07 07	ETB 23 17	' 39 27	7 55 37	G 71 47	W 87 57	g 103 67	w 119 77
	8	BS 08 08	CAN 24 18	(40 28	8 56 38	H 72 48	X 88 58	h 104 68	x 120 78
	9	HT 09 09	EM 25 19	) 41 29	9 57 39	I 73 49	Y 89 59	i 105 69	y 121 79
	10	LF 10 0A	SUB 26 1A	* 42 2A	: 58 3A	J 74 4A	Z 90 5A	j 106 6A	z 122 7A
	11	VT 11 0B	ESC 27 1B	+ 43 2B	; 59 3B	K 75 4B	¡ 91 5B	k 107 6B	° 123 7B
	12	FF 12 0C	FS 28 1C	, 44 2C	< 60 3C	L 76 4C	Ñ 92 5C	l 108 6C	ñ 124 7C
	13	CR 13 0D	GS 29 1D	- 45 2D	= 61 3D	M 77 4D	¿ 93 5D	m 109 6D	ç 125 7D
	14	SO 14 0E	RS 30 1E	. 46 2E	> 62 3E	N 78 4E	^ 94 5E	n 110 6E	~ 126 7E
	15	SI 15 0F	US 31 1F	/ 47 2F	? 63 3F	O 79 4F	_ 95 5F	o 111 6F	DEL 127 7F

|← CO CODES →|← GL CODES →|

KEY

Character	Ñ	92	Decimal
		5C	Hexadecimal

**Table A-14. Spanish NRC Set
(Spanish Keyboard)**

Appendix B

CONTROL CODES

The following is a summary of the control codes used with the CIT224.

CURSOR CONTROL KEYS

	ANSI Mode*		VT52 Mode	
	Cursor Key Mode			
Key	Reset	Set		
	Normal	Application	Normal	Application
↑	CSIA	SS3A	ESCA	ESCA
↓	CSIB	SS3B	ESCB	ESCB
→	CSIC	SS3C	ESCC	ESCC
←	CSID	SS3D	ESCD	ESCD

* ANSI mode refers to VT200 and VT100 modes.

EDITING KEYS

Key	Code Generated
FIND	CSI1~
INSERT HERE	CSI2~
REMOVE	CSI3~
SELECT	CSI4~
PREV SCREEN	CSI5~
NEXT SCREEN	CSI6~

The editing keys are inoperable in VT100 or VT52 modes.

NUMERIC KEYPAD

Key	ANSI Keypad Numeric Mode	ANSI Keypad Appli- cation Mode	VT52 Keypad Numeric Mode	VT52 Keypad Appli- cation Mode
Ø	Ø	SS3p	Ø	ESC?p
1	1	SS3q	1	ESC?q
2	2	SS3r	2	ESC?r
3	3	SS3s	3	ESC?s
4	4	SS3t	4	ESC?t
5	5	SS3u	5	ESC?u
6	6	SS3v	6	ESC?v
7	7	SS3w	7	ESC?w
8	8	SS3x	8	ESC?x
9	9	SS3y	9	ESC?y
PF1	SS3P	SS3P	ESCP	ESCP
PF2	SS3Q	SS3Q	ESCQ	ESCQ
PF3	SS3R	SS3R	ESCR	ESCR
PF4	SS3S	SS3S	ESCS	ESCS
-	-(minus)	SS3m	-	ESC?m
,	,(comma)	SS3l	,	ESC?l
.	.(period)	SS3n	.	ESC?n
ENTER	CR or CR LF	SS3M	CR or CR LF	ESC?M

TERMINAL CONTROL AND FUNCTION KEYS

Key Label	Key Designation	Codes	
		VT200 Mode	VT100 * VT52 Modes
HOLD SCREEN	(F1)	–	–
PRINT SCREEN	(F2)	–	–
SET-UP	(F3)	–	–
DATA/TALK	(F4)	–	–
BREAK	(F5)	–	–
F6	F6	CSI17~	–
F7	F7	CSI18~	–
F8	F8	CSI19~	–
F9	F9	CSI20~	–
F10	F10	CSI21~	–
F11 (ESC)	F11	CSI23~	ESC
F12 (BS)	F12	CSI24~	BS
F13 (LF)	F13	CSI25~	LF
F14	F14	CSI26~	–
HELP	(F15)	CSI28~	–
DO	(F16)	CSI29~	–
F17	F17	CSI31~	–
F18	F18	CSI32~	–
F19	F19	CSI33~	–
F20	F20	CSI34~	–

* In VT100 mode, keys F6 through F20 may be set to operate as
  in VT200 mode through the Keyboard Enhancements Set-Up menu.

7-BIT CONTROL CHARACTER CODES

Control Code	Hex Value	Key *
NUL	00H	@
SOH	01H	A
STX	02H	B
ETX	03H	C
EOT	04H	D
ENQ	05H	E
ACK	06H	F
BEL	07H	G
BS	08H	H
HT	09H	I
LF	0AH	J
VT	0BH	K
FF	0CH	L
CR	0DH	M
SO	0EH	N
SI	0FH	O
DLE	10H	P
DC1	11H	Q **
DC2	12H	R
DC3	13H	S **
DC4	14H	T
NAK	15H	U
SYN	16H	V
ETB	17H	W
CAN	18H	X
EM	19H	Y
SUB	1AH	Z
ESC	1BH	3, [
FS	1CH	4, \
GS	1DH	5,]
RS	1EH	6, ~
US	1FH	7, ?
DEL	7FH	8

* The CTRL key is held down while these keys are pressed.

** CTRL-S locks the screen if XOFF support is enabled, and CTRL-Q unlocks it. If XOFF support is disabled these keystrokes generate the 7-bit control codes listed.

SUPPORTED CØ CONTROL CODES

CØ Code	Function	Hex Value	Key*	Description
NUL	Null	ØØH	SPACE	Ignored upon receipt
ENQ	Enquiry	Ø5H	E	Transmits the answerback message
BEL	Bell	Ø7H	G	Sounds the audible tone (bell) if the warning bell is enabled
BS	Back Space	Ø8H	H	Back space, unless at left margin
HT	Horizontal Tab	Ø9H	I	Moves cursor to next tab stop or to right margin if there are no tab stops. Does not advance the cursor to the next line.
LF	Line Feed	ØAH	J	Causes a linefeed or a new line, depending on New Line Mode
VT	Vertical Tab	ØBH	K	Same as LF
FF	Form Feed	ØCH	L	Same as LF
CR	Carriage Return	ØDH	M	Moves cursor to left margin on the same line
SO (LS1)	Shift Out (Locking Shift G1)	ØEH	N	Invokes G1 character set into GL when G1 is properly designated.
SI (LSØ)	Shift In (Locking Shift GØ)	ØFH	O	Invokes GØ character set into GL when GØ is properly designated.
DC1 (XON)	Device Control 1	11H	Q	Resumes transmission if XON/XOFF mode is enabled.
DC3 (XOFF)	Device Control 3	13H	S	Halts transmission of all codes except XON and XOFF if XON/XOFF mode is enabled.
CAN	Cancel	18H	X	Terminates a sequence without executing it; CAN is not displayed.

SUPPORTED CØ CONTROL CODES   (Cont.)

CØ Code	Function	Hex Value	Key*	Description
SUB	Substitute	1AH	Z	Same as CAN, except displays a reverse question mark as the error character.
ESC	Escape	1BH	[	Introduces an escape sequence. The codes that follow it are executed. Terminates any escape, control, or device control sequence.
DEL	Delete	7FH		Ignored. May not be used as a fill character.

* The CTRL key is held down while the indicated key is pressed.

SUPPORTED C1 CONTROL CODES

C1 Code	Function	Hex Value	Keys*	Description
IND	Index	84H	ESC D	Moves the cursor down one line in the current column. At the bottom margin, scrolls the screen up.
NEL	Next Line	85H	ESC E	Moves the cursor to the first column on the next line. At the bottom margin, scrolls the screen up.
HTS	Horizontal Tab Set	88H	ESC H	Places a horizontal tab stop at the current cursor position.
RI	Reverse Index	8DH	ESC M	Moves cursor up one line in the current column. At top margin, scrolls the screen down.
SS2	Single Shift G2	8EH	ESC N	Invokes the G2 character set into GL for the next character received.
SS3	Single Shift G3	8FH	ESC O	Invokes the G3 character set into GL for the next character received.
DCS	Device Control String	90H	ESC P	The opening delimiter of a device control string.
CSI	Control Sequence Introducer	9BH	ESC [	The opening delimiter of a control sequence.
ST	String Terminator	9CH	ESC \	The closing delimiter of a device control string.

* This is the 7-bit code extension equivalent described below.

Appendix C

CONTROL SEQUENCES

CHARACTER SET DESIGNATION

CHARACTER SET	DESIGNATE AS:	CONTROL SEQUENCE
ASCII	GØ	ESC(B
	G1	ESC)B
	G2	ESC*B
	G3	ESC+B
Supplemental	GØ	ESC(<
	G1	ESC)<
	G2	ESC*<
	G3	ESC+<
Special Graphics	GØ	ESC(Ø
	G1	ESC)Ø
	G2	ESC*Ø
	G3	ESC+Ø
NRC Sets		
British	GØ	ESC(A
	G1	ESC)A
Dutch	GØ	ESC(4
	G1	ESC)4
Finnish	GØ	ESC(C or ESC(5
	G1	ESC)C or ESC)5
French	GØ	ESC(R
	G1	ESC)R
French Canadian	GØ	ESC(Q
	G1	ESC)Q
German	GØ	ESC(K
	G1	ESC)K
Italian	GØ	ESC(Y
	G1	ESC)Y
Norwegian/Danish	GØ	ESC(E or ESC(6
	G1	ESC)E or ESC)6

CHARACTER SET DESIGNATION   (Cont.)

CHARACTER SET	DESIGNATE AS:	CONTROL SEQUENCE
Spanish	G0	ESC(Z
	G1	ESC)Z
Swedish	G0	ESC(H or ESC(7
	G1	ESC)H or ESC)H
Swiss	G0	ESC(=
	G1	ESC)=
Soft Character Set	G0	ESC(name
	G1	ESC)name
	G2	ESC*name
	G3	ESC+name

INVOKING CHARACTER SETS

CONTROL SEQUENCE	ACTION
ESCN or SS2 (8EH)	Single shift G2 into GL (VT200 mode only)
ESCO or SS3 (8FH)	Single shift G3 into GL (VT200 mode only)
SI (0FH)	Invoke G0 into GL (Default)
SO (0EH)	Invoke G1 into GL
ESC~	Invoke G1 into GR (VT200 mode only)
ESCn	Invoke G2 into GL (VT200 mode only)
ESC}	Invoke G2 into GR (VT200 mode only)
ESCo	Invoke G3 into GL (VT200 mode only)
ESC¦	Invoke G3 into GR (VT200 mode only)

Down-Line Loading Each Character using the CIET Method

DCS Pfn;Pcn;Pe w <name> <data> ST

Down-Line Loading Each Character using the DEC Compatible Method

DCS Pfn;Pcn;Pe;Pcms;Pw;Pt { name Sxbp1;Sxbp2;...;Sxbp94 ST

Clear Character Set

DCS 1;1;2 { sp @ ST

SET OPERATING MODES

Set VT200 7-Bit Mode	CSI62;1"p
Set VT200 8-Bit Mode	CSI62"p or
	CSI62;0"p or
	CSI62;2"p
Set VT100 Mode	CSI61"p
Set VT52 Mode	CSI?2l

SET C1 CONTROL CODE TRANSMISSION

ESCspF   Translates 8-bit C1 control codes to their equivalent
7-bit codes for transmission to the host. (VT200 mode
only)

ESCspG   Does not translate 8-bit C1 control codes into their
equivalent 7-bit codes. C1 control codes remain 8-bit
upon transmission to the host. (VT200 mode only)

TERMINAL MODES

Auto Repeat Mode

Set Auto Repeat Mode	CSI?8h
Reset Auto Repeat Mode	CSI?8l

Auto Wrap Mode

Set Auto Wrap Mode	CSI?7h
Reset Auto Wrap Mode	CSI?7l

Character Insert/Replace Mode

    Set Insert Mode   CSI4h
    Reset Replace Mode   CSI4l

Character Set Mode

    Set National Mode   CSI?42h
    Reset Multinational Mode   CSI?42l

Column Mode

    Set to 132 Column Mode   CSI?3h
    Reset to 80 Column Mode   CSI?3l

Cursor Key Application Mode

    Set Cursor Key Application Mode   CSI?1h
    Reset to Cursor Key Mode   CSI?1l

Cursor Origin Mode

    Set Cursor Origin Mode   CSI?6h
    Reset Cursor Origin Mode   CSI?6l

Keyboard Action Mode

    Set Keyboard Action Mode   CSI2h
    Reset Keyboard Action Mode   CSI2l

Keypad Application Mode

    Set Keypad Application Mode   ESC =
    Reset Keypad Numeric Mode   ESC >

Line Feed-New Line Mode

    Set New Line Mode   CSI20h
    Reset Line Feed Mode   CSI20l

Print Extent Mode

    Set Print Extent Mode   CSI?19h
    Reset Print Extent Mode   CSI?19l

Print Form Feed Mode

    Set Print Form Feed Mode   CSI?18h
    Reset Print Form Feed Mode   CSI?18l

Screen Mode

Set Reverse Screen Mode	CSI?5h
Reset Normal Screen Mode	CSI?5l

Scrolling Mode

Set Smooth Scroll Mode	CSI?4h
Reset Jump Scroll Mode	CSI?4l

Send-Receive Mode

Set Send-Receive Mode	CSI12h
Reset Send-Receive Mode	CSI12l

Text Cursor Enable Mode

Set Visible Cursor Mode	CSI?25h
Reset Invisible Cursor Mode	CSI?25l

CURSOR CONTROL SEQUENCES

Relative Cursor Positioning

Move Cursor Up	CSIPnA
Move Cursor Down	CSIPnB
Move Cursor Right (forward)	CSIPnC
Move Cursor Left (backward)	CSIPnD

Direct Cursor Positioning

Position Cursor	CSIPn;PnH
	or
	CSIPn;Pnf

Scroll Direction

Index	ESC D (IND, 84H)
Reverse Index	ESC M (RI, 8DH)

Next Line

Next Line	ESC E (NEL, 85H)

Save and Restore Cursor and Attributes

Save Cursor and Attributes	ESC 7
Restore Cursor and Attributes	ESC 8

TABULATION

Set Horizontal Tab

    Set Tab Stop   ESC H (HTS, 88H)

Clear Tab(s)

    Clear Tab Stops   CSIPsg

            Ps = Ø   Clear Tab Stop at current column
               3   Clear all Tab Stops

WIDTH/HEIGHT LINE COMMANDS

Double-height, double-width top	ESC#3
Double-height, double-width bottom	ESC#4
Single-height, single-width (normal)	ESC#5
Single-height, double-width	ESC#6
Double-height, single-width top	ESC#:
Double-height, single-width bottom	ESC#;

SELECT GRAPHIC RENDITION

    Set Graphic Rendition   CSIPs;Ps;Psm

    Valid parameters (Ps) are:

            Ø = All attributes off
            1 = Bold intensity
            4 = Underline
            5 = Blinking
            7 = Negative (reverse) image
          22 = Normal intensity
          24 = Not underlined
          25 = Not blinking
          27 = Positive (normal) image

EDITING COMMANDS

Insert Line	CSIPnL
Delete Line	CSIPnM
Insert Character	CSIPn@
Delete Character	CSIPnP

ERASE CONTROL SEQUENCES

Set Erase Character	CSIPns or CSI>Pns
Erase Character(s)	CSIPnX

Selective Erase Attribute   CSIPs"q

                        Ps = Ø   Attribute off (erasable)
                             1   Non-erasable character (attribute on)
                             2   Erasable character (attribute off)

Erase Screen/Line: Attributes Protected

    Erase within Screen   CSI?PsJ

                    Valid parameters (Ps) are:

                    Ø = Erase from cursor to end of screen
                    1 = Erase from top of screen to cursor
                    2 = Erase entire screen

    Erase within Line   CSI?PsK

                    Ø = Erase from cursor to end of line
                    1 = Erase from start of line to cursor
                    2 = Erase entire line

Erase Screen/Line: Attributes Unprotected

    Erase within Screen   CSIPsJ

                    Valid parameters (Ps) are:

                    Ø = Erase from cursor to end of screen
                    1 = Erase from top of screen to cursor
                    2 = Erase entire screen

    Erase within Line   CSIPsK

                    Ø = Erase from cursor to end of line
                    1 = Erase from start of line to cursor
                    2 = Erase entire line

SCROLLING REGION

    Set Scrolling Region   CSIPn;Pnr

PRINT COMMANDS

Print the cursor line   CSI?1i
Print Screen   CSIi   or   CSIØi

Auto Print Mode

Auto Print On   CSI?5i
Auto Print Off   CSI?4i

Printer Controller Mode

Printer Controller On   CSI5i
Printer Controller Off   CSI4i

CIET Private Printer Commands

The following CIET Private Printer commands are blocked (will not have any effect) while in the DEC printer mode.

ESC#Ø   -   Enter Auto Auxiliary Mode
ESC#1   -   Exit Auto Auxiliary or Concurrent Print Mode
ESC#2   -   Output cursor line to Auxiliary
ESC#7   -   Output page to Auxiliary

ESCØ   -   Enter Concurrent Auxiliary Mode
ESC1   -   Enter Auxiliary Control Mode
ESC2   -   Exit Auxiliary Control Mode

25TH ROW STATUS LINE

DCS Pn1;Pn2;Pn3;PnN Q Data ST   (8-bit mode)
ESC P Pn1;Pn2;Pn3;PnN Q Data ESC \   (7-bit mode)

USER-DEFINED KEYS (UDK'S)

DCS Pc;P1 ¦ Kyn/stn;...;Kyn/stn ST   (8-bit mode)
ESC P Pc;P1 ¦ Kyn/stn;...;Kyn/stn ESC \   (7-bit mode)

To clear keys, send the following string:

DCSØ;1¦ST

To lock keys, send the following string:

DCS1;Ø¦ST

REPORTS

Request Device Attributes	CSI c or CSI Ø c
Response with Attributes (VT22Ø ID)	CSI ? n;n;...n c
Response (VT1ØØ ID)	ESC[?1;2 c
Response (VT1Ø1 ID)	ESC[?1;Ø c
Response (VT1Ø2 ID)	ESC[?6 c
Request Secondary Device Attributes	CSI > c or CSI > Ø c
Response with Attributes	CSI > 1;Pv;Po c
Request for Terminal Status	CSI 5n
Response that terminal is OK	CSI Øn
Response that terminal is not OK	CSI 3n
Request for Cursor Position	CSI 6n
Response with cursor position	CSI Pv;Ph R
Request for Printer Status	CSI ?15n
Response :	
Printer is ready	CSI ?1Øn
Printer is not ready	CSI ?11n
There is no printer	CSI ?13n
Request for UDK Status	CSI ?25n
Response:	
UDK keys are unlocked	CSI ?2Øn
UDK keys are locked	CSI ?21n
Request for Keyboard Language	CSI ?26n
Response with keyboard language	CSI ?27;Pn n
Request for Terminal Parameters	CSI<sol>x
Response with parameters:	
CSI<sol>;<par>;<nbits>;<xspeed>;<rspeed>;<clkmul>;<flag>x	
Request Identification	ESC Z

RESETTING THE TERMINAL

Hard Terminal Reset	ESCc
Soft Terminal Reset	CSI!p

SELF-TEST DIAGNOSTICS   CSI4;Ps;...;Psy

Valid parameters (Ps) are:

1 = Same as power up: ROM, NVR, RAM
2 = Dual Channel loop back: Communications
       Channel to Auxiliary Channel
4 = EIA loop back
8 = Continuous testing of selected functions

SCREEN ALIGNMENT

Fill Screen with E's	ESC#8
Fill Screen with Character Assortment	ESC#9

VT52 MODE ESCAPE SEQUENCES

Cursor Control Sequences

Move Cursor Up	ESC A
Move Cursor Down	ESC B
Move Cursor Right	ESC C
Move Cursor Left	ESC D
Move Cursor Home	ESC H
Position Cursor	ESC Yrc

Erase Control Sequences

Erase to End of Line	ESC K
Erase to End of Page	ESC J

Graphics Mode

Enter Special Graphics Mode	ESC F
Exit Special Graphics Mode	ESC G

Keypad Application Mode

Enter Keypad Application Mode	ESC =
Exit Keypad Application Mode	ESC >

Bidirectional Auxiliary Port Control

Output Cursor Line to Printer	ESC V
Enter Printer Controller Mode	ESC W
Exit Printer Controller Mode	ESC X
Output Full Screen to Printer	ESC]
Enter Auto Print Mode	ESC ^
Exit Auto Print Mode	ESC _

Scroll

Reverse Line Feed	ESC I

ANSI Mode

Enter ANSI Mode	ESC <

Request Identity

Identify Terminal Type	ESC Z

Appendix D

SET-UP SCREEN MENUS

SET-UP DIRECTORY	DISPLAY SET-UP
Display	To Next Set-Up
General	To Directory
Communications	80/132 Columns
Printer	Interpret/Display Controls
Keyboard	Auto Wrap
Tab	Smooth/Jump Scroll
On-Line/Local	Light/Dark Screen
Clear Display	Cursor/No Cursor
Clear Communications	Cursor Style
Reset Terminal	
Recall Saved Parameters	
Save Parameters	
Set-Up Language	
Keyboard Language	
Factory Defaults	
Exit Set-Up	

DISPLAY ENHANCEMENTS	GENERAL SET-UP
To Next Set-Up	To Next Set-Up
To Directory	To Directory
Smooth Scroll n Lines	Terminal Mode
Scroll Rate nn	Terminal ID
Blinking/Static Cursor	UDK Locked/Unlocked
Preserve Screen	User Features Locked
Shift-Remove	Multinational
CRT Saver On/Off	Keypad Mode
Insert Line Attribute	Cursor Key Mode
Refresh Rate	No New Line
Status Line On/Off	

GENERAL ENHANCEMENTS SET-UP	COMMUNICATIONS SET-UP
To Next Set-Up	To Next Set-Up
To Directory	To Directory
Form Feed:Line Feed	Transmit Speed
Erase Extent	Receive Speed
Tab Motion	XOFF/XON Point
BS-Underline	Data-Bits/Parity
Parm Report Flag = nnnn	Stop Bits
Main RX XOFF = Process	Local Echo
Main DTR	Host Port Selection
	Disconnect Time
	Transmit Rate Limit

PRINTER SET-UP

To Next Set-Up
To Directory
Transmit=4800
Receive=Transmit
Normal Print Mode
8 Bits, No Parity
1 Stop Bit
Print Full Page
Print National Only
Terminator/No Terminator

KEYBOARD SET-UP

To Next Set-Up
To Directory
Typewriter/D.P.
Caps/Shift-Lock
Auto Repeat
Keyclick
Margin Bell
Warning Bell
Break
Auto Answerback
Answerback Message
Conceal Answerback

TAB SET-UP

To Next Set-Up
To Directory
Clear All Tabs
Set 8 Column Tabs
Tab Fields and Ruler

AUX PORT ENHANCEMENTS SET-UP

To Next Set-Up
To Directory
Aux RX : XOFF
XON/XOFF Point
Print DH Bottoms
DW Line Prefix
Print Features
Fill After CR
Print Non-Fill Characters
Fill Count nn
Ignore/Pass Null

KEYBOARD ENHANCEMENTS SET-UP

To Next Set-Up
To Directory
Hold Screen Key Type
Auto Repeat Rate
UDK F6-F20 Shifted/Unshifted
F6-F20 Keys, VT100 Mode
Compose Key Interlock
Decimal/Hex Keypad
UDK's Volatile/NVR

C.ITOH