CIT326
Video Display Terminal

Programmer's Manual

C.ITOH

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PROGRAMMER'S MANUAL

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VIDEO DISPLAY TERMINAL

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CIE Terminals

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CHAPTER 1
INTRODUCTION

The CIT326 is a versatile, multifunctional video data terminal. It provides four DEC emulation modes that allow it to interact with a variety of application programs:

- VT200, 7-bit mode
- VT200, 8-bit mode
- VT100 mode
- VT52 mode

In addition, the terminal accepts private CIET control sequences.

All standard 7-bit control characters are supported on the CIT326. A set of 8-bit control characters is also available. These characters can be used directly when in VT200, 8-bit mode. By using the ANSI-defined 7-Bit Code Extension Technique, 8-bit control characters can be used in VT100 or VT200, 7-bit modes.

Chapter 2 lists the control codes recognized by the CIT326.

Besides single-byte control characters, multi-byte control code commands can be used. These commands include ESCAPE SEQUENCES, CONTROL SEQUENCES, and DEVICE CONTROL STRINGS.

ESCAPE SEQUENCES are multi-byte control code strings that begin with the 7-bit ESCAPE control character - **ESC** (1BH). CONTROL SEQUENCES and DEVICE CONTROL STRINGS are control functions that begin with 8-bit control codes - **CSI** (9BH) and **DCS** (90H). 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.

Chapter 3 contains the escape sequences, control sequences, and device control strings applicable to the CIT326 video terminal.

The graphic character sets of the CIT326 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.

Chapter 4 provides a complete description of how to define, designate, and invoke the various graphic character sets.

Chapter 5 lists the codes generated by the keys from the terminal's keyboard.

Chapter 6 describes control functions that perform diagnostic tests and lists explanations of error messages.

These features greatly expand the capabilities of the CIT326 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.

EMULATION MODES

The CIT326 has four emulation modes that are either selectable from the keyboard through the Terminal Set-Up Menu, or from the host computer by control sequences, (see 'Set Emulation Modes' in Chapter 3). Below is a description of each of the four modes.

VT200, 7-BIT Mode

The terminal responds to standard ANSI commands and is 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, multinational characters (European), the NRC sets, and Special Graphics characters can be accessed. (Default mode)

VT200, 8-BIT Mode — The terminal responds to standard ANSI commands and is 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 CIT326 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 CIT326 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 Standard 2022.2	7-Bit and 8-Bit Coded Character Sets -- Code Extension Techniques
ISO Draft International Standard 6429.2	Additional Control Functions for Character Imaging Devices

7- AND 8-BIT CHARACTER OPERATION

The terminal 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.

TERMINOLOGY

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

RELATED DOCUMENTS

CIT326 documentation can be ordered from CIE Terminal's Field Service Center. Additional documentation includes:

MANUAL	PART NUMBER
CIT326 User's Manual	093-070
CIT326 Maintenance Manual	093-072

The User's Manual contains information on installation, set-up, and operation of your CIT326 video terminal. The Maintenance Manual provides technical information on maintenance along with complete parts lists, wiring diagrams and schematic diagrams for the CIT326 terminal.

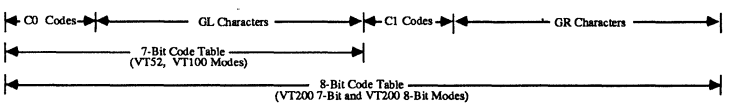
CHAPTER 2

CONTROL CODES

Control codes are single-byte codes that initiate, modify, or terminate a control operation. In Table 2-1 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.

Table 2-1. 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						////



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 CIT326 are listed in Table 2-2 together with their functions, their Hex values, the keys used to produce the codes, and a description of each action.

Table 2-2. Supported C0 Control Codes

C0 Code	Function	Hex Value	<CTRL> &	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 the cursor to the left margin on the same line
SO	Shift Out	0EH	N	Invokes the G1 character set into GL when G1 is properly designated.
SI	Shift In	0FH	O	Invokes the 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.

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

C0 Code	Function	Hex Value	<CTRL> &	Description
CAN	Cancel	18H	X	Terminates a sequence without executing it; CAN is not displayed.
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 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.

CONTROL ONE (C1)

The 8-bit code table has an area designated as Control One (C1) control codes (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.

C1 codes are generated by pressing the <ESC> key with the appropriate key chosen from among the standard characters. C1 control codes supported by the CIT326 are listed in Table 2-3 together with their functions, Hex values, the keys used to produce the codes, and a description of each action.

Table 2-3. 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 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.
>
> C1 control code = ESC + [Hex value of 8-bit control code - 40H]

For example:

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

CHAPTER 3

CONTROL FUNCTIONS

This chapter describes in detail the standard and private ANSI commands that control the internal workings of the CIT326 video data terminal.

ENTERING COMMANDS

The control sequence introducer (CSI) is entered on the keyboard by pressing:

<ESC> <[>

In hexadecimal format, this is expressed as:

1BH 5BH

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. In hexadecimal format, this is expressed as:

1BH 5BH 35H 6EH
or
9BH 35H 6EH

Be careful to distinguish between:

- an upper- or lowercase character,
- a number one (31H) or a lowercase letter l 6CH),
- a zero (30H) or an uppercase letter O (4FH).

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 (0) 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 [?

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 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 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, (as described in Chapter 2) CSI can also be expressed as ESC [. 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 programmable 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.

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).

More detailed information on these functions is included later in this manual.

CONTROL SEQUENCE FUNCTIONS

The CIT326 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 C0 and C1 control characters and the control sequences used to define, designate, and invoke character sets, these transmitted codes represent the capabilities of the CIT326.

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 EMULATION MODES

Emulation 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 emulation mode at the end of the program.

Under certain conditions a soft reset is performed if the operating mode of the terminal is altered in Set-Up Mode or by an escape sequence. Conditions that cause the soft reset are:

- Sending an escape sequence to the terminal to set VT200 8-bit mode, VT200 7-bit mode, or VT100 mode

Escape sequences to change the terminal to VT52 or from VT52 to ANSI do not cause a soft reset, and hence do not affect any terminal parameters that are changed upon a soft reset operation.

The parameters altered upon performing a soft reset are listed below in Table 3-1.

Table 3-1. Soft Reset Parameters

Function/Mode	Reset State
Autowrap	OFF
Cursor Key Mode	Normal
Cursor Position	Home
Text Cursor	On
Keypad Mode	Numeric
Keyboard Action	Unlocked
Top Margin	1
Bottom Margin	24
Origin Mode	Absolute
Insert/Replace Mode	Replace
Video Character Attributes	Normal

In addition to these parameters, the graphic set selections for G0 through G3 are redefined to their default states.

Set VT200, 7-Bit Mode

CSI62;1"p

Sets the terminal for VT200, 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 CIT326 are accessible in this mode. This is the factory default mode.

Set VT200, 8-Bit Mode

CSI62"p or
CSI62;0"p or
CSI62;2"p

Sets the terminal for VT200, 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 CIT326 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 CIT326 are accessible, except the Supplemental Character set.

Set VT52 Mode

CSI?21

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 CIT326 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.

> The last character in the reset modes listed in this section is a lowercase letter "l" (Hex value 6CH), not a number one (31H).

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.

Note that 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, when held down for more than 1/2 second, automatically repeats until that key is released. In the reset state, no keys repeat. Exceptions in this mode include the following keys:

<HOLD SCREEN>	<CTRL>
<PRINT SCREEN>	<SHIFT>
<SET-UP>	<COMPOSE CHARACTER>
<MODE/SESSION>	<RETURN>
<BREAK>	

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 5-3 in Chapter 5.

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	CSI20h
Reset Line Feed Mode	CSI20l

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 **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 **LF**, **FF**, or **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 **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 Set-Up menu in the CIT326 User's Manual.)

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 CIT326 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 = 0 Clear Tab Stop at current column
3 Clear all Tab Stops

The default value is 0. 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 single or double-height and single or double-width characters on a line at a time basis. Double-width decreases the number of characters on a line by 50%. 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#;

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, 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 (Ps) parameters are:

```
 0 = 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 (0). 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 CIT326 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)

Erase 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 0 or 1 indicates that one character is erased. A numeric parameter (Pn) indicates that (Pn) characters are erased. For VT200 mode only.

Erase Window

Erase Window CSI>3;rt;cl;rb;crJ

Erases a portion of the screen within the window specified by the parameters:

rt = top row
cl = left column
rb = bottom row
cr = right column

Erase Window Line

Erase portion of the line CSI>3;cl;crK

Erases a portion of the line the cursor is on within boundaries specified by the parameters:

cl = left column
cr = right column

Selective Erase Attribute

Set Erase Attribute CSIPs"q

Ps = 0 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 0 or 2 to turn the attribute off. (VT200 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 (Ps) parameters 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

Valid (Ps) parameters are:

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 (Ps) parameters 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

Valid (Ps) parameters are:

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

Define Scrolling Region CSIPn;Pnr

The first PN parameter 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 CIT326 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 CSI0i

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 (FF) 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, or when the terminal is set to dual host communication.

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
ESC[0z	- Keyboard data to communications port
ESC[1z	- Keyboard data to auxiliary port
ESC[2z	- Auxiliary port to communications port
ESC[3z	- Auxiliary port to display
ESC[4z	- Cease input from auxiliary port
ESC[5z	- Clear auxiliary port output buffer

This block is toggled by the set-up feature 'CIT101 or DEC220' Print Features field in the Auxiliary Enhancement menu (refer to the CIT326 User's Manual).

Note that the equivalent DEC printer commands (for example; 'CSI?5i' for Enter Auto Auxiliary Mode) will be accepted regardless of the 'Print Features' 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 CIT326 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 "24 + Status Line" in the 'Data Rows' field on 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.

0 or None = Clear entire line (default)
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 0 through 9 and A through F represent one binary number. The binary number is used as an absolute character address:

```
00 through 1F - displays the C0
                control set

20 through 7F - displays GL characters

80 through 9F - displays the C1
                control set

A0 through FF - displays GR characters
```

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

```
DCS 0;1;7;4 Q 48656C6C6F2C2049276D206120434954333236 ST
```

where:

```
          DCS = device control string introducer
            0 = clear entire status line
            1 = start at column 1
            7 = reverse image
            4 = underline
            Q = terminator
Data string = 'Hello, I'm a CIT326'
           ST = DCS terminator
```

The length of the data string is determined by the mode of the terminal, either 80 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.

SEGMENTED DISPLAY MODE

In this mode, the terminal display memory is subdivided into a series of separate pages of 24 or 25 lines each. In single host mode, the terminal provides four pages and in dual host mode the terminal supports two pages for each host. Each page is considered independent and all editing commands affect the selected page only.

The following figures illustrate the different configurations of segmented display memory.

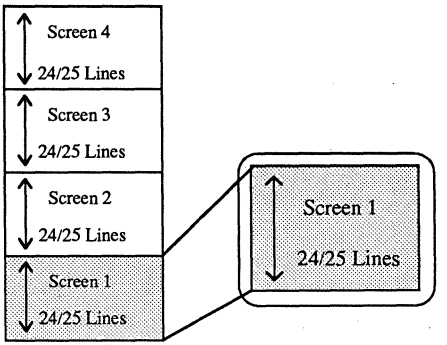


Figure 3-1. Segmented Memory - Single Host

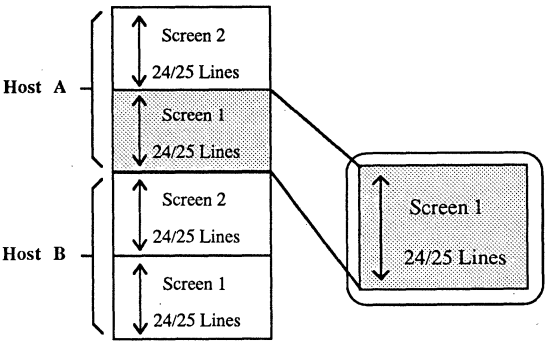


Figure 3-2. Segmented Memory - Dual Host Independent Mode

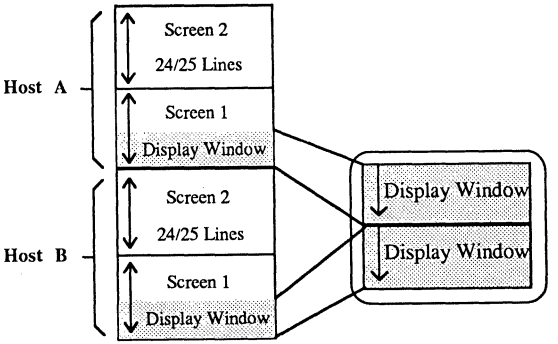


Figure 3-3. Segmented Memory - Dual Host Split Screen Mode

Display memory is organized on 132 column boundaries, with global selection for display formats of 80 or 132 column formats. In dual host selection, each host may be configured for a different display format.

Page display is controlled locally through the keyboard or by the host through escape sequences. Refer to your CIT326 User's Manual for local control of page display.

Next Page Command

```
ESC[PnU  or  ESC[>PnU

Pn value of 0,1 or none = Go to next page
                    2 = Go forward two pages
                    3 = Go forward three pages
```

These sequences display succeeding pages on the screen. If the Pn parameter is specified as a 0 or a 1, or no parameter is entered, the next page in sequence is displayed. If a parameter of 2 is entered, the display advances two pages; if a value of 2 is entered, the last page displays. However, if the last page is currently displayed, then no action occurs.

The cursor is placed at the Home position of the newly displayed page unless the private use character '>' is included in the command. When included, the cursor remains on the previously displayed page. If new displayable data is received, the data is entered at the cursor position on the previous page.

Note, however, that when a 'Next Page' command is entered locally, the cursor is placed at the Home position of the newly displayed page.

Previous Page Command

ESC[PnV or ESC[>PnV

Pn value of 0,1 or none = Go to previous page
2 = Go back two pages
3 = Go back three pages

These sequences display preceding pages on the screen. If the Pn value is specified as a 0 or a 1, or no parameter is entered, the preceding page is displayed. If page 1 is currently displayed, then no action occurs. If a parameter of 2 is entered, the display moves back two pages; if a parameter of 3 is entered, the display moves back three pages.

The cursor is placed at the Home position of the newly displayed page unless the private use character '>' is included in the command. When included, the cursor remains on the originally displayed page. If new displayable data is received, the data is entered at the cursor position on the original page.

Note, however, that when a 'Previous Page' command is entered locally, the cursor is placed at the Home position of the newly displayed page.

Copy Data Command

```
ESC[Ps;P1;P2;P3;P4;P5p

Ps = 0  Copy lines in the forward direction
     1  Copy lines in the reverse direction
P1 = Copy from page
P2 = Copy from line
P3 = Copy to page
P4 = Copy to line
P5 = Number of lines to copy
```

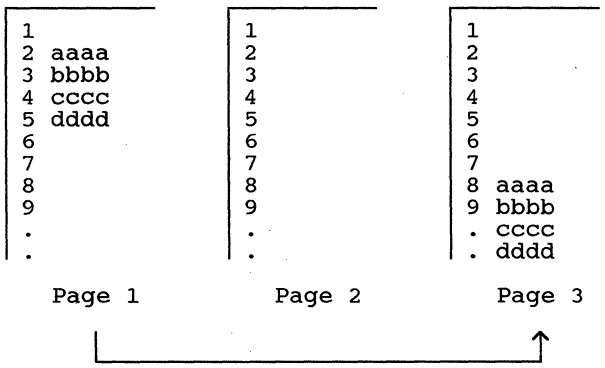
This sequence is an editing command that allows you to copy lines of text from one page to another or from one section of a page to another section on the same page.

If Ps is '0', text is copied in a forward direction, and if Ps is '1', text is copied in a reverse direction.

This escape sequence causes P5 lines of data on page P1 from line P2 to be copied to page P3 starting on line P4. The Ps parameter determines the direction in which the lines are copied. The 'copy data' command is usable in the segmented mode of display operation only.

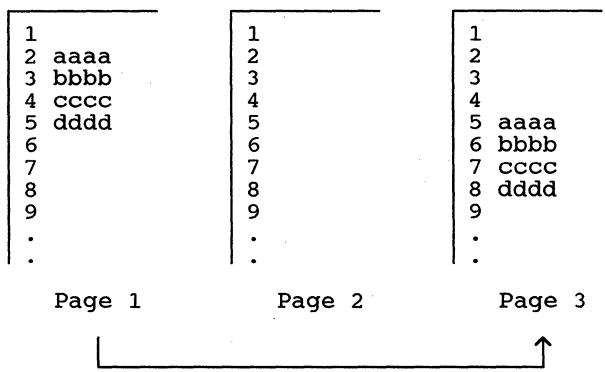
For example, to copy 4 lines of data from page 1 (starting at line 2) to page 3 (starting at line 8), and to copy them in the forward direction, the command would be:

```
ESC [ 0;1;2;3;8;4p
```



If these lines of data are copied to page 3 in the reverse direction, the data would be copied with the bottom line on line 8, as shown below. Note that any existing data would be replaced with the new data.

```
ESC [ 1;1;2;3;8;4p
```



PROGRAMMABLE KEYS

A feature of the CIT326 is the capability to program keys to perform a variety of functions. The keys may be programmed by the operator at the keyboard by using the Programmable Key Editor in Set-Up mode (see the CIT326 User's Manual), or by the host computer with the use of device control strings.

This feature is available in VT200 modes and may be accessed in VT100 mode through the 'F6-F20 VT100 Mode' parameter in the Keyboard Enhancements menu. Programmable keys are not operable in VT52 mode.

Keys that are programmable include:

- The <F6> through <F20> Function Keys
- <Back Space>
- <Delete>
- The Editing Keypad
- Cursor Movement Keys
- The Numeric Keypad
- <PF1> through <PF4> Keys
- The <ENTER> Key

All programmable keys, including the <F6> through <F20> function keys, are provided with four levels of programmability - Normal, Shift, Control, and Control/Shifted. These key combinations provide a total of 180 programmed key sequences.

The keys output their normal hard coded values under any modifier, unless they have been specifically programmed by the host or the user, in which case they output the programmed sequence. Clearing the content of any programmable key causes it to be restored to its un-programmed condition.

Memory Area

A memory area of 1024 bytes stores the programmed key contents. In dual host mode, the memory area is equally divided between the hosts - 512 bytes for Host A and 512 bytes for Host B.

Once the memory area is full, no more keys may be programmed until space is made available. The amount of space available for reprogramming the keys is monitored by the host computer and the Programmable Key Editor.

To free up space, you may:

- redefine a key definition with a shorter sequence,
- clear a key with a device control string, or
- clear all programmed keys by setting the 'Programmable Keys' 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, programmable key definitions are lost if they have not been saved by setting the 'Programmable Keys' field in the Keyboard Enhancements menu to "non-volatile".

Facilities are provided to clear a single key or a specific level (Normal, Shift, Control, or Control/Shift) for an entire group. Refer to the 'Delete Key Group' field in the Programmable Key Editor menu in the CIT326 User's Manual for more information.

Programming Keys to be Inactive

Keys may be programmed to be specifically inactive for one or more modifiers. By programming the selected key content with a user defined character, the key outputs no function when pressed. Refer to the 'Define Dead Key Character' field in the Programmable Key Editor menu in the CIT326 User's Manual for more information.

Programmable Key Command
DEC-Compatible Method

The format for loading a programmable key using the DEC-compatible method is shown below:

```
DCS Pc; Pl; P2 | Kyn/stn;...;Kyn/stn ST       (8-bit mode)
ESC P Pc; Pl; P2 | 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 keys will be cleared when downloading the keys. Valid entries are:

0 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, the 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.

Pl (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:

0 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 ('Programmable Keys Unlocked,' Keyboard Enhancements menu) before another device control string can change their definitions.

is the parameter delimiter. The ; is omitted if no P2 value is entered.

P2 is a routing parameter that directs the programmed function when the key is pressed. Valid destination entries are:

0 or None = Host Only (Default)
1 = Local Only
2 = Host and local routing

Parameter P2 may be omitted if no routing control is required.

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 programmable key to be redefined. Stn is the data, expressed in hexadecimal values, to be transmitted by the programmed key. See Table 3-2 below for a listing of Kyn values.

The string parameters (Stn's) are hexadecimal pairs in the range:

30H through 39H (0-9)
41H through 46H (A-F)
61H through 66H (a-f)

When these hex values are combined, they represent an 8-bit quantity. Several definitions can be entered on 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 \.

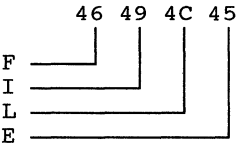
Table 3-2. Kyn Values

Key Group	Key Name	Kyn Value			
		<Normal>	<SHIFT>	<CTRL>	<CTRL><SHIFT>
F-Keys	F6	77	17	37	57
	F7	78	18	38	58
	F8	79	19	39	59
	F9	80	20	40	60
	F10	81	21	41	61
	F11	83	23	43	63
	F12	84	24	44	64
	F13	85	25	45	65
	F14	86	26	46	66
	HELP	88	28	48	68
	DO	89	29	49	69
	F17	91	31	51	71
	F18	92	32	52	72
	F19	93	33	53	73
	F20	94	34	54	74
Edit	Back Space	100	101	102	103
	Delete	104	105	106	107
	Find	108	109	110	111
	Insert Here	112	113	114	115
	Remove	116	117	118	119
	Select	120	121	122	123
	Prev Screen	124	125	126	127
	Next Screen	128	129	130	131
Cursor	Up Arrow	132	133	134	135
	Left Arrow	136	137	138	139
	Down Arrow	140	141	142	143
	Right Arrow	144	145	146	147
Numeric	0	148	149	150	151
	1	152	153	154	155
	2	156	157	158	159
	3	160	161	162	163
	4	164	165	166	167
	5	168	169	170	171
	6	172	173	174	175
	7	176	177	178	179
	8	180	181	182	183
	9	184	185	186	187
	-	188	189	190	191
	.	192	193	194	195
	,	196	197	198	199
PF	PF1	200	201	202	203
	PF2	204	205	206	207
	PF3	208	209	210	211
	PF4	212	213	214	215
ENTER	Enter	216	217	218	219

For example, to program F-key 10 (at the shifted level) to display the word 'FILE' when pressed, and to do this without clearing values in any other keys, the string would begin:

```
DCS 1;1 | 21 /
```

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



Thus, after the slash character (/), continue with this string:

```
46494C45ST
```

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

Programmable Key Command CIET Method

In addition to the DEC-compatible device control string used to define the programmable keys, a second, more 'convenient' command has been implemented.

The CIET command is as follows:

```
DCS P1;P2 u <key data> ST          (8-bit mode)
ESC P P1;P2 u <key data> ESC \     (7-bit mode)
```

where:

ESC P — is the ANSI Device Control String (DCS) introducer. In 8-bit mode it is expressed as DCS.

P1 — is the key number (Kyn value) of the key to be loaded. (See Table 3-2 above for a list of key numbers.)

; — is the parameter delimiter. The ; is omitted if no P2 value is entered.

P2 is a routing parameter that directs the programmed function when the key is pressed. Valid destination entries are:

0 or None = Host only (Default)
1 = Local only
2 = Host and local routing

Parameter P2 may be omitted if no routing control is required.

u is the terminator for the DCS introducer.

<key data> is the string of ASCII characters.

ESC \ is the ANSI String Terminator. In 8-bit mode, this is expressed as ST.

For example, to program F-key 10 to display the word 'FILE' when pressed, enter:

```
DCS 21;0 u FILE ST          (8-bit mode)
ESC P 21;0 u FILE ESC \     (7-bit mode)
```

Overload of Programmable Key Memory

Overload of the memory area for the programmable keys using device control strings causes the terminal to absorb received characters until a string terminator (ESC\ or ST) is received.

The terminal clears the key being loaded when overload occurs and executes the lock and clear parameters passed at the beginning of the load sequence.

Clear Programmable Keys Command

```
DCS 0;1 | ST
```

Clears the programmable key contents. The default value of each key is reinstated. Refer to Chapter 5 for a listing of codes generated by the programmable keys.

Lock Programmable Keys Command

DCS1;0|ST

Locks the keys to prevent a breach of security at the terminal and in the computer system.

Notes on Programmable Keys

By finding the hexadecimal equivalent of any of the control functions discussed earlier in this chapter, a programmable key could perform those functions by downloading one of the device control sequences.

When a device control string is used to define programmable keys, and it encounters an ESC character in an 8-bit environment, the loading process is aborted. In addition, CAN (<CTRL> <X>) and SUB <CTRL> <Z> control codes abort the loading 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 download 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 download process aborts.

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 Terminal Set-Up menu.

Request Device Attributes

```
CSI c    or    CSI 0 c
```

Response with Attributes (VT220 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 VT220, the following responses apply.

Response (VT100 ID) ESC[?1;2 c

Response (VT101 ID) ESC[?1;0 c

Response (VT102 ID) ESC[?6 c

Request Secondary Device Attributes

```
CSI > c    or    CSI > 0 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;20;0c

which means: I am a VT220, version 2.0, 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 Programmable Key Status

CSI ?25n

Response:	Keys are unlocked	CSI ?20n
	Keys are locked	CSI ?21n

Request for Keyboard Language

CSI ?26n

Response:	North American	CSI ?27;1n
	British	CSI ?27;2n
	Flemish	CSI ?27;3n
	Canadian (French)	CSI ?27;4n
	Danish	CSI ?27;5n
	Finnish	CSI ?27;6n
	German	CSI ?27;7n
	Dutch	CSI ?27;8n
	Italian	CSI ?27;9n
	Swiss (French)	CSI ?27;10n
	Swiss (German)	CSI ?27;11n
	Swedish	CSI ?27;12n
	Norwegian	CSI ?27;13n
	French (Belgian)	CSI ?27;14n
	Spanish	CSI ?27;15n

Request for Terminal Parameters

CSI<sol>x

Parameter	Value	Meaning
<sol>	0 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<sol>;<par>;<nbits>;<xspeed>;<rspeed>;<clkmul>;<flag>x

Parameter	Value	Meaning
<sol>	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 Terminal Set-Up menu.

Request Identification

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 Main Set-Up 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 programmable keys (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 3-3. 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 3-3. Soft Reset States

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 Main Set-Up menu.

VT52 MODE ESCAPE SEQUENCES

The CIT326 control sequences defined below are valid in the VT52 emulation mode. C0 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 1F. For example, row 2, column 2 is Hex 21 (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

Enter concurrent auxiliary mode	ESC U
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.

CHAPTER 4

GRAPHIC CHARACTER SETS

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.

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

Figure 4-1. Graphic Left Character Set

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 contains an area designated as GR or GRAPHIC RIGHT. By factory default, the GR area contains the Supplemental Graphics character set.

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

Figure 4-2. Graphic Right Character Set

This GR graphic character area can be used as an auxiliary character set in applications programs.

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

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.

CHARACTER SET REPERTOIRE

The graphic repertoire of the CIT326 consists of the following character sets:

ASCII Graphics
Supplemental Graphics
Special Graphics
National Replacement Character (NRC) Sets
'Soft' Character Sets

Appendix A illustrates the various 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 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 'Character Sets' field in the Display Enhancements Menu must be set to "National" before accessing the NRC sets. They are accessed one at a time, depending on the 'Keyboard Layout' field in the Keyboard Set-Up menu.

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

'Soft' Character Set

The 'soft' 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' 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 4-1.)

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' 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 4-3 illustrates the reloading process.

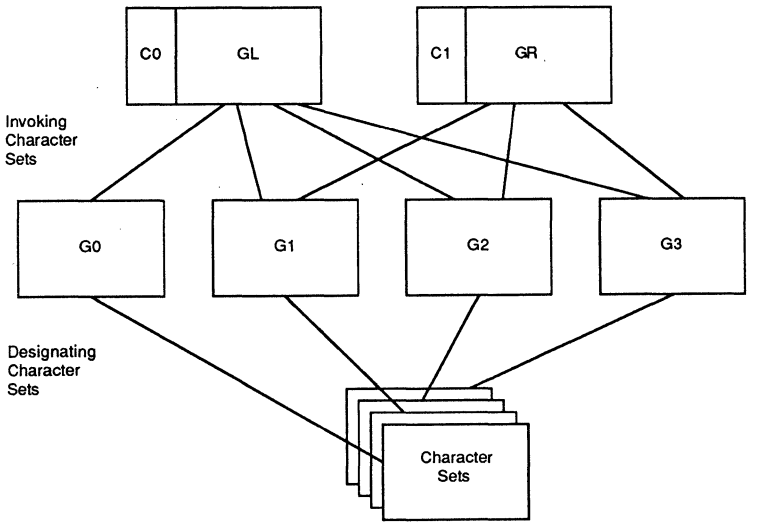


Figure 4-3. Reloading Character Sets

Designate Character Sets

To designate character sets into G0, G1, G2, or G3 use the control sequences listed below in Table 4-1. A character set is reassigned by entering another control sequence from the table below, or by resetting the terminal.

Table 4-1. Designating Character Sets

Character Set	Designate as:	Control Sequence
ASCII	G0	ESC(B
	G1	ESC)B
	G2	ESC*B
	G3	ESC+B
Supplemental	G0	ESC(<
	G1	ESC)<
	G2	ESC*<
	G3	ESC+<
Special Graphics	G0	ESC(0
	G1	ESC)0
	G2	ESC*0
	G3	ESC+0
NRC Sets		
Dutch	G0	ESC(4
	G1	ESC)4
Finnish	G0	ESC(C or ESC(5
	G1	ESC)C or ESC)5
French	G0	ESC(R
	G1	ESC)R
French Canadian	G0	ESC(Q
	G1	ESC)Q
German	G0	ESC(K
	G1	ESC)K
Italian	G0	ESC(Y
	G1	ESC)Y
Norwegian/Danish	G0	ESC(E or ESC(6
	G1	ESC)E or ESC)6

Table 4-1. Designating Character Sets (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)7
Swiss	G0	ESC(=
	G1	ESC)=
Soft Character Set	G0	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 20H - 3FH. The final character is required and in the range 40H - 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 G0, G1, G2, or G3 can be invoked into GL or GR by using the control sequences listed below in Table 4-2.

Table 4-2. Invoking Character Sets

Control Sequence	Action
ESCN or SS2 (8EH)	Single shift G2 into GL (VT200 mode)
ESCO or SS3 (8FH)	Single shift G3 into GL (VT200 mode)
SI (0FH)	Invoke G0 into GL (Default)
SO (0EH)	Invoke G1 into GL
ESC~	Invoke G1 into GR (VT200 mode)
ESCn	Invoke G2 into GL (VT200 mode)
ESC}	Invoke G2 into GR (VT200 mode)
ESCo	Invoke G3 into GL (VT200 mode)
ESC|	Invoke G3 into GR (VT200 mode)

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

'SOFT' CHARACTER SETS

When in either of the VT200 modes, up to 94 characters may be created and 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 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 10. 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.

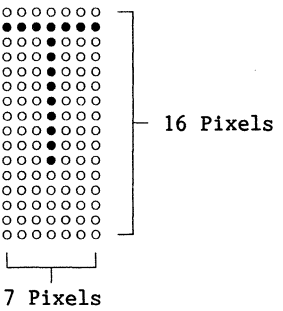


Figure 4-4. Soft Character on 7 x 16 Matrix

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 0 (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 4-5 illustrates the conversion process described above.

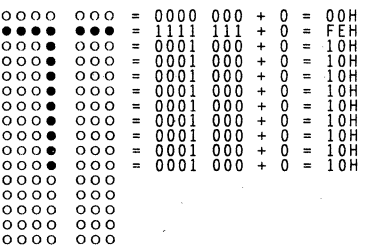


Figure 4-5. CIET Conversion Process

The CIET private command may also be used to program DEC-compatible characters using 10 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-3) 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.

Loading Each Character using the CIET Method

A device control string is used to 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 00FE101010101010101010;23B5;;55555566 ST
```

where:

DCS is the ANSI device control string introducer.

0 is the soft font buffer index.

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

0 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.

00FE101010101010101010 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 10; however when defining a character, the maximum number of columns and rows available are 7 x 10. The following steps outline the procedure to define a 'soft' character set.

1. Define characters on a matrix of 7 x 10 pixels.

   A normal terminal character cell is a matrix of 7 x 10 pixels. The terminal ignores characters defined beyond its normal size.

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

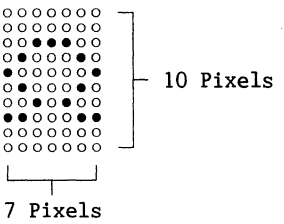


Figure 4-6. Soft Character on 7 x 10 Matrix

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.

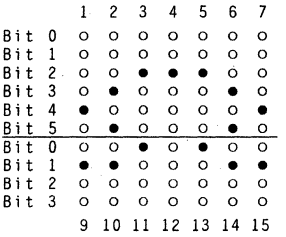


Figure 4-7. Example of a Divided Matrix

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 4-8 illustrates the conversion process described above.

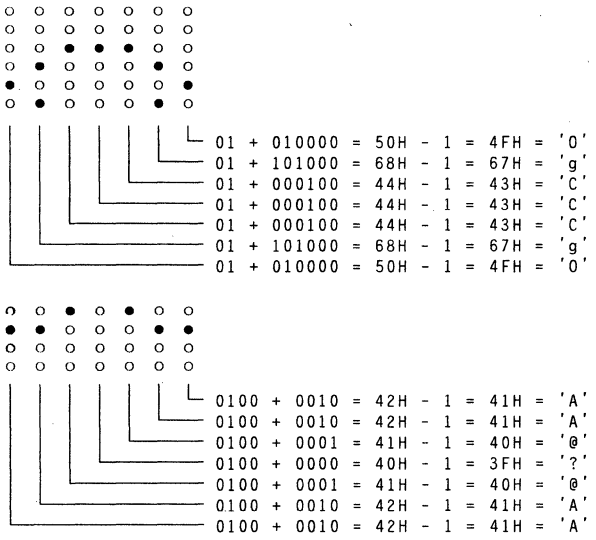


Figure 4-8. DEC-Compatible Conversion Process

Loading Each Character using the DEC-Compatible Method

A device control string is used to 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. (Default = 0)

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. (Default = 0)

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.)

Sxbpl... — 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.

Note that the first six parameters (Pfn;Pcn;Pe;Pcms;Pw;Pt) are not required if the soft character being loaded has the same values as the default values, which are all zero (0). These parameters are assumed.

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

```
DCS 0 ; 1 ; 1 ; 0 ; 0 ; 0 { sp@ OgCCCgO / AA@?@AA ST
```

The DCS process may be aborted when it receives an ESC argument. In addition, CAN (<CTRL> <X>) and SUB (<CTRL> <Z>) control characters 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.

CHAPTER 5

KEYBOARD GENERATED CODES

This chapter contains a listing of the codes generated by the keys on the CIT326 keyboard.

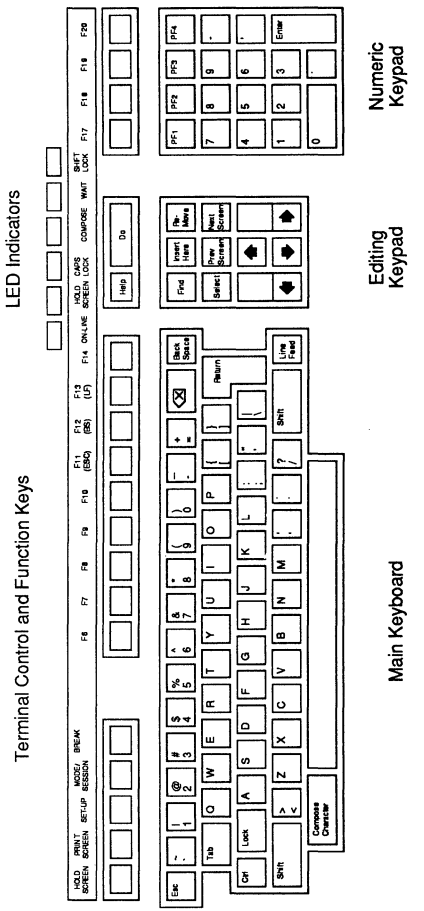


Figure 5-1. CIT326 Keyboard

CONTROL CODES

The CIT326 generates 7-bit control codes by pressing the <CTRL> key simultaneously with the appropriate key chosen from among the standard characters. Table 5-1 lists the control codes together with their hexadecimal values and corresponding standard keys. All CIT326 keyboards accept these keys and key combinations.

Table 5-1. Keyboard Generated Control Codes

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

MAIN KEYBOARD FUNCTION KEYS

ASCII codes generated by the main keyboard function keys are noted in hexadecimal notation in Table 5-2 below.

Table 5-2. Main Keyboard Function Keys

Key(s)	Code Generated	Hex Value
Back Space	BS	08H
Tab	HT	09H
Line Feed	LF	0AH
Return *	LF or	0AH
	LF and	0AH
	CR	0DH
Esc	ESC	1BH
Delete	DEL	7FH
Shift, Delete	DEL	7FH
Ctrl, Delete	CAN	18H
Ctrl, Shift, Delete	CAN	18H
Space Bar	SP	20H

* Refer to 'Line Feed/New Line Mode' in the Terminal Modes section in Chapter 3.

EDITING KEYPAD

Table 5-3 lists the codes generated by the cursor control keys, and Table 5-4 lists the codes generated by the editing keys.

Table 5-3. Cursor Control Keys

Key	ANSI Mode* Cursor Key Mode		VT52 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.

Table 5-4. 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 permits single key entry of various special control sequences and direct input of decimal data.

The keypad can operate in one of two modes, numeric or application, as selected in the Keyboard Set-Up Menu. The modes can also be set through escape sequences as described in Terminal Modes in Chapter 3. In either mode the keypad generates ANSI or VT52 compatible code sequences. Table 5-5 lists the generated code sequences.

Table 5-5. Numeric Keypad

Key	ANSI Keypad Numeric Mode	ANSI Keypad Application Mode	VT52 Keypad Numeric Mode	VT52 Keypad Application Mode
0	0	SS3p	0	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
-	-	SS3m	-	ESC?m
,	,	SS3l	,	ESC?l
.	.	SS3n	.	ESC?n
Enter	CR or CR LF	SS3M	CR or CR LF	ESC?M

TERMINAL CONTROL AND FUNCTION KEYS

Table 5-6 lists the codes generated by the terminal control and function keys.

Table 5-6. Terminal Control and Function Keys

Key Label	VT200 Mode	VT100 * VT52 Modes
HOLD SCREEN	-	-
PRINT SCREEN	-	-
SET-UP	-	-
MODE/SESSION	-	-
BREAK	-	-
F6	CSI17~	-
F7	CSI18~	-
F8	CSI19~	-
F9	CSI20~	-
F10	CSI21~	-
F11 (ESC)	CSI23~	ESC
F12 (BS)	CSI24~	BS
F13 (LF)	CSI25~	LF
F14	CSI26~	-
Help (F15)	CSI28~	-
Do (F16)	CSI29~	-
F17	CSI31~	-
F18	CSI32~	-
F19	CSI33~	-
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.

CHAPTER 6

TROUBLESHOOTING

SELF-TEST DIAGNOSTICS

The CIT326 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;Psy

where 'Ps' is a parameter chosen for the desired test as follows:

Parameter	Functions Tested
1	Same as power up: ROM, NVR, RAM
2	Dual Channel loop back; Communications Channel to Auxiliary Channel (Requires dual port loop back connector)
4	EIA loop back (Requires EIA loop back connector)
8	Continuous testing of selected function

To run a test repeatedly, add 8 to the test parameter. For example, to run the EIA loop back test on a continuous basis, enter the command:

CSI4;12y

The terminal also allows you to chain certain tests together. This is done by adding the Ps numbers together. For example, to run Tests 1 and 4 on a continuous basis, enter the command:

CSI4;13y

Valid parameter combinations are as follows:

```
 3 = Tests 1 & 2  (1,2)
 9 = Test 1 continuously  (1,8)
10 = Test 2 continuously  (2,8)
12 = Test 4 continuously  (4,8)
13 = Tests 1 & 4 continuously  (1,4,8)
```

ERROR MESSAGES

The diagnostics indicate detected errors 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.

APPENDIX A

CODE TABLES

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	[	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

C0 CODES — GL CODES

KEY

Character: # — 35 (Decimal) / 23 (Hexadecimal)

Table A-1. 7-Bit Code Table (ASCII Graphics)

COLUMN 8		9		10		11		12		13		14		15			
	128 80	DCS	144 90		160 A0	°	176 B0	À	192 C0		208 D0	à	224 E0		240 F0	0	ROW
	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	Œ	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

KEY

Character: æ — 230 (Decimal) / E6 (Hexadecimal)

Table A-2. 8-Bit Code Table (Supplemental Graphics)

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	SCAN3	112 70
1	SOH	01 01	DC1 (XON)	17 11	!	33 21	1	49 31	A	65 41	Q	81 51	▬	97 61	SCAN5	113 71
2	STX	02 02	DC2	18 12	"	34 22	2	50 32	B	66 42	R	82 52	H_T	98 62	SCAN7	114 72
3	ETX	03 03	DC3 (XOFF)	19 13	#	35 23	3	51 33	C	67 43	S	83 53	F_F	99 63	SCAN9	115 73
4	EOT	04 04	DC4	20 14	$	36 24	4	52 34	D	68 44	T	84 54	C_R	100 64	├	116 74
5	ENQ	05 05	NAK	21 15	%	37 25	5	53 35	E	69 45	U	85 55	L_F	101 65	┤	117 75
6	ACK	06 06	SYN	22 16	&	38 26	6	54 36	F	70 46	V	86 56	°	102 66	┴	118 76
7	BEL	07 07	ETB	23 17	'	39 27	7	55 37	G	71 47	W	87 57	±	103 67	┬	119 77
8	BS	08 08	CAN	24 18	(	40 28	8	56 38	H	72 48	X	88 58	N_L	104 68	│	120 78
9	HT	09 09	EM	25 19	)	41 29	9	57 39	I	73 49	Y	89 59	V_T	105 69	≤	121 79
10	LF	10 0A	SUB	26 1A	*	42 2A	:	58 3A	J	74 4A	Z	90 5A	┘	106 6A	≥	122 7A
11	VT	11 0B	ESC	27 1B	+	43 2B	;	59 3B	K	75 4B	[	91 5B	┐	107 6B	π	123 7B
12	FF	12 0C	FS	28 1C	,	44 2C	<	60 3C	L	76 4C	\	92 5C	┌	108 6C	≠	124 7C
13	CR	13 0D	GS	29 1D	-	45 2D	=	61 3D	M	77 4D	]	93 5D	└	109 6D	£	125 7D
14	SO	14 0E	RS	30 1E	.	46 2E	>	62 3E	N	78 4E	^	94 5E	┼	110 6E	•	126 7E
15	SI	15 0F	US	31 1F	/	47 2F	?	63 3F	O	79 4F	(BLANK)	95 5F	SCAN1	111 6F	DEL	127 7F

C0 CODES — GL CODES

KEY

Character: # — 35 (Decimal), 23 (Hexadecimal)

Table A-3. Special Graphics

ROW	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

C0 CODES — GL CODES

KEY

Character: £ — 35 Decimal, 23 Hexadecimal

Table A-4. British NRC Set
(British 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	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
	C0 CODES				GL CODES											

KEY

Character: § | 93 (Decimal) | 5D (Hexadecimal)

Table A-5. French NRC Set
(Flemish and French/Belgian Keyboards)

ROW	COLUMN 0	1	2	3	4	5	6	7
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

C0 CODES — GL CODES

KEY

Character: ç — 92 (Decimal), 5C (Hexadecimal)

Table A-6. French Canadian NRC Set (French Canadian Keyboard)

ROW	COLUMN 0	1	2	3	4	5	6	7
0	NUL 00 00	DLE 16 10	SP 32 20	0 48 30	Ä 64 40	P 80 50	å 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

C0 CODES — GL CODES

KEY

Character: Æ — 91 Decimal, 5B Hexadecimal

Table A-7. Norwegian/Danish NRC Set (Norwegian and Danish Keyboards)

ROW	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	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

C0 CODES — GL CODES

KEY

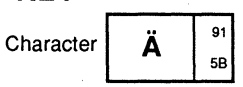


Table A-8. Finnish NRC Set (Finnish Keyboard)

ROW	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	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

C0 CODES — GL CODES

KEY

Character: ß | 126 (Decimal) | 7E (Hexadecimal)

Table A-9. German NRC Set (German Keyboard)

ROW	COLUMN 0	1	2	3	4	5	6	7
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	ƒ 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-10. Dutch NRC Set
(Dutch 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	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

C0 CODES — GL CODES

KEY

Character: £ — 35 Decimal, 23 Hexadecimal

Table A-11. Italian NRC Set
(Italian Keyboard)

ROW	COLUMN 0	1	2	3	4	5	6	7
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

C0 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	

C0 CODES — GL CODES

KEY

Character: É — 64 Decimal, 40 Hexadecimal

Table A-13. Swedish NRC Set
(Swedish Keyboard)

ROW	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	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

C0 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 CIT326.

C0 CONTROL CODES

C0 Code	Function	Hex Value	<CTRL> &
NUL	Null	00H	SPACE
ENQ	Enquiry	05H	E
BEL	Bell	07H	G
BS	Back Space	08H	H
HT	Horizontal Tab	09H	I
LF	Line Feed	0AH	J
VT	Vertical Tab	0BH	K
FF	Form Feed	0CH	L
CR	Carriage Return	0DH	M
SO	Shift Out	0EH	N
SI	Shift In	0FH	O
DC1	Device Control 1 (XON)	11H	Q
DC3	Device Control 3 (XOFF)	13H	S
CAN	Cancel	18H	X
SUB	Substitute	1AH	Z
ESC	Escape	1BH	[
DEL	Delete	7FH	

C1 CONTROL CODES

C1 Code	Function	Hex Value	Keys
IND	Index	84H	ESC D
NEL	Next Line	85H	ESC E
HTS	Horizontal Tab Set	88H	ESC H
RI	Reverse Index	8DH	ESC M
SS2	Single Shift (G2)	8EH	ESC N
SS3	Single Shift (G3)	8FH	ESC O
DCS	Device Control String	90H	ESC P
CSI	Control Sequence Introducer	9BH	ESC [
ST	String Terminator	9CH	ESC \

APPENDIX C
CONTROL SEQUENCES

The following is a summary of the control sequences used with the CIT326.

SET EMULATION 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?21

Set C1 Control Code Transmission

Translate 8-bit C1 control codes to their equivalent 7-bit codes for transmission to the host. (VT200 mode only)	ESCspF
Do 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)	ESCspG

TERMINAL MODES

Keypad Application Mode

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

Keyboard Action Mode

Set Keyboard Action Mode	CSI2h
Reset Keyboard Action Mode	CSI2l

Character Insert/Replace Mode

Set Insert Mode	CSI4h
Reset Replace Mode	CSI4l

Send-Receive Mode

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

Line Feed-New Line Mode

Set New Line Mode	CSI20h
Reset Line Feed Mode	CSI20l

Cursor Key Application Mode

Set Cursor Key Appl. Mode	CSI?1h
Reset to Cursor Key Mode	CSI?1l

Column Mode

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

Scrolling Mode

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

Screen Mode

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

Cursor Origin Mode

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

Auto Wrap Mode

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

Auto Repeat Mode

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

Print Form Feed Mode

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

Print Extent Mode

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

Text Cursor Enable Mode

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

Character Set Mode

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

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 = 0   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

Ps = 0  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 = 0  Attribute off (erasable)
     1  Non-erasable character
          (attribute on)
     2  Erasable character
          (attribute off)
```

Erase Window — CSI>3;rt;cl;rb;crJ

```
rt = top row
cl = left column
rb = bottom row
cr = right column
```

Erase Window Line — CSI>3;cl;crK

```
cl = left column
cr = right column
```

Erase Screen/Line: Attributes Protected

Erase within Screen — CSI?PsJ

```
Ps = 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

```
Ps = 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

Erase within Screen — CSIPsJ

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

Erase within Line	CSIPsK

Ps = 0 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 CSI0i

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.

Enter Concurrent Auxiliary Mode	ESC0
Enter Auxiliary Control Mode	ESC1
Exit Auxiliary Control Mode	ESC2
Enter Auto Auxiliary Mode	ESC#0
Exit Auto Auxiliary or Concurrent Print Mode	ESC#1
Output cursor line to Auxiliary	ESC#2
Output page to Auxiliary	ESC#7
Keyboard data to communications port	ESC[0z
Keyboard data to auxiliary port	ESC[1z
Auxiliary port to communications port	ESC[2z
Auxiliary port to display	ESC[3z
Cease input from auxiliary port	ESC[4z
Clear auxiliary port output buffer	ESC[5z

25TH ROW STATUS LINE

```
DCS Pn1;Pn2;Pn3;PnN Q Data ST
ESC P Pn1;Pn2;Pn3;PnN Q Data ESC \
```

SEGMENTED DISPLAY MODE

```
Next Page                          ESC[PnU
                                   or
                                   ESC[>PnU

  Pn of 0,1 or none = Go to next page
                  2 = Go forward two pages
                  3 = Go forward three pages

Previous Page                      ESC[PnV
                                   or
                                   ESC[>PnV

  Pn of 0,1 or none = Go to previous page
                  2 = Go back two pages
                  3 = Go back three pages

Copy Data          ESC[Ps;P1;P2;P3;P4;P5p

  Ps = 0  Copy lines in the forward direction
       1  Copy lines in the reverse direction
  P1 = Copy from page
  P2 = Copy from line
  P3 = Copy to page
  P4 = Copy to line
  P5 = Number of lines to copy
```

PROGRAMMABLE KEYS

DEC-Compatible Method

```
DCS Pc;P1;P2 | Kyn/stn;...;Kyn/stn ST
ESC P Pc;P1;P2 | Kyn/stn;...;Kyn/stn ESC \
```

CIET Method

```
DCS P1;P2 u <key data> ST
ESC P P1;P2 u <key data> ESC \


Clear Programmable Keys            DCS0;1|ST

Lock Programmable Keys             DCS1;0|ST
```

CHARACTER SET DESIGNATION

Character Set	Designate as:	
ASCII	G0	ESC(B
	G1	ESC)B
	G2	ESC*B
	G3	ESC+B
Supplemental	G0	ESC(<
	G1	ESC)<
	G2	ESC*<
	G3	ESC+<
Special Graphics	G0	ESC(0
	G1	ESC)0
	G2	ESC*0
	G3	ESC+0
NRC Sets		
Dutch	G0	ESC(4
	G1	ESC)4
Finnish	G0	ESC(C or ESC(5
	G1	ESC)C or ESC)5
French	G0	ESC(R
	G1	ESC)R
French Canadian	G0	ESC(Q
	G1	ESC)Q
German	G0	ESC(K
	G1	ESC)K
Italian	G0	ESC(Y
	G1	ESC)Y
Norwegian/Danish	G0	ESC(E or ESC(6
	G1	ESC)E or ESC)6
Spanish	G0	ESC(Z
	G1	ESC)Z
Swedish	G0	ESC(H or ESC(7
	G1	ESC)H or ESC)7
Swiss	G0	ESC(=
	G1	ESC)=

Character Set	Designate as:	
Soft Character Set	G0	ESC(name
	G1	ESC)name
	G2	ESC*name
	G3	ESC+name

INVOKING CHARACTER SETS

Single shift G2 into GL (VT200 mode only)	ESCN or SS2 (8EH)
Single shift G3 into GL (VT200 mode only)	ESCO or SS3 (8FH)
Invoke G0 into GL (Default)	SI (0FH)
Invoke G1 into GL	SO (0EH)
Invoke G1 into GR (VT200 mode only)	ESC~
Invoke G2 into GL (VT200 mode only)	ESCn
Invoke G2 into GR (VT200 mode only)	ESC}
Invoke G3 into GL (VT200 mode only)	ESCo
Invoke G3 into GR (VT200 mode only)	ESC|

LOADING CHARACTERS

CIET Method

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

DEC-Compatible Method

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

CLEAR CHARACTER SET

DCS 1;1;2 { sp @ ST

REPORTS

Request Device Attributes	CSI c or CSI 0 c
Response with Attributes (VT220 ID)	CSI ? n;n;...n c
Response (VT100 ID)	ESC[?1;2 c
Response (VT101 ID)	ESC[?1;0 c
Response (VT102 ID)	ESC[?6 c
Request Secondary Device Attributes	CSI > c or CSI > 0 c
Response with Attributes	CSI > 1;Pv;Po c
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
Request for Printer Status	CSI ?15n
Response :	
Printer is ready	CSI ?10n
Printer is not ready	CSI ?11n
There is no printer	CSI ?13n
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 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;Psy

Ps = 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

Graphics Mode

Enter Special Graphics Mode	ESC F
Exit Special Graphics Mode	ESC G

Scroll

Reverse Line Feed	ESC I

Erase Control Sequences

Erase to End of Page	ESC J
Erase to End of Line	ESC K

Bidirectional Auxiliary Port Control

Enter Concurrent Auxiliary Mode	ESC U
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 _

Keypad Application Mode

Enter Keypad Application Mode	ESC =
Exit Keypad Application Mode	ESC >

ANSI Mode

Enter ANSI Mode	ESC <

Request Identity

Identify Terminal Type	ESC Z

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R

R (Continued)

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T

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V

W

Control Sequences

VT200, VT100 Modes

Designate Character Sets

Control Sequences (Continued)

C.ITOH

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