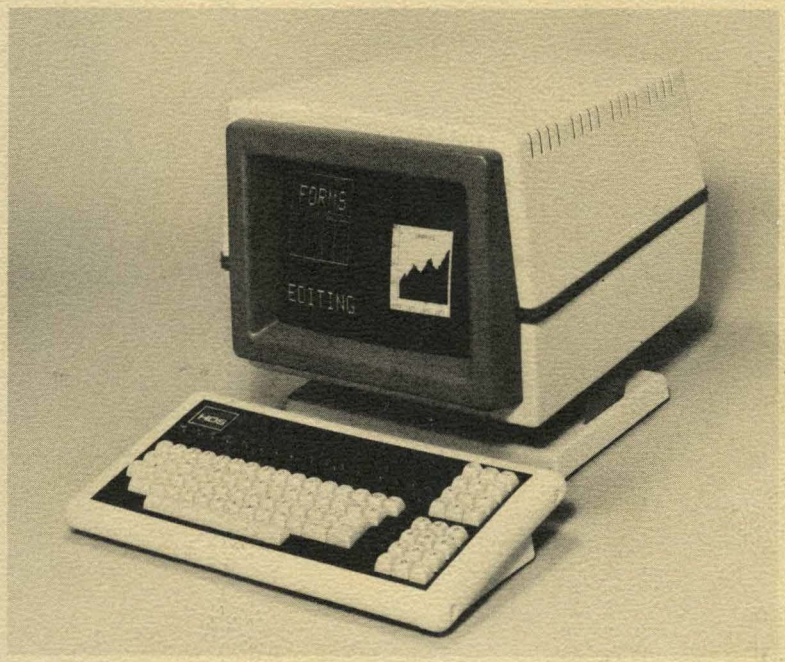
concept 108 USERS MANUAL

concept 108

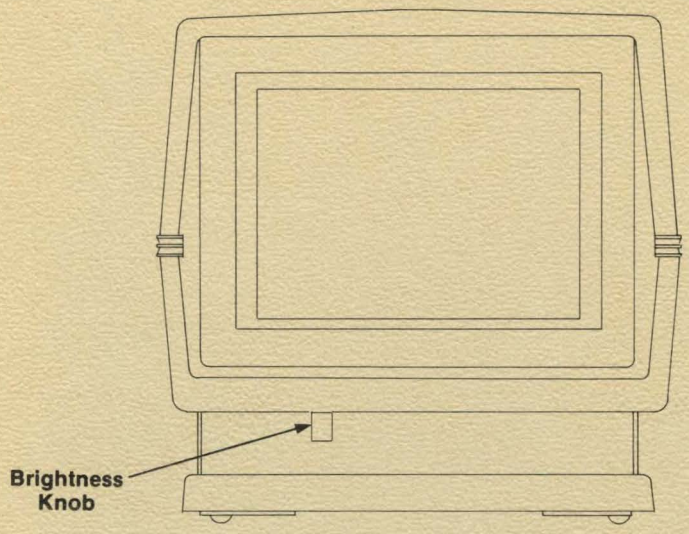
USERS MANUAL



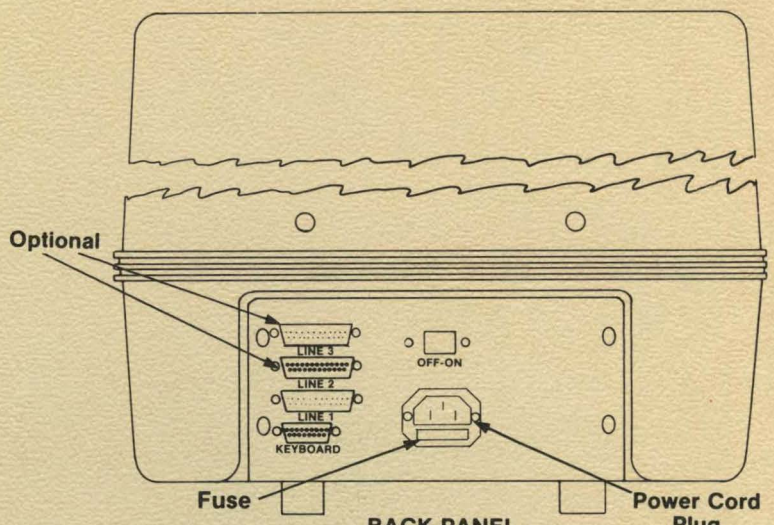
HDS
human designed systems, inc.
3700 Market Street
Philadelphia, PA 19104
215-382-5000

DN1300-8108-1R

Figure 1-1
CONCEPT CONTROLS AND CONNECTIONS

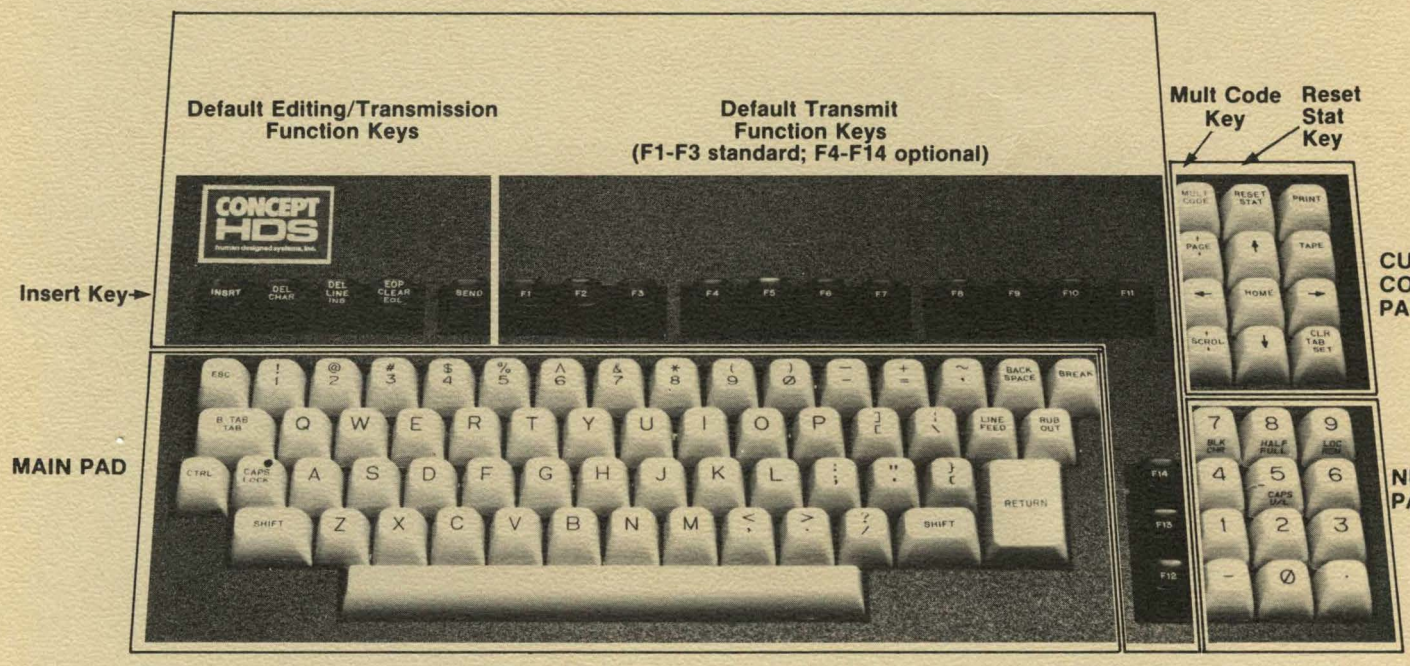


DISPLAY



BACK PANEL

CONCEPT KEYBOARD LAYOUT



USER STATUS LINE

KB	50	FULL	1STOP	NONE	/	OFF	REM	USER	BLOK	U/L	III:ccc	ASC	III,ccc,III,ccc	annnn	080	INS/OFF
L1	75	HALF	2STOP	EVEN		ON	LOC	PROG	CHAR	CAP		CH1			132	INS/ON
L2	:			ODD								CH2				
L3	9600			MARK								CH3				
				SPAC								APL				
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	

a. Device (KB = keyboard, L1 = line 1, L2 = line 2, L3 = line 3)
b. Baud Rate
c. Half Duplex (HALF) / Full Duplex (FULL)
d. Stop Bits (1 or 2)
e. Parity (NONE, EVEN, ODD, MARK, SPACE)
f. Parity Checking on Input (OFF or ON)
g. Remote (REM) / Local (LOC)
h. User (USER) / Programmer (PROG)
i. Block (BLOK) / Character (CHAR)
j. Upper/Lower Case (U/L) / Caps Lock (CAP)
k. Cursor Position (Line: Column)
l. Character Set (ASCII [ASC], Alt. Char Set 1 [CH1], Alt. Char Set 2 [CH2], Alt.Char Set 3 [CH3], APL [APL]). Graphics is normally CH1. APL also indicates overstrike.
m Window (home line, home column, no. of lines, no. of columns)
n. Software version
† o. Display Width
† p. Insert Mode off/on

† Not shown on 80-column display

SPECIFICATIONS

■ Concept 108 Four-Page ASCII
■ Concept APL8 Four-Page APL/ASCII

DISPLAY

Physical Dimensions	15¼" W x 14½" H x 16½" D (38.7 cm x 36.8 cm x 41.9 cm)
Size/Type	12" diagonal, 9" x 6" display area, P4 white, 60 Hz
Format	25 lines by 80 or 132 columns, within a 96 x 80 or 56 x 132 memory size (four pages). 25th line displays status information only
Character Generation	7 x 11 dot matrix in 10 x 12 dot array (80 columns), 5 x 9 dot matrix in 7 x 10 dot array (132 columns)
Design Features	Tilt Adjustment, recessed hooded screen
Character Attributes (Concept 108)	ASCII, 128 upper/lower case characters with lower case descenders, blink, reverse video, non-destructive underline, half bright, protection, nondisplay (security). Block attribute setting for fast generation of attributes for all characters in a display area. Standard character set includes forms, curve approximation and mathematical characters
Character Attributes (Concept APL8)	APL with full true overstrike, 128 upper/lower case ASCII characters with lower case descenders, reverse video, nondestructive underline, blink*, half bright*, protection*, nondisplay (security)*. Block attribute setting for fast generation of attributes for all characters in a display area. Standard character sets include forms, curve approximation, mathematical and subscript/superscript characters. *attributes available for all APL characters except overstruct operators
Screen Attributes	White characters on black background or reverse and normal/half bright protected fields
Windows	Rectangular areas of display memory which effectively divide the display into multiple subscreens (maximum — four)
Line Drawing	Basic graphic characters allow easy form and graph generation. Horizontal/vertical line drawing functions
Status Lines	User (configuration, cursor position, current window and mode settings), Programmer (complete status detail), Alert (self-test errors and programmable status message), Tabs and Programmable Message Characters. Displayable on the bottom line or transmittable to the host computer
Cursor	Flashing underline or flashing reverse video block selectable. Controls — left, right, up, down, home. Absolute address reading and writing. Position cursor in current line or column
Tabs	Forward and backward typewriter, form, automatic
Communications	Asynchronous 10, 11, or 12 bit code, seven or eight data bits, one or two stop bits, EIA RS232C, 15 baud rates (50-9600) even/odd/no parity, parity checking of input, block/character transmission, half/full duplex

KEYBOARD

Physical Dimensions	17½" W x 3" H x 8¾" D (44.4 cm x 7.6 cm x 22.2 cm)
Size/Type	91 keys with typewriter style layout — numeric, cursor control, function pads (eight function keys standard)
Design Features	Detached, matte finish, click positive touch, N-key rollover, autorepeat on all keys
Functions	Lock, bell enable/disable
Cursor Pad Control	Can be set to execute functions, transmit character sequences or both

STANDARD CONCEPT FUNCTIONS

General	All terminal functions are selectable from the keyboard and communications line(s) by control codes or escape sequences
Text Editing	Insert character in line/page mode, delete character in line/page, clear to end of line/page, insert/delete line in page
Form Editing	Insert/delete character in field, clear field/all unprotected fields/screen. Create screen allows transmission of forms created offline
Non-Volatile Memory	Permanent storage of terminal configuration and mode settings. The latent expression stored in NVM allows execution of a set of terminal commands upon power up or reset
Programmable Function Keys	Character sequences generated by all function keys are user modifiable. Memory is allocatable between display pages and function keys. Stored function keys sequences are executable from the communication lines
Message Characters	Special terminal control characters are modifiable (including the "escape" character used in command sequences)

OPERATING MODES

User/Programmer	Provides simple operation for the novice and application users while providing sophisticated capabilities to the system developer
Page/Scroll	Cursor wraparound or rolling of screen on bottom line overflow
Text/Transparent	Selects scroll mode, typewriter tabs, text editing functions or page mode, form tabs, form editing functions
Normal/Transparent	Normal handling of control codes or display of their character symbols
Auto Wraparound	Wraparound to next line or overwrite of last column on last column overflow
Buffer Overflow Control	Prevents input buffer overflow through transmission of XOFF/XON characters (user specifiable)

OPTIONS

Additional Memory	Eight pages (192 lines x 80 columns or 112 lines x 132 columns)
Video	Filtered Screen, Green Phospher (P31), Amber Phospher (ALA)
Shared Printer Interface	Allows multiple CRTs to share one printer (or other peripheral) for hardcopy of the display or terminal I/O
Multiple Characters Sets	Up to four character sets selectable on an individual character basis including extended graphics, foreign languages, and special designs
Additional Function Keys	Additional 11 function keys are available with eight associated with the function pad and three associated with the numeric pad
Auxiliary Communications	Two additional I/O interfaces for local peripheral support or remote connection
Communications	20 mA
Video Output	For classroom/demonstration presentations
Foreign Version	Accommodation for 220/240 VAC, 50 Hz power source

P R E L I M I N A R Y

CONCEPT 108 SERIES

USERS MANUAL

Human Designed Systems, Inc.
3700 Market Street
Philadelphia, PA 19104
(215) 382-5000

DN1300-8108-1R
September, 1981

NOTE: Bars (||) on page margins indicate terminal features present in Version 3 (V3) firmware and in all future versions. Version 3 firmware was shipped with all terminals produced after November 23, 1981.

The material in this manual is for informational purposes and is subject to change without notice.

Human Designed Systems, Inc. assumes no responsibility for any errors which may appear in this manual.

Printed in U.S.A.

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COMPLIANCE WITH SUBPART J OF PART 15 OF FCC RULES

Warning:

This equipment generates and uses radio frequency energy and if not installed and used properly, i.e., in strict accordance with the instructions manual, may cause harmful interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

The following procedures may help to alleviate the Radio or Television Interference Problems.

1. Reorient the antenna of the receiver receiving the interference.

2. Relocate the equipment causing the interference with respect to the receiver (move or change relative position).

3. Reconnect the equipment causing the interference into a different outlet so the receiver and the equipment are connected to different branch circuits.

4. Remove the equipment from the power source.

NOTE:

The user may find the following booklet prepared by the FCC helpful: "How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the U.S. Printing Office, Washington, D.C. 20402. Stock No. 004-000-00345-4.

WARRANTY

Human Designed Systems (HDS) warrants that each terminal will be free from defective materials and workmanship for ninety (90) days from date of shipment to the original customer.

HDS agrees to correct any of the above defects (parts and labor only) when the terminal is returned to the factory freight prepaid by customer. Return authorization must be obtained from HDS before returning the terminal to the factory. The repaired terminal will be returned to the customer freight collect.

Under this warranty HDS may at its option repair or replace the defective terminal or terminal components. Normally, HDS will not ship replacement equipment until the defective terminal or terminal component is received (freight prepaid by the customer) at the HDS factory or service depot — HDS at its option may ship replacement equipment prior to receipt of the defective equipment. In this case the customer will receive an invoice (for the full price of the equipment) upon shipment of the replacement and a cancellation of that invoice upon receipt of the defective terminal or terminal component at HDS' factory or service depot. The model number and serial number must be furnished by the customer at the time of request for warranty service.

This warranty shall be invalid if, in HDS' sole judgment, the terminal or component has been subjected to misuse, abuse, neglect, accident, improper installation or application, alteration or neglect in use, storage, transportation or handling, or if the serial number has been removed, defaced or altered.

EFFECTIVE JANUARY 1, 1979

Introduction

The CONCEPT 108/APL8 is an interactive display terminal offering a host of display, editing and communications features to enhance both general interactive usage and special applications (e.g. forms/data entry - retrieval, text editing). Fundamental to the design of the CONCEPT terminal is the principal that the availability of sophisticated features should not complicate the use of the terminal for the novice user or the user not initially wanting to make use of such features. The CONCEPT is designed to provide a friendly, easy to use interface between the computer and users with varying degrees of expertise, including data entry or text editing operators, novice programmers and sophisticated application system developers.

This manual is organized in a manner consistent with the CONCEPT design philosophy. The first chapter, 'Getting Started with the CONCEPT Terminal', instructs the new user on how to unpack and set up the terminal, verify that it is working, attach it to his/her computer system, and use it as a basic interactive terminal. This section also describes the common method in which all the CONCEPT features are accessed and the use of several of the basic features of value to the interactive user.

The second chapter, 'Programmers Guide', describes in detail the capabilities of the terminal as well as their use in different applications. In general, the capabilities described in this section are ordered in increasing levels of sophistication.

The third chapter, 'Command Reference', is a subject oriented description of each terminal command and its operation.

Examples appear throughout this manual to assist the reader in understanding the use of the terminal capabilities.

Chapter 1
Getting Started with the CONCEPT Terminal

1.0 Introduction

Figure 1-1, showing the CONCEPT display, back panel, keyboard and status line, can be folded out from the front cover for convenient reference while reading the following sections.

1.1 Unpacking, Setting Up and Powering On

Upon receipt of the CONCEPT terminal and before unpacking it, the user should inspect it for any damage to the external packaging material.

The terminal should then be unpacked. The box should contain the following separate items:

1. Display
2. Keyboard
3. Power Cord
4. Communication Cable
5. Packet of Reference Material

Assuming there is no physical evidence of shipping damage, the user should proceed with the following steps.

1. Attach the keyboard connector to the labeled receptacle on the back panel. The screws on either side of the connector should be tightened into the receptacle to insure a secure connection.

2. Attach one end of the communication cable to the LINE 1 receptacle on the back panel, securing the connection with the connector screws as above. The other end should be attached to your communications equipment.

3. Insuring first that the 'ON-OFF' switch on the Back Panel is in the 'OFF' position, plug the power cord connector into the recessed power receptacle on the back panel and the plug end into a normal 115 volt, three pronged (grounded) outlet. The user should NOT disable the grounding by using a two pronged ungrounded adapter plug.

4. Turn the 'ON-OFF' switch on the back panel (Figure 1-1) to the 'ON' position. The keyboard bell will sound on power up. The screen will take a few moments to come on. A blank dark screen with the cursor in the upper left corner should appear. The cursor, displayed as a white flashing underline, indicates the location where characters typed on the keyboard or received from the communications line will be displayed. If the cursor does not appear, is dim, or the screen is light with lines through it, the display brightness may have become misadjusted in shipping. The brightness level may be adjusted

with the knob under the left side of the display (Figure 1-1). A self test is performed by the terminal on power up. If an error is detected, an 'Alert Line' is displayed in reverse video (black characters on a white background) on the bottom (25th) line of the screen. Contact HDS or your terminal supplier if any self test errors are shown on the Alert Line. The Alert Line , if it appears, may be removed by pressing the STAT key (Figure 1-1).

5. After the display has come up with the cursor in the upper left corner, the user should check that the keyboard is operating by pressing the INSRT key (Figure 1-1). The light on the key should come on. The user should then type a shifted INSRT (pressing the INSRT key while holding down the SHIFT key). This will turn off the light. If either the display or keyboard did not operate as it should in the above procedure, the user should report the problem to HDS or the terminal supplier.

6. During use, the vents on the top of the terminal should never be covered over with papers or other material as this can cause the terminal to overheat.

1.2 Local Operation

Now that the keyboard and display are operating, the user can proceed to familiarize himself with the CONCEPT terminal in Local mode as follows:

1. The User Status Line (Figure 1-1) should now be displayed. This line shows the basic terminal configuration and appears as the bottom (25th) line on the screen. It is displayed in reverse video (black characters on a white background). To bring up the Status Line, type the STAT key (Figure 1-1). The Status Line can be alternately removed and displayed by pressing the STAT key, but for the time being, the user should leave it displayed.

2. The terminal can be set to operate in Remote mode to communicate with a computer or in Local mode to interact only with the keyboard operator. Field g of the Status Line (Figure 1-1) indicates the current mode of operation - 'REM' for Remote or 'LOC' for Local. If the terminal is currently in Remote mode, as it is normally shipped, the user should select Local mode by typing the MULT CODE key (Figure 1-1) and than the shifted 9 key. Field g of the Status Line should now display 'LOC' to indicate the terminal is in Local mode.

1.3 Keyboard - Display Operation

The main pad of the keyboard (Figure 1-1) is similar to that of a Selectric typewriter, and, in Local mode, operates much as a typewriter. Characters typed on the keyboard appear on the screen. The cursor,

displayed as a flashing underline, indicates the position in which the next character typed will be displayed. As each character is typed, it is displayed and the cursor moves one position to the right. When a character is typed in the last column of a line, the cursor moves to the first column of the next line. The keys in the main pad (Figure 1-1) labeled RETURN, LINE FEED, and BACK SPACE operate in the same way as a typewriter - moving the cursor to the left margin, next line, and the previous column of the display respectively. Note, however, that RETURN, unlike a typewriter, does not automatically generate a line feed, but returns the cursor to the left margin of the current line. The SHIFT key, as on a typewriter, when held down while striking a character key, causes the shifted version of the key to be generated. For example, shifted alphabetic keys (A-Z) cause the upper case characters to be generated while unshifted cause the lower case characters to be generated. The user should type some characters on the screen to verify that the keyboard and display are working properly.

The terminal stores 96 (optionally 192) 80 column lines of characters in 'Display Memory', as shown in Figure 1-2. Thus, the user can type 96 lines of text before losing information. The screen, however, can display only 24 of these 96 lines at a time. As the cursor moves down past line 24, the 24 line screen display area will move down to keep the cursor (that is, the area where the user is typing) on the screen. For example, assume lines 10-33 are displayed on the screen, and the user is typing on line 33 and types a line feed. The cursor will move to line 34 and the screen will display lines 11 through 34. The user can type characters and line feeds through the 96 lines of display memory to familiarize himself with the movement of the screen display through display memory. Field k of the User Status Line shows the line and column of the cursor position. Note that in this field, line and column numbering begin at zero rather than one. The user will also note that the Status Line, displayed on the 25th line of the screen, is independent of and does not affect the movement of the 24 line screen display area through display memory.

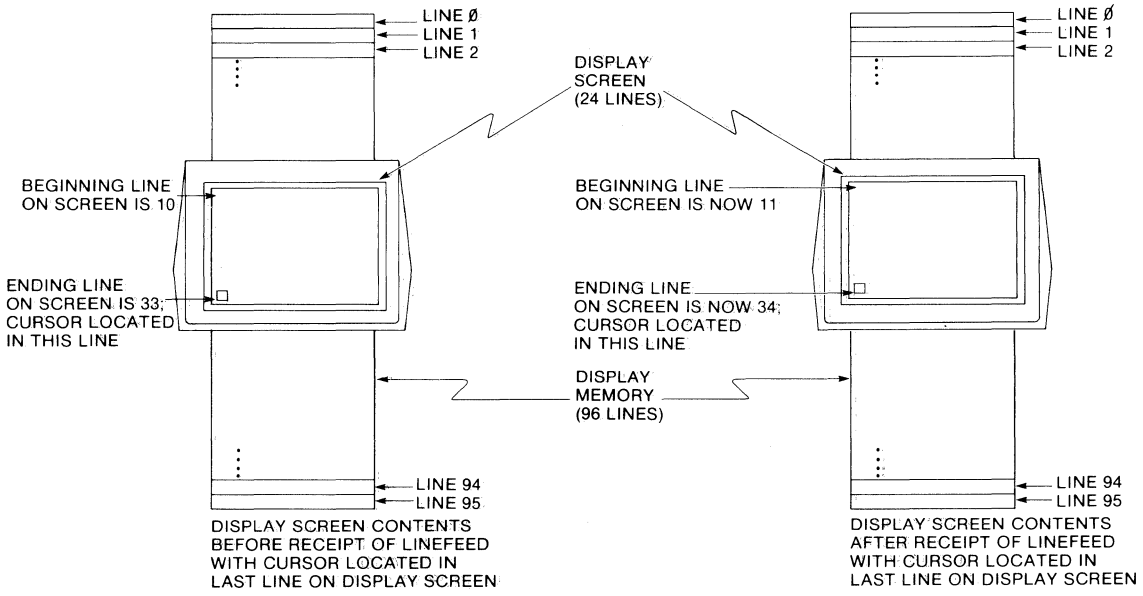


FIGURE 1-2
Display Memory and Display Screen Relationships

As line feeds are typed on the last line of display memory, the 96 lines of display memory are 'scrolled up', losing the data originally on the first line of display memory and creating a new blank line on the last line.

Alternately, the terminal can be configured to store 56 (optionally 112) 132 column lines of characters in 'Display Memory'. As before, the screen can display 24 of these lines at a time. In this case, the first line of display memory will be 'scrolled up' and lost after the user has entered 56 lines of data.

The cursor control keys (↑ , ↓ , ← , → , and HOME) in the cursor pad (Figure 1-1) move the cursor up one line, down one line, left one column, right one column, and to the first column of the first line of display memory respectively. As cursor controls move the cursor out of the area displayed (as with line feed above) the screen display will move to keep the cursor visible. For example, assume the screen is displaying lines 21 through 44, the cursor is on line 21 (line 21 is displayed on the top line of the screen) and a cursor up (↑) is typed. The cursor will move up one line in the same column to line 20 and the screen display area will 'move up' one line to display lines 20 through 43.

1.4 The Keyboard

The above section described in general the interaction of the keyboard operator and the display, mentioning only those keyboard commands, such as cursor controls, that help in understanding the operation. This section describes the keyboard in detail. Throughout this section Figure 1-1 can be used to locate keys described in the text.

The keyboard has been designed to provide a comfortable and efficient operator interface to the display terminal. The familiar typewriter layout, audible key click, and specially designed key plunge pressure response all help to increase typing efficiency. Other human factors related to the keyboard include matte finished keytops to reduce glare, a calculator layout numeric pad for fast entry of numeric data, and auto-repeat on all keys (when held down for more than the set delay period the key will automatically repeat at 15 characters per second until the key is released).

The keyboard is composed of four separate areas - the MAIN PAD, the NUMERIC PAD, the CURSOR CONTROL PAD, and the PROGRAMMABLE FUNCTION KEYS. The PROGRAMMABLE FUNCTION KEYS actually are composed of several small groups of keys including the keys described below as the Editing/Transmission Keys and the Default Transmit Function Keys (keys with legends starting 'F').

1.4.1 Main Pad

The Main Pad, as mentioned above, is similar to that of an IBM Selectric typewriter. In addition to the alphabetic, numeric, and special

character keys, the pad contains 10 special action keys. Six of these - SHIFT, RETURN, LINE FEED, BACK SPACE, CAPS LOCK, and TAB - are analogous to special action on a typewriter. The other four - RUB OUT, BREAK, ESC, and CTRL are unique to communication terminals. The action of each special action key is described below.

RETURN - Analogous to a typewriter, this key returns the cursor to the left margin of the screen. Unlike a typewriter, no automatic line feed occurs. The cursor remains on the current line.

LINE FEED - Moves the cursor down one line in the current column. A line feed with the cursor on the last line of display memory will cause all lines to scroll up one line, losing the first line of information and creating a new blank last line. If the cursor is displayed in the 24th line of the screen display area, as described above, a line feed will cause the screen display area to move down one line to keep the cursor visible, but no data are lost until a line feed is performed on the last line (96th or 56th depending on the number of columns displayed) of display memory.

TAB - Moves the cursor to the next tab stop column on the current line. If there is no 'next' tab stop, it will move the cursor to the last column of the current line. Initially tab stops are set at every 8 columns. Tab stops can be set and cleared with keys described in the Cursor Control Pad section below. An alternative tab mode of operation is described in Chapters 2 and 3.

BACK TAB (Shifted TAB key) - Moves the cursor to the previous tab stop column of the current line. If there is no previous tab stop, it will move the cursor to the first column of the current line.

SHIFT - Analogous to a typewriter. When this key is held down while striking another key, the shifted version of that key is generated.

CAPS LOCK - This is an 'alternate action' key. When pressed it lights and sets 'CAPS LOCK' on for the keyboard. When pressed again it turns off the light and resets the keyboard to normal operation. With CAPS LOCK on, the character keys A through Z generate the shifted (upper case) version whether or not the SHIFT key is depressed. No other keys are affected.

BREAK - This key causes a 'break' condition on the communication line. BREAK is recognized by some computer systems as a signal to stop output, and is typically used to interrupt listings or other output that has started.

CTRL - The CTRL key is used like the shift key in conjunction with another key to generate the 'control' version of that key. The control version of a character, or control code, is

indicated in this manual by a '^'. For example, a 'control-M' would be indicated by ^M. Control codes are used to cause special action. For example, ^M causes a 'return' and is identical to hitting the RETURN key. ^J is a line feed, ^H is a backspace, and ^I is a tab. The individual keys on the keyboard for these control codes are for the convenience of the operator, but are operationally identical to striking the corresponding character while holding down the CTRL key. The user may verify this by trying the above control codes.

RUBOUT - Causes the RUBOUT control code character to be generated. This character is not displayed and causes no action by the terminal. Many computer systems use this character as a 'fill' character, transmitting it only to take up time to allow some terminal function to complete before sending more "real" data. Other computer systems use this character to indicate that the previous character typed is to be erased.

ESCAPE - Causes the ESCAPE control code character (^[) to be generated. This character is not displayed and causes no action by the terminal. Some computer systems recognize this character when received as a signal to abort the currently running program.

1.4.2 Numeric Pad

The numeric pad is a calculator layout of the numbers '0' to '9', '.', and '-'. Use of the numeric pad is identical to use of the corresponding keys in the main pad; they are provided to facilitate fast entry of numeric data. You will notice several of the keys ('5', '7', '8', and '9') have front legends. These are of importance only when these keys are used as parameters to special terminal commands. See 'MULT CODE Commands' below.

1.4.3 Cursor Control Pad

The Cursor Control Pad provides cursor movement keys as well as keys for frequently used commands. Note that cursor control keys move the cursor through the display memory and may cause a shift of the screen display area to keep the cursor visible as described above in 'Keyboard Display Operation'. However, these keys will not cause the permanent loss of data from display memory.

↑ - Moves the cursor up one line in the same column. If on the top line, the cursor will move to the same column on the bottom line.

↓ - Moves the cursor down one line in the same column. If on the bottom line, the cursor will move to the same column on the top line.

→ - Moves the cursor one position to the right. If in the last

column of the line, the cursor will move to the first column of the next line. If in the last column of the last line, the cursor will move to the first column of the first line.

← - Moves the cursor one position to the left. If in the first column of the line, the cursor will move to the last column of the previous line. If in the first column of the first line, the cursor will move to the last column of the last line.

HOME - Moves the cursor to the first column of the first line.

TAB SET - Sets a tab stop in the current cursor column.

TAB CLR (TAB SET shifted) - Clears the tab stop in the current cursor column.

TAPE - Transmits data to communications Line 3 (optional- also referred to as the second auxiliary communications line or the tape port), which might be attached to a tape cassette or floppy disk. If Line 3 is unavailable, the bell will sound. (See Section 1.7 for details on setting up the tape port.)

Unshifted or shifted - Transmits text from the home position up to but not including the cursor position. If the cursor is at the home position all text is transmitted to Line 3. This feature allows the user to make a complete copy of an interactive session on the terminal on a storage device attached to Line 3.

Control - Attaches Line 3 so that all data going to the display will also be transmitted to Line 3.

Control Shifted - Detaches Line 3 from the data flow.

PRINT - Transmits data to communication Line 2 (optional - also referred to as the first auxiliary communication line or the printer port), which might be attached to a printer for hard copy or to an HDS Shared Printer Interface allowing a number of display terminal users to share one printer. If the printer is unavailable, the bell will sound. (See Section 1.7 for details on setting up and using the printer port.)

Unshifted - Prints text from the home position up to, but not including, the cursor position. If the cursor is at the home position, all text will be printed.

Shifted - Prints text from the beginning of the line up to, but not including, the cursor position. If the cursor is at the beginning of the line, the entire line is printed.

Control - Attaches to the printer so that all data going to the display are also printed. This feature allows the user to get hard copy of a listing or an entire interactive session.

Control Shifted - Detaches the printer from the data flow.

SCROLL ↓ (Unshifted) - Moves the screen display area down one line. For example, if lines 27 through 50 are being displayed, SCROLL ↓ will cause lines 28 through 51 to be displayed. The cursor is also moved down one line, making it appear in the same relative position in the screen display area. See the 'before & after' example in Figure 1-2. If the last line of display memory is already displayed on the bottom of the screen display area, the SCROLL ↓ will have no effect.

SCROLL ↑ (Shifted) - Moves the screen display area up one line. For example, if lines 27 through 50 are being displayed, SCROLL ↑ will cause lines 26 through 49 to be displayed. The cursor is also moved up one line, making it appear in the same relative position of the screen display area. See the 'before & after' example in Figure 1-2. If the first line of display memory is already displayed at the top of the screen display area, SCROLL ↑ will have have no effect.

PAGE ↓ (Unshifted) - Moves the screen display area down 24 lines (1 page). For example, if lines 5 through 28 are being displayed, PAGE ↓ will cause lines 29 through 52 to be displayed. The cursor is also moved down 24 lines maintaining its same relative position on the screen. If there are not 24 additional lines left to display when PAGE ↓ is struck, the last 24 lines of display memory will be displayed.

PAGE ↑ (Shifted) - Moves the screen display area up 24 lines (1 page). If lines 29 through 52 are being displayed, a PAGE ↑ will cause lines 5 through 28 to be displayed. The cursor is also moved up 24 lines maintaining its same relative position on the screen. If there are not 24 lines previous to those displayed when PAGE ↑ is typed, the first 24 lines will be displayed.

RESET (Shifted) - Resets the terminal to power on configuration. This configuration may have been changed by the user after initially turning on the terminal.

STAT (Unshifted) - Displays the User Status Line (Figure 1-1) showing the current terminal configuration.

MULT CODE - When typed, the MULT CODE key indicates to the terminal that a multiple keystroke terminal command is to be executed. For example, typing the MULT CODE key followed by unshifted 'k' (2 separate key strokes) will cause the screen to change from white characters on a dark background (Normal Video) to dark characters on a white background (Reverse Video). The command sequence to set the screen to Normal video is MULT CODE followed by shifted K. A complete list of MULT CODE commands is given in Appendix E. Terminal command execution is described in more detail below.

1.4.4 Programmable Function Keys

The Programmable Function Keys consist of both the Editing/Transmission Keys and the Default Transmit Keys ('F' keys). These keys, in addition to performing the functions described below, can be programmed to contain a user specified sequence of characters and/or terminal commands. Thus, a single key can be used to transmit frequently used character sequences. This capability is described in detail in Chapter 2.

1.4.4.1 Editing/Transmission Keys

The Editing/Transmission pad is composed of five keys that provide the capability to edit locally on the screen. These keys are typically used in special applications and may or may not be directly usable for general interactive use.

INSRT (Unshifted) - Sets the terminal to Insert mode and lights the indicator. In Insert mode, text from the cursor position to the first empty space is shifted to the right (wrapping around lines if necessary) one location before new characters typed are inserted. This allows new text to be inserted within existing text on the screen rather than replacing it.

(Shifted) - Turns Insert mode (and the indicator light) off. In normal mode, the characters typed replace those in the current cursor position.

DEL CHAR (Unshifted) - Deletes the character at the current cursor position by left shifting all text to the right of the cursor up to the first empty space or the end of the line, and putting a space in the last position left shifted.

DEL CHAR (Shifted) - Deletes the character at the current cursor position as above, but left shifting will continue to subsequent lines, wrapping the first character to the end of the previous line until an empty space or end of display is encountered, and putting a space in the last position left shifted.

INS LINE (Unshifted) - Inserts a blank line at the current cursor position by moving the text on the current and subsequent lines down one line (the last line of text is lost), and blanking the line on which the cursor is positioned.

DEL LINE (Shifted) - Deletes the line on which the cursor is positioned by moving the text on all subsequent lines up one line and creating a blank last line.

CLEAR EOL (Unshifted) - Clears the text from the current cursor position to the end of the line.

CLEAR EOP (Shifted) - Clears the text from the current cursor position to the end of the display memory.

SEND - Transmits displayed text to communication Line 1, normally attached to the host computer.

(Unshifted) - Sends text from the beginning of the line up to but not including the cursor position. If the cursor is at the beginning of the line, it sends the entire line.

(Shifted) - Sends text from the beginning of display memory up to but not including the cursor position. If the cursor is at the beginning of display memory (home position), all of display memory is sent.

1.4.4.2 Default Transmit Function Keys ('F' keys)

The Default Transmit Function keys consist of three (3) keys labeled 'F1' through 'F3'. Optionally, there are eleven (11) additional keys labeled 'F4' through 'F14' (See Figure 1-1). Each function key sends out a unique sequence of characters in shifted and unshifted mode. These keys are frequently used as a one key stroke identifier to the computer program of the operation desired.

1.5 Terminal Commands

All CONCEPT terminal commands are invoked either by control codes or MULT CODE character sequences. A number of control code commands, such as Return, Back Space, and Line Feed, were described above. A complete list of the 32 control codes and the commands that they invoke, if any, is given in Appendix E. A complete list of MULT CODE commands is also given in the same Appendix.

Certain more sophisticated MULT CODE commands are generally used only by programmers or on initial installation of the terminal. The novice user is protected from these commands by User/Programmer mode. The terminal must be in Programmer mode to execute these commands. Chapter 3, describing all MULT CODE commands in detail, indicates those commands requiring Programmer mode in the header preceding each command. Field h of the Status Line indicates the current User/Programmer mode setting. The user should now select Programmer Mode by typing the two keys MULT CODE U (note - upper case U) so that he may try the commands described below. The Status Line should now show 'PROG' in Field h.

The MULT CODE sequences described above to select reverse and normal video were two-key sequences - MULT CODE followed by the specific command identifier. Some MULT CODE commands require additional information or parameters and therefore sequences of three or more keys are required. For example, the command to select the terminal communication speed (baud rate) requires a three key sequence MULT CODE 0 (oh) and a character to specify the desired speed. The sequence to select 3600 baud would be executed by typing the three keys MULT CODE 0 +. If you execute this command, you should see Field b of the status line change to '3600'. The three character sequence MULT CODE 0 % will

change it back to '300' baud. Some command sequences are more than three characters in length. For example, the command to set the cursor to a specific location of the display requires the user to type a four key sequence.

1.6 Setting Up Communications

To set up communications between the CONCEPT terminal and the user's host computer system, the terminal must be: (1) physically connected to the computer or communication equipment via the Line 1 connector; and (2) configured with a compatible communication protocol / interface for the user's computer. Follow the steps below to establish communications.

1. After turning the power off to the terminal, the communication Line 1 connector should be plugged into the user's communication equipment or to his computer. The connection should be secured by the screws on either side of the connector. The terminal can then be turned on again.

2. The appropriate setting for each of the following four communication parameters must be selected on the terminal for compatibility with the host computer:

   - Duplex: Half or Full
   - Parity: None, Even, Odd, Space, or Mark
   - Baud Rate: 50, 75, 110, 135, 150, 300, 1200, 1800, 2000, 2400, 3600, 4800, 7200, or 9600
   - Stop Bits: One or Two

   If you are not sure of the appropriate selections, you should check with your computer system manager.

   After you have determined the appropriate selections for the terminal, you should set the terminal to the required configuration as follows:

3. Display the Status Line by typing the STAT key. If the terminal is not in Remote mode (Field g), select Remote mode by typing the two keys MULT CODE 9. If the terminal is not in Programmer mode (Field h), select Programmer mode by typing the two keys MULT CODE U (note - upper case U).

4. Select the appropriate duplex setting (Field c). The factory default is Half Duplex. If this setting is correct proceed to step 5. Change the duplex by one of following two key sequences:

   MULT CODE 8 (Full Duplex)
   MULT CODE * (Half Duplex)

   Hint: The following manufacturers are usually half duplex: Amdahl, Burroughs, Honeywell, IBM, and Univac (Also Sharp and

STSC timesharing services). The following manufacturers are usually full duplex: Data General, DEC, Hewlett Packard, Prime, Texas Instruments and most microcomputer systems.

5. Select the appropriate Parity setting (Field e). The factory default setting is none (no parity bit is sent). If this is correct proceed to step 6. To change the parity type one of the following three key sequences:

```
MULT CODE P Space   (None)
MULT CODE P !       (Even)
MULT CODE P "       (Odd)
MULT CODE P #       (Mark)
MULT CODE P $       (Space)
```

6. Select the appropriate Baud Rate setting (Field b). The factory default setting is 300 baud. If this setting is correct proceed to step 7. To change the baud rate type one of the following three key sequences:

```
MULT CODE 0 Space (50)   MULT CODE 0 %  (300)   MULT CODE 0 * (2400)
MULT CODE 0 !     (75)   MULT CODE 0 &  (600)   MULT CODE 0 + (3600)
MULT CODE 0 "    (110)   MULT CODE 0 ' (1200)   MULT CODE 0 , (4800)
MULT CODE 0 #    (135)   MULT CODE 0 ( (1800)   MULT CODE 0 - (7200)
MULT CODE 0 $    (150)   MULT CODE 0 ) (2000)   MULT CODE 0 . (9600)
```

7. Select the appropriate stop bit setting (Field d). The factory default setting is two stop bits. If this is correct proceed to step 8. To change the number of stop bits type one of the following four key sequences:

```
MULT CODE Space < !     (One Stop Bit)
MULT CODE Space < "     (Two Stop Bits)
```

Stop bits are usually set to two for baud rates of 300 or below and otherwise are set to one.

Having selected the appropriate communication settings, you should now be communicating with your computer. If there seems to be a problem, check the Status Line first to make sure that the proper settings were in fact selected.

8. Once you have achieved communications you can store these settings permanently in the terminal by typing the three character sequence MULT CODE Space C. This command stores in nonvolatile memory the communications settings only. Whenever you turn the terminal on or RESET it, your stored selections will be set, and you will not have to go through the above process again. To test, turn the terminal off, wait 15 seconds and turn the terminal back on. Verify via the Status Line.

9. APL users should change the terminal to APL mode. To change to APL mode, type the two key sequence MULT CODE 0 (zero).

Field 1 of the Status Line should now read APL. To return to ASCII mode, type the two character sequence MULT CODE).

To have the terminal power on and reset in APL mode, change to APL mode as above and store the terminal configuration in non-volatile memory by typing the three key sequence MULT CODE Space S. This command is extremely powerful as it saves the ENTIRE terminal configuration in non-volatile memory. The user should make sure that the configuration is correct before execution of this command.

10. The terminal can also be configured to display in 132 columns. To change to 132 column display, type the two key sequence MULT CODE ". To change back to 80 column display, type the two character sequence MULT CODE !.

    To have the terminal power on or reset in 132 columns, set the display to 132 columns as indicated above, and store the terminal configuration in non-volatile memory by typing the three key sequence MULT CODE Space S. Please note the caution statement made in the APL discussion above.

11. In emergencies (if you become confused or don't know the exact terminal configuration), the terminal's non-volatile memory can be reset to the factory default configuration by typing the three key sequence MULT CODE Space ~. Reset the terminal to this configuration by typing the RESET key (shifted STAT). Then start over from step 3 above.

1.7 Setting Up Communications on the Printer and/or Tape Port

In order to set up communications with the optional printer and/or tape ports a procedure similar to that described above must be followed. In the following discussion, peripheral devices include printers, floppy disks, magnetic tape, cassette units, etc.

No standard cabling is supplied for this connection as the required cable length is unknown and printers and other peripheral devices generally come equipped with a cable. The user may, of course, purchase special cables from HDS. Cabling requirements are described in Appendix C of this manual. Cabling on Line 2 (the printer port) is set up so that most printer cables can be used without modification. Technically this means that the transmit and receive signals are found on the opposite connector pins from those on the Line 1 and Line 3 connectors. Once the correctness of the cabling is verified, proceed with the steps described below.

1. With the terminal turned off, attach the cable to the appropriate connector on the back panel (Figure 1-1). A printer should be attached to the connector labeled Line 2 and a floppy disk or magnetic tape/cassette unit should be attached to the connector labeled Line 3. Both the terminal and the peripheral device can now be turned on.

2. Display the Status Line by typing the STATUS key. If the terminal is not in Programmer mode (Field h), select Programmer mode by typing the two keys MULT CODE U.

3. The terminal can easily be configured so that keyboard commands apply to either Line 2 or Line 3 and so that typed characters are transmitted to these lines. To configure the terminal in this way, change the 'Keyboard's Communication Line' to the desired communication line by typing one of the following four key sequences:

   MULT CODE Space) " (Line 2)
   MULT CODE Space) # (Line 3)

4. If the bell rings when step 3 above is executed, the peripheral device is not attached to the CONCEPT terminal. This condition is probably caused by one of the following:

   - The peripheral device is not turned on.
   - The cabling is incorrect.
   - The peripheral device does not supply a required control signal (Clear-to-Send).

   If the problem is caused by either of the first two items listed above, after they are corrected reexecute step 3. The bell should not sound.

   If the problem is not caused by either of the first two items listed above, the user should determine whether the peripheral device can supply the required control signal. If not, this protocol requirement can be suppressed by typing the three characters MULT CODE Space v. The protocol requirement can be turned back on by typing the three characters MULT CODE Space V.

   If the keyboard bell rings (indicating that the peripheral device is not attached), the user should type only keyboard commands and NOT characters after the Change Keyboard's Communication Line command is executed. Note- characters may inadvertently be typed if a command is incorrectly entered. Entering characters without the peripheral attached will cause the terminal to 'hang' after two characters have been entered (the characters have to be transmitted but cannot be). If the hang condition occurs, reset the terminal (shifted RESET STAT key) and redo this step.

5. Change the required communications parameters as specified in Chapter 1.6, steps 5-7.

6. Change the keyboard's communication line back to Line 1 by typing the four keys MULT CODE Space) ! .

7. Save the communications configuration by typing the three key

sequence MULT CODE Space C. If you have turned off the clear-to-send protocol and wish to save this permanently, the extremely powerful command which saves the entire terminal configuration must be executed. To execute this command, type the three keys MULT CODE Space S after verifying that the terminal is configured exactly as desired.

8. At any time, the user can start over and go back to the factory defaults by typing the three keys MULT CODE Space ~ and resetting the terminal (press the shifted RESET STAT key). Then start over from step 2 above.

1.8 Terminal Commands under Program Control

In the above sections, terminal commands were discussed in terms of execution from the keyboard. All terminal commands - Control Code commands and MULT CODE commands - can also be executed from the communication line under program control by sending the terminal the same codes that would be typed on the keyboard with one difference - a special character (by default the Escape control code - ^[) is transmitted which is equivalent to typing the MULT CODE key on the keyboard. From the keyboard, the user would type MULT CODE K to set the screen to reverse video. To set the screen to reverse video from a program, the program would send the terminal ESCAPE K. See Chapter 2 for a detailed explanation of this capability.

Chapter 2
Programmer's Guide

2.0 Introduction

The CONCEPT 108/APL8 terminal is a command oriented 'smart' video display terminal. All terminal commands are entered by typing characters on the keyboard or transmitting characters to the terminal on any of up to three communication lines. The standard configuration has one communication line referred to as either the 'Main Communications Line' or 'Line 1'. This communication line is normally connected to the host computer system. The optional two communications lines may be used to connect to peripheral devices (printers, tapes, floppy disks) or (since they have both input and output capability) to additional computer systems. The second communication line is referred to as either 'Line 2' or the 'Printer Port' and the third communications line is referred to as 'Line 3' or the 'Tape Port'.

2.0.1 Introductory Notes

The ASCII chart referenced throughout this document is included in Appendix A of this manual. The APL chart is also included in Appendix A. They are also shown on the back of the CONCEPT 108 Reference Card.

APL USERS PLEASE TAKE NOTE: This manual is presented in the ASCII character set. ASCII characters, when different from APL characters, are shown on the keytop fronts. When using the CONCEPT APL/8 terminal, type the APL equivalent character (ASCII a = APL A). For the translation, see Appendix A or the back of the CONCEPT 108 Reference Card.

Standard abbreviations used in this manual are: MC (key labeled MULT CODE), Sp (Space), ^ (First 32 Control Codes), Rub (Rubout Control Code-ASCII chart location 127), CTRL (key labeled CTRL - used to generate control codes from the keyboard), SHIFT (key labeled SHIFT - used to generate shifted characters from the keyboard), and CR (key labeled RETURN).

For simplicity, all examples are presented for keyboard entry of commands and characters. However all commands may also be entered via communications lines and the examples could be modified for computer execution.

2.1 Commands

Two types of commands are used as described below.

2.1.1 Control Codes

Control code commands are single characters which are industry standard and occupy positions 0 - 31 and 127 of the ASCII character/code chart.

Throughout this manual, the first 32 control codes are depicted by a ^ preceding a single character. For example, ^@ (control @) is ASCII chart location 0, ^A (control A) is 1, ^B is 2,..., ^Z is 26, ^[is 27, ^\ is 28, ^] is 29, ^^ is 30, and ^_ is 31. Position 127 is the RUBOUT control code. Control codes are generated from the keyboard by typing the appropriate character while depressing the CTRL key (the same control code will be generated if both the SHIFT and CTRL keys are depressed). A simple technique for determining the position of specific control codes can be deduced from the ASCII chart (Appendix A or the back of the CONCEPT 108 Reference Card). The control codes in lines 1 and 2 of the ASCII chart are referenced by the corresponding characters in lines 5 and 6. Several control code commands have special keys on the keyboard. These are RETURN (^M, ASCII chart location 13), LINE FEED (^J, 10), BACKSPACE (^H,8), TAB (^I, 9), and RUBOUT (Rub,127).

2.1.2 Command Sequences

Command sequences have the following format:

Command Introducer	Command Identifiers	Parameters

The Command Introducer is a single character which tells the terminal that what follows will be command information. From the keyboard, this character can only be generated by typing the key labeled MULT CODE. From any of the communications lines, this character defaults to the ESCAPE character (^[, ASCII chart location 27). The Command Introducer used by each of the communications lines can be changed by the user (see Programmable Message Characters - Section 2.12).

Command Identifiers are one or two character sequences which identify the specific command to be executed. They may be any character, but in general control codes are avoided. If two characters are required, the first is the space character.

Parameters are of variable length depending on the command being executed. When multiple parameters are required, no separator character between parameters is used. Parameters can be either numerical or non-numerical. Numerical parameters are entered as the corresponding ASCII character excluding the first 32 control code characters (ASCII chart locations 32 - 127). See Appendix A or the back of the CONCEPT 108 Reference Card for a graphic representation of the ASCII character set. Thus, 0 is entered by typing a space (ASCII chart location 32), 1 is entered by typing a ! (33), 80 is entered by typing a p (112), 95 is entered by typing a RUBOUT (127), etc. For numbers larger than 95, two characters are entered. The first is a control code and indicates the largest number of times 96 can be divided into the number. Thus, ^A (1) is used for numbers between 96 and 191, ^B (2) is used for numbers 192 - 287 and so on. The second character is a displayable ASCII character which is equal to the remainder after the first number times 96 is subtracted from the desired number. Thus, space is used for 96, ! for

97, " for 98, etc. Figure 2-1 below, lists all numerical parameters between 0 and 192.

Number	Parameter	Number	Parameter	Number	Parameter	Number	Parameter	Number	Parameter
0	Sp	40	H	80	p	120	^A,8	160	^A,`
1	!	41	I	81	q	121	^A,9	161	^A,a
2	"	42	J	82	r	122	^A,:	162	^A,b
3	#	43	K	83	s	123	^A,;	163	^A,c
4	$	44	L	84	t	124	^A,<	164	^A,d
5	%	45	M	85	u	125	^A,=	165	^A,e
6	&	46	N	86	v	126	^A,>	166	^A,f
7	'	47	O	87	w	127	^A,?	167	^A,g
8	(	48	P	88	x	128	^A,@	168	^A,h
9	)	49	Q	89	y	129	^A,A	169	^A,i
10	*	50	R	90	z	130	^A,B	170	^A,j
11	+	51	S	91	{	131	^A,C	171	^A,k
12	,	52	T	92	|	132	^A,D	172	^A,l
13	-	53	U	93	}	133	^A,E	173	^A,m
14	.	54	V	94	~	134	^A,F	174	^A,n
15	/	55	W	95	Rub	135	^A,G	175	^A,o
16	0	56	X	96	^A,Sp	136	^A,H	176	^A,p
17	1	57	Y	97	^A,!	137	^A,I	177	^A,q
18	2	58	Z	98	^A,#	138	^A,J	178	^A,r
19	3	59	[	99	^A,$	139	^A,K	179	^A,s
20	4	60	\	100	^A,$	140	^A,L	180	^A,t
21	5	61	]	101	^A,%	141	^A,M	181	^A,u
22	6	62	^	102	^A,&	142	^A,N	182	^A,v
23	7	63	_	103	^A,'	143	^A,O	183	^A,w
24	8	64	`	104	^A,(	144	^A,P	184	^A,x
25	9	65	a	105	^A,)	145	^A,Q	185	^A,y
26	:	66	b	106	^A,*	146	^A,R	186	^A,z
27	;	67	c	107	^A,+	147	^A,S	187	^A,{
28	<	68	d	108	^A,,	148	^A,T	188	^A,|
29	=	69	e	109	^A,-	149	^A,U	189	^A,}
30	>	70	f	110	^A,.	150	^A,V	190	^A,~
31	?	71	g	111	^A,/	151	^A,W	191	^A,Rub
32	@	72	h	112	^A,0	152	^A,X	192	^B,Sp
33	A	73	i	113	^A,1	153	^A,Y		
34	B	74	j	114	^A,2	154	^A,Z		
35	C	75	k	115	^A,3	155	^A,[		
36	D	76	l	116	^A,4	156	^A,\		
37	E	77	m	117	^A,5	157	^A,]		
38	F	78	n	118	^A,6	158	^A,^		
39	G	79	o	119	^A,7	159	^A,_		

FIGURE 2-1
Numerical Parameters

Several command sequences -- for example, cursor controls, editing commands, status requests, and a terminal reset command -- have been preprogrammed on keyboard keys.

2.1.3 Examples

The following examples demonstrate several simple terminal commands which can be typed at the keyboard.

1. Place the terminal in Local mode and ring the keyboard bell:
   To place the terminal in Local mode, type the two characters MC (.
   To ring the keyboard bell, type a ^G (depress G while holding the CTRL key down). This is an example of both a command sequence and a control code command.

2. Reverse the screen video:
   Type the two keys MC k

3. Return the screen to normal video:
   Type the two keys MC K

4. Execute the RAM and ROM self test:
   Type the four keys MC Sp ? E. This command sequence contains the Command Introducer (MC), a two character Command Identifier (Sp ?) and a numerical Parameter (E).

5. Position the cursor at line 5, column 10:
   First, place the terminal in Programmer mode by typing the two characters MC U. This mode is required in order to execute the position cursor command. Then type the four characters MC a % *. The position cursor command contains the Command Introducer (MC), a single character Command Identifier (a) and two numerical Parameters (% *) indicating the desired cursor position.

6. Draw a vertical line ten lines long:
   This command makes use of the repeat character vertical command. With the terminal still in Programmer mode, type the four characters MC R ^S *. This command contains the Command Introducer, a single character Command Identifier, a non-numerical Parameter and a numerical Parameter.

7. Reset the terminal to the permanently stored configuration:
   Type the RESET key (shifted cursor pad key labeled RESET STAT).

The following examples demonstrate commands as they would be executed under program control.

1. Examples of sending the two character sequence ESCAPE k (reverse screen video) for a variety of computers and languages.

   BASIC (Data General Nova) - PRINT "<27>k"

   The <x> in a literal string designates the character whose position in the ASCII chart is 'x'. This convention is only necessary for control codes, and BASIC will convert 'normal' characters to their displayable equivalent character.

   APL (I.P. Sharp/STSC) - ⎕*ARBOUT* 27 107

   The ⎕*ARBOUT* function transmits to the terminal the string of characters whose positions in the APL/ASCII chart are specified by the argument. In this case, the 'k' was specified by its character position.

   An alternate form would be the two statements: [1] ⎕*ARBOUT* 27
   [2] '*K*'

   Note that an APL K is lower case and thus is equivalent to an ASCII k.

2. The following programming example, written in Data General BASIC, will position the cursor at line 10, column 20 and display the blinking message 'TEST'. The program uses the following CONCEPT commands:

Programmer Mode	MC U	Select Programmer mode to enable the program to execute commands which are restricted to Programmer mode.
User Mode	MC u	Select User mode. Opposite of Programmer mode.
Cursor Position	MC a line,col	Positions the cursor at the specified location.
Blink On	MC C	Sets blink attribute on so that subsequent data written to the display will appear blinking.
Blink Off	MC c	Sets blink attribute off so that subsequent data written to the display will be displayed normally.

```
10  REM CONCEPT 108 SAMPLE PROGRAM
20  REM
30  PRINT "<27>U"                ! SELECT PROGRAMMER MODE
90  REM GENERAL FROM GENERATING THE NORMAL AUTOMATIC CARRIAGE RETURN
100 REM LINEFEED SEQUENCE AFTER A 'PRINT' STATEMENT, WHICH IN THIS
110 REM CASE WOULD RETURN TO THE LEFT MARGIN, JUST AFTER WE HAD
120 REM POSITIONED IT WHERE WE WANTED.
130 REM
140 PRINT "<27>C";             ! SET BLINK ON (PREVENT CURSOR RETURN)
150 PRINT "TEST"               ! PRINT BLINKING MESSAGE (ALLOW RETURN)
160 PRINT "<27>c<27>u"         ! SET BLINK OFF AND USER MODE
170 REM
180 REM NOTE: THE 'PRINT' SEQUENCE CAN CONTAIN ANY NUMBER OF FUNCTIONS
190 REM AND/OR TEXT.  THE ABOVE PRINTS COULD HAVE BEEN REPLACED BY ONE
200 REM PRINT AS FOLLOWS:
210 REM
220 REM     PRINT "<27>U<27>a<42><52><27>CTEST<27>c<27>u"
230 REM
```

2.2 Protecting Unsophisticated/Unauthorized Users

2.2.1 User/Programmer mode

User mode provides a mechanism for protecting the novice user from inadvertently executing most terminal commands. When in User mode (the factory default), most of the terminal commands will be ignored when entered. To enter Programmer mode, type the two keys MC U. To go back to User mode, type the two keys MC u. All commands requiring Programmer mode are detailed in Chapter 3. From a practical standpoint, it is best to permanently leave the terminal in Programmer mode when testing applications, and then add the desired level of user protection after the application has been completed.

2.2.2 Additional Levels of Protection

There are several additional methods for preventing unauthorized use of commands:

- -The cursor key pad (including the MULT CODE key) can be set to Transmit mode. In this mode, when cursor pad keys are pressed a unique character sequence is transmitted to the host computer. The host can then decide whether to initiate the requested commands;

- -The cursor key pad can be disabled. In this mode, when cursor pad keys are pressed, no character sequence is generated and the bell is sounded;

- -Individual keys on the cursor key pad can be set to Transmit mode or disabled; and

- -The entire keyboard can be locked. In this mode, when a key is pressed no character is generated and the bell is sounded.

2.2.3 Related Commands

Chapter 3 Section	Command
3.4 Mode Setting	User Mode
3.4 Mode Setting	Programmer Mode
3.12 Keyboard	Keyboard Lock/Unlock
3.12 Keyboard	Set Cursor Pad to Transmit
3.12 Keyboard	Set Cursor Pad to Execute
3.12 Keyboard	Set Cursor Pad- Trans & Exec
3.12 Keyboard	Disable Cursor Pad
3.12 Keyboard	Set Cursor Pad Keys - General

For a detailed discussion of these commands, see the appropriate section of Chapter 3.

2.3 Debugging Programs

2.3.1 Transparent mode

When the terminal is in Transparent mode, ALL characters received by the terminal are displayed. Control codes will be displayed as their equivalent graphic representation and will not be executed. This is extremely important for debugging software as it is the only way to determine if the user software is generating the required character sequences. See Appendix A or the CONCEPT 108 Reference Card for the graphic representations of all characters. Note that when in APL, the equivalent characters and APL control code graphic representations will be displayed (see Appendix A).

From the keyboard, Transparent mode applies to characters received for display and does not apply to cursor pad keys (including the MULT CODE key, the BREAK key, and the BACK TAB key) or to editing programmable function keys. These keys, in their default state, do not cause characters to be received for display.

When in Full Duplex mode of operation, characters typed on the keyboard are transmitted directly to the host computer and not displayed unless they are echoed back to the terminal. For this reason, in Full Duplex mode, Transparent mode may not appear to work for characters typed on the keyboard (some characters may not be echoed).

In Half Duplex mode of operation, characters typed on the keyboard are both displayed and transmitted to the host computer. Thus, in Half Duplex mode, Transparent mode will display all characters typed on the keyboard.

From the host computer, in either Full or Half Duplex mode of operation, all characters received, including control codes, will be displayed when the terminal is in Transparent mode.

To enter Transparent mode (with the terminal in Programmer mode) type the two characters MC T. To exit Transparent mode, type the two characters MC t.

2.3.2 Status Information

The entire terminal configuration is displayable via status lines (the terminal's 25th line). Initially, except for setting different communications configurations (e.g., Baud Rates), the new user need only be concerned with the keyboard status lines. Status lines for each device are available on the CONCEPT 108 because the terminal can be configured so that different devices (keyboard, Line 1, Line 2, Line 3) have different mode settings, communications configurations, windows and attributes as described in Section 2.13. If the terminal does not have optional Lines 2 and 3, the user need never be concerned with the status lines corresponding to these devices. The five different status lines are as follows:

1. User - Displays the communications configuration, major mode settings, cursor position, character set and several other pieces of user-oriented information. The four different user status lines can be displayed as follows:

User Status Line	Type
Keyboard	STAT key or MC / Sp Sp
Line 1	MC / Sp !
Line 2	MC / Sp "
Line 3	MC / Sp #

2. Programmer - Displays the detailed terminal configuration. The four different programmer status lines can be displayed as follows:

Programmer Status Lines	Type
Keyboard	MC / ! Sp
Line 1	MC / ! !
Line 2	MC / ! "
Line 3	MC / ! #

3. Tabs Line - Text tab locations are indicated by a period. To display type the four characters:

   MC / " Sp

4. Message Characters Line - Displays the current values of the terminal's programmable message characters. (See Section 2.12.) The four different message character lines can be displayed as follows:

Message Character Lines	Type
Keyboard	MC / # Sp
Line 1	MC / # !
Line 2	MC / # "
Line 3	MC / # #

5. Alert Line - Displays the keyboard lock status, self test errors, programmable function key information and a user programmable status message. To display, type the four characters:

   MC / $ Sp

If the request for status information is received from a communications line, the characters making up the requested status line will be transmitted back to that line followed by the EOM programmable message character (default carriage return ^M). Programmer status line delimiter characters are replaced by spaces. Appendix F describes the contents of Transmitted Status Requests.

Scrolling through status lines in the sequence listed above can be performed via the Scroll Status Line commands.

To scroll forward to the next line, type the three character sequence MC Sp d

To scroll backward to the previous line, type the three character sequence MC Sp D

These commands can be programmed on function keys if desired (see Section 2.9).

A detailed description of the contents of each status line can be found in Figure 2-2 . Several status items on the User and Programmer Status Lines are only visible when the terminal is set to 132 columns. All status items are transmitted by Transmit Status Requests regardless of the 80/132 column display status.

2.3.3 Related Commands

Chapter 3 Section	Command
3.4 Mode Setting	Transparent Mode On/Off
3.3 Status Information	All commands

Figure 2-2

STATUS LINES

USER LINE

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
KB	50	FULL	1STOP	NONE /	OFF	REM	USER	BLOK	U/L	lll:ccc	ASC	lll,ccc,lll,ccc	annnn	080	INS/OFF
L1	75	HALF	2STOP	EVEN	ON	LOC	PROG	CHAR	CAP		CH1			132	INS/ON
L2	:			ODD							CH2				
L3	9600			MARK							CH3				
				SPAC							APL				

a. Device (KB = keyboard, L1 = line 1, L2 = line 2, L3 = line 3)
b. Baud Rate
c. Half Duplex (HALF) / Full Duplex (FULL)
d. Stop Bits (1 or 2)
e. Parity (NONE, EVEN, ODD, MARK, SPACE)
f. Parity Checking on Input (OFF or ON)
g. Remote (REM) / Local (LOC)
h. User (USER) / Programmer (PROG)
i. Block (BLOK) / Character (CHAR)
j. Upper/Lower Case (U/L) / Caps Lock (CAP)
k. Cursor Position (Line: Column)
l. Character Set (ASCII [ASC], Alt. Char Set 1 [CH1], Alt. Char Set 2 [CH2], Alt.Char Set 3 [CH3], APL [APL]). Graphics is normally CH1. APL also indicates overstrike.
m Window (home line, home column, no. of lines, no. of columns)
n. Software version
† o. Display Width
† p. Insert Mode off/on

† Not shown on 80-column display

PROGRAMMER LINE

ab	cde fgh	i	jkl mno	p	q	rst uvw xyz ABCD	EFG	H	I	J	K	L
K1	RUB TST	lll ccc	00w x01	lll ccc lll ccc	sss	000 000 000 0000	wmc	mmm	lll ccc	4	lll	ddd
12	LPC FPN		11 12			111 111 111 1111				8		
23			22 2 :									
3			33 38									

a. Device (K = keyboard, 1 = line 1, 2 = line 2, 3 = line 3)
b. Keyboard Communication Line (1 = line 1, 2 = line 2, 3 = line 3)
c. Remote (R) / Local (L)
d. User (U) / Programmer (P)
e. Block (B) / Character (C)
f. Text (T) / Form (F)
g. Scroll (S) / Page (P)
h. Transparent Mode On (T) / Off (N)
i. Cursor Position (line column)
j. Attribute List Number (0-3)
k. Window Number (0-3)
l. Attribute Word ("w" input parameter)
m. Network Word ("network" input parameter)
n. Character Set (ASCII = 0, APL = 3)
o. Display Pages Allocated
p. Window (home line home column no. of lines no. of columns)
q. Start of Screen (line)
r. CTS/RTS Protocol off (0) / on (1)
s. Upper-Lower Case (0) / Caps Lock (1)
t. Trailing Blank Suppression off (0) / on (1)
u. Underline Transmission off (0) / on (1)
v. Form Feed Prior to Print off (0) / on (1)
w. Keyboard Bell off (0) / on (1)
x. Insert in Window (0) / Line (1)
y. Parity Checking off (0) / on (1)
z. Buffer Overflow Control off (0) / on (1)
A. Auto-Linefeed off (0) / on (1)
B. Auto-tabs off (0) / on (1)
C. Replace Char & Attribute (0) / Char Only (1)
D. Autowraparound off (0) / on (1)
E. Clear Attribute ("w" input parameter)
F. Clear Mask ("m" input parameter)
G. Clear Character ("char" input parameter)
H. Margin Bell Offset
I. Start of Print/Transmit (line column)
†J. Display Pages — Physical
†K. Display Lines Allocated
†L. Transmission Delay (in 100 ms increments)

† Not shown on 80-column display

TABS LINE

Tab locations are indicated by a period.

MESSAGE CHARACTERS LINE

a		b	c	d	e	f	g	h	i	j	k	l	m
KB	MESSAGE CHARACTERS	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
L1													
L2													
L3													

The ASCII chart location of each character is displayed. If the character is not defined, N/A is displayed.

a. Device (KB = keyboard, L1 = line 1, L2 = line 2, L3 = line 3)
b. "Escape" Message Character (ESC)
c. Acknowledgement (ACK)
d. Negative Acknowledgement (NAK)
e. Start of Message (SOM)
f. End of Field (EOF)
g. End of Line (EOL)
h. End of Message (EOM)
i. Function Key Transmission Lead In (FKID)
j. Resume Transmission (XON)
k. Suspend Transmission (XOFF)
l. Cursor Pad End of Message (CPEOM)
m. Delay Character (NULL)

ALERT LINE

a	b	c	d	e
LOCK	12345678	K: aaaa	xxx BLK, yyy CHAR	a a a a a a a a a a a a a a a a a a a a a a a a a a a a a a a a a a a a a a a a

a. Keyboard Locked (LOCK) / Keyboard Unlocked (blank)
b. Self-Test Errors: 1 = ROM 1, 2 = ROM 2, 3 = ROM 3, 4 = ROM 4, 5 = RAM, 6 = NVM, 7 = Communication Character (loopback), 8 = Communication Controls (loopback), NO ERROR = none.
c. Programmable Function Key being Displayed
d. Available Function Key Space in Blocks (256 characters) and Characters (shown when a key is being displayed)
e. Programmable Status Message (40 characters)

2.4 Application of Commands

In general, CONCEPT 108 commands apply to the device on which they are received. Commands received on Line 1 apply to Line 1 while those received on Line 2 apply to Line 2. In order to simplify the terminal, in the default configuration, most terminal commands have been made to apply to all devices. Several terminal commands which apply to the receiving device in the default terminal configuration are:

Set Baud Rate
Set Parity
Set Stop Bits
CTS/RTS Protocol On/Off
Buffer Overflow Control On/Off
Parity Checking on Input On/Off
Insert Mode On/Off
Set Insert Type (Line/Window)
Set Output Network

For more sophisticated applications, devices can be made to use different lists of attributes, mode settings, cursors, and windows. When the terminal is configured for these applications, changes apply to the receiving device. See Section 2.13 for a detailed description of these capabilities.

2.4.1 Function Routing

The Function Routing command provides a mechanism by which characters and commands received by one device are processed as if they were received by another device. Changes made to mode settings, attributes or communications settings will be processed as if they were received on the specified device. This command is particularly useful for changing communications settings such as baud rate, parity and stop bits for auxiliary communications lines from the keyboard.

2.4.2 Keyboard's Communication Line

Certain commands executed from the keyboard do not apply to the keyboard but rather to a communication line referred to as the 'Keyboard's Communication Line'. The default Keyboard's Communications Line is Line 1. The ability to change the Keyboard's Communications Line via a terminal command is provided for two main reasons. The first is to simplify the terminal's functionality. For example, function routing is not required when setting the Line 1 communications configuration - baud rate, parity, stop bits, etc. The second benefit of the capability is that it provides an easy extension to more sophisticated applications. For example, a user could connect a second computer system to Line 2 for a multiple computer application. If the Keyboard's Communication Line is set to Line 2, communications and keyboard functionality will be established with Line 2 exactly as it had been with the main communications line (for example - Remote/Local modes, Character/Block modes, Half/Full Duplex modes, Break key, Send key etc.). The complete

list of affected commands is as follows:

Set Baud Rate
Set Parity
Set Stop Bits
CTS/RTS Protocol on/off
Parity Checking of Input on/off
Buffer Overflow Control on/off
Remote/Local mode
Block/Character mode
Half/Full Duplex mode
Transmit Line / Field / Window
Transmit All Line / Window
Break
Function Keys in Transmit mode
Cursor Pad Keys in Transmit mode
Create Screen
Transmit Answerback Message

A command is provided which allows the user to change the Keyboard's Communication Line. In addition, this command changes the keyboard's data flow so that communication with the specified device is established. This command is particularly useful in multiple computer applications for switching between several different computer systems. This command can also be used to change communications settings for a peripheral device easily.

2.4.3 Related Commands

Chapter 3 Section	Command
3.8 Multiple Devices	Function Route
3.12 Keyboard	Keyboard's Communication Line

2.5 Display Memory, Cursor and Windows

2.5.1 Display Memory

The CONCEPT 108/APL8 display terminal allows both 80 and 132 column display of data. When the terminal is set to 80 columns, the four page terminal stores 96 lines of data and the eight page terminal stores 192 lines (24 lines per page). When the terminal is set to 132 columns, the four page terminal stores 56 lines of data and the eight page terminal stores 112 lines of data (14 lines per page). In all cases, 24 lines of data will be displayed on the screen.

Two commands are provided to switch the terminal between 80 and 132 columns. By typing the two characters MC " the terminal will be switched to 132 column mode; by typing the two characters MC ! the terminal will be switched back to 80 column mode. In both cases, the maximum memory contents will be retained.

2.5.2 Cursor

The cursor defines the location in display memory where the next character to be displayed will be placed. In the default configuration, displayable characters received from any device (keyboard and communications lines) all use the same cursor. This cursor is indicated by a flashing underline or a flashing reverse video block on the screen.

More sophisticated applications can configure the terminal so that each device uses a separate cursor. For example, it may be desirable for the keyboard to be writing in one area of display memory while the main communication line is writing in another and Line 2 is writing in a third. The keyboard's cursor is depicted as the displayable graphic (underline or reverse video block) while the cursors used by other devices are invisible. See Section 2.13.4 (Multiple Cursors and Windows) for an explanation of this capability.

Initially, when the terminal is turned on or reset, the cursor is homed (line 0, column 0 - on the CONCEPT terminals line and column numbering begin at 0). As data are entered into display memory, the cursor is moved accordingly. The keyboard cursor must be visible at all times. If other devices are using separate cursors, their cursors may be placed in areas of display memory which are not visible. Moving the keyboard cursor to an area of display memory which is not visible will cause that area to be displayed.

Several commands perform cursor positioning. Included within these commands are cursor positioning control codes and command sequences (Carriage Return, Line Feed, Back Space, Tab, Reverse Line Feed and Back Tab), absolute cursor addressing to a specific location in display memory (Write Address, Home and End of Text) and relative cursor movement commands (Up, Down, Left, Right). Additionally, a command (Read Cursor) is provided which allows the cursor location (address) to be determined by the host computer.

Additional commands are provided which allow the user to select which 24 lines of memory are to be displayed. Included within these commands are scrolling (Scroll Up and Down) and paging (Page Up and Down) commands and a command which specifies the first line for display (Start of Screen).

2.5.3 Windows

Windows are rectangular areas of display memory which are treated as if they were the terminal's entire display memory. In its default configuration, the terminal's 'window' is defined as all of display memory, although this appears to the novice user exactly as if no window has been defined. If the user defines a different window, all commands (such as cursor controls) which had previously applied to all of display memory become window relative.

Windows are defined by their home position and number of lines and columns. For example, to create a window with a home position of 10, 10 and 20 lines and 20 columns, type the six characters MC v * * 4 4 . Once this window has been defined, if a cursor positioning command is transmitted to the terminal which positions the cursor at line 5, column 5, the cursor will actually be positioned at line 15, column 15. To execute this example, (with the terminal in Programmer mode) type the four characters MC a % %. The user may also wish to experiment with the cursor control keys (home, up, down, left and right) and the editing keys.

More sophisticated applications can set up the terminal so that different devices use different windows. Section 2.13 details this capability.

2.5.4 Related Commands

Chapter 3 Section	Command
3.5 Cursor Controls	All Commands
3.6 Screen Control	All Commands
3.6 Screen Control	Display Width 80 Columns
3.6 Screen Control	Display Width 132 Columns
3.6 Screen Control	Define Window
3.1 General	Window Selection

2.6 Character Attributes

2.6.1 Usage

Characters stored in display memory can have any of seven available attributes:

Character set - The character graphic representation is selectable from up to four different character sets (0-3). The ASCII character set is set 0 and the APL character set is set 3. The optional graphics character set is inserted as set 1. Character set 2 is an optional fourth character set. Any character set may be replaced with a user defined character set by replacing the appropriate character generator ROM on the printed circuit card within the terminal (see Appendix A).

Blinking - Characters are shown flashing at the rate of 2 times per second.

Reverse Video - The character and character cell are reversed from the normal screen video presentation. For a black screen (screen normal video), reverse video characters are displayed as black characters on a white background. For a white screen (screen reverse video), reverse video characters are displayed as white characters on a black background.

Non-display (secure) - Characters typed into display memory are stored but not displayed.

Half bright - Characters are displayed at half their normal video intensity.

Underlining - Characters appear underlined.

Protection - Characters cannot be overwritten by a device which is in User mode (overwriting is allowed if that device is in Programmer mode). Any attempt to overwrite a protected character from the keyboard will cause the keyboard bell to ring.

Any combination of the above attributes is allowed for a displayed character with one exception: APL overstruck operators (those consisting of two different characters overlaid in the same position) may only select the Reverse Video attribute.

As characters are inserted into display memory, the current attribute values are stored and the appropriate video presentation is made. Commands are provided which change the attribute settings (for example, blink on, blink off). Characters received after the settings have been changed are stored with the new settings. Thus, adjacent locations in display memory can have different video attribute presentations.

Changed in V3 See App. G

When character set 0 (ASCII) has been selected, underline characters typed on the screen are stored as the underline attribute. If underline CHARACTERS are to be displayed, they must be put up via one of the repeat character commands (Repeat Character Horizontal, Repeat Character Vertical).

A single command --Set Attribute Word-- is provided which allows setting the values of attributes other than character set all at once. Another command --Read Attribute Word-- is provided which allows the values of all attributes settings other than character set to be determined by the host computer.

The command Set Attribute of Block allows the attributes in any rectangular portion of display memory to be changed without changing the characters in that area. This command is particularly useful for setting large areas of memory to desired attributes (Reverse Video, Protection) without having to send out a large number of characters. It is also possible to make an area of the screen look like it was put up instantaneously by first putting the data up with the nondisplay attribute set and then removing this attribute via the Set Attribute of Block command.

The Replace Character Only command allows characters to be entered without changing the attribute settings stored in display memory. This is useful in applications where the entire screen is protected, and user entry fields are displayed as unprotected characters. If the unprotected fields have different attributes (e.g., Reverse Video and Reverse Video Nondisplay for password), the terminal can be configured to use the attributes that exist at each location.

2.6.2 Character Sets and Overstrike Mode

As described in the previous section, the CONCEPT terminal can support up to four character sets simultaneously. Since the character set is an attribute of each character stored in display memory, adjacent screen locations may display characters from different character sets.

Character set number three (3) has been modified in hardware to provide the overstrike capability. Since APL requires this capability, the CONCEPT APL/8 terminal places APL in this character set position. When the terminal is in Overstrike mode, typing a character on top of an existing displayed character will overlay the two characters and display the combination on the screen. If two characters are already displayed in any given location, the typed character will replace the second character entered.

When in overstrike mode, the space character is nondestructive. When it is typed over another character (including overstruck characters), the character will be unchanged. To erase a character in Overstrike mode, a clear or delete editing command must be performed.

A command sequence is provided which selects character set 3 (APL) and also selects Overstrike mode. This command is executed by typing the

two characters MC 0 (alternatively ^N). A second command sequence is provided which selects character set 0 (ASCII) and also turns off overstrike mode. This command is executed by typing the two characters MC) (alternatively ^O).

As mentioned previously, overstruck characters may only select the Reverse Video attribute.

Character set changes may also be accomplished via the Select Character Set command. When this command is executed, the overstrike mode setting will not be changed. If character set 3 (APL) is selected after previously being in non-overstrike ASCII, APL characters will be displayed, but overstriking of these characters will not be allowed. Similarly, if character set zero (ASCII) is selected after previously being in overstrike APL, ASCII characters will be displayed until an overstruck character is encountered. Overstruck characters will be displayed as the combination of the equivalent two characters from the APL character set.

Users may create their own overstrike character sets by replacing the two overstrike character generator ROMs on the printed circuit board. Since two separate character generator ROMs are used (one for the first character typed and one for the second character typed), it is possible to use two different character graphics for overstruck combinations.

2.6.3 Related Commands

Chapter 3 Section	Command
3.7 Display	All commands

2.7 Networking

The CONCEPT terminal system provides a general purpose mechanism for organizing communications between the terminal's devices. The devices are the keyboard (input only), display (output only) and communications lines - maximum three (input and output). Input devices transmit data to the terminal and output devices transmit data from the terminal to communications lines or to the display (see Figure 2-3). The terminal acts as a switching mechanism to route data from input devices to output devices. The output network defines the desired routing. That is, an input device's network specifies which output devices are to receive characters transmitted from that device.

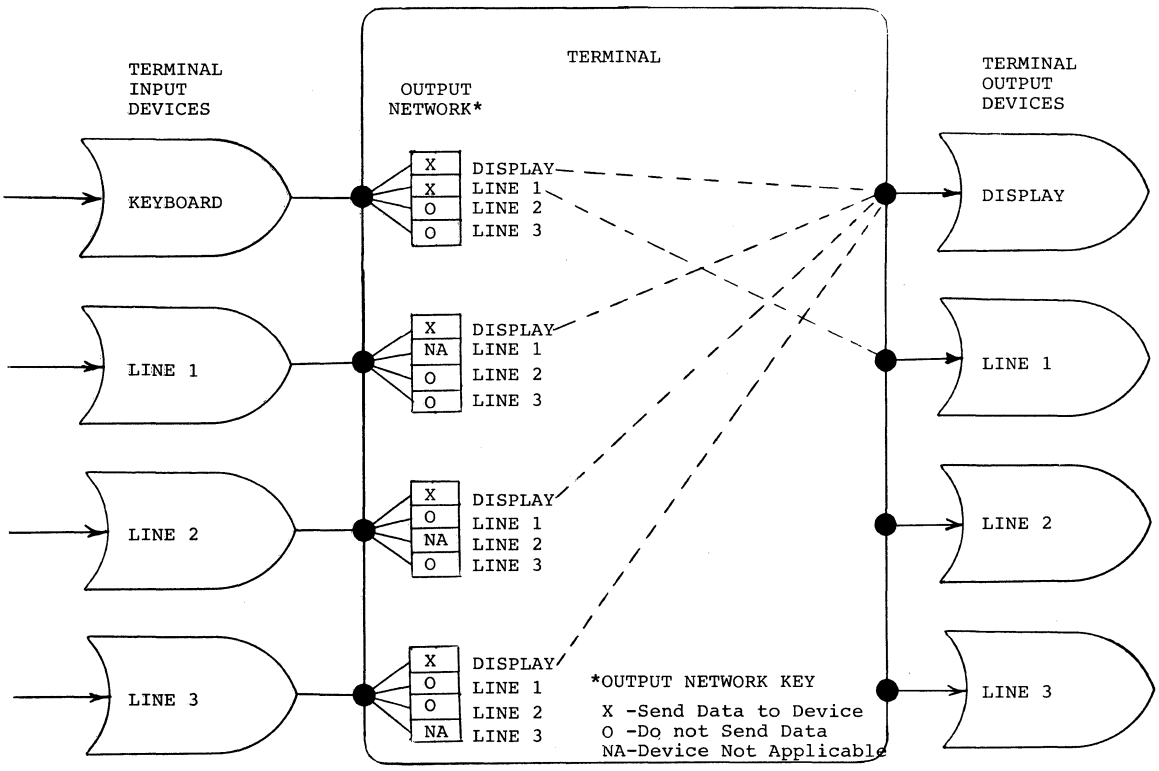


FIGURE 2-3
Networking Example
Default Terminal Configuration

The factory default output network configuration is as follows:

Input Device	Default Output Network
Keyboard	Display, Line 1
Line 1	Display
Line 2	Display
Line 3	Display

Thus, in the default configuration, characters typed on the keyboard are displayed and transmitted to Line 1 and characters received on Lines 1, 2 or 3 are displayed. The display screen is considered to be an output device for output network purposes. This configuration is equivalent to having the terminal set to Remote mode, Character mode and Half Duplex mode (see below).

These modes of operation as well as the other ones defined below actually configure or change the output network for specific devices.

2.7.1 Remote mode (MC 9)

Sets the individual networks according to the values of Block/Character modes and Full/Half Duplex modes. When returning to Remote mode from Local mode, the output networks are changed to the appropriate configuration described below:

2.7.1.1 Character Mode (MC 5)

The normal conversational mode of operation transmits each character as it is typed on the keyboard. When set to Remote-Character modes (from commands), the output networks are changed according to the settings of Full/Half Duplex as follows:

Full Duplex (MC 8)

Input Device	Changes the Network as follows:
Keyboard	Line 1 Added
Line 1	Display Added
Line 2	Unchanged
Line 3	Unchanged

Half Duplex (MC *)

Input Device	Changes the Network as follows:
Keyboard	Display and Line 1 Added
Line 1	Display Added
Line 2	Unchanged
Line 3	Unchanged

The above settings assume that the Keyboard's Communication Line is Line 1 (default). If changed, the network would be set up with the new Keyboard's Communication Line added rather than Line 1.

2.7.1.2 Block mode (MC &)

Block mode sets up keyboard communications with the display; the communications lines' networks remain unchanged. This mode is intended for Block Transmission applications. These applications (discussed in Section 2.15) allow entry and local editing of displayed characters with subsequent transmission of portions of the entered data (field, line, window).

Input Device	Changes the Network as follows:
Keyboard	Display Added, Line 1 Off
Line 1	Unchanged
Line 2	Unchanged
Line 3	Unchanged

The above settings assume that the Keyboard's Communication Line is Line 1 (default). If changed, the network would be set up with the new Keyboard's Communication Line turned off rather than Line 1.

2.7.2 Local mode (MC ( )

This mode allows the keyboard to communicate with the display, but turns off all communications between the terminal and communications lines. Local mode is intended to provide a mechanism for detaching the terminal from the host computer system. This may be needed to perform some local operation such as programming function keys.

When in Local mode, commands which make use of the keyboard's communication line will not be executed. These include Transmit Line/Field/Window, Transmit mode function keys, BREAK, cursor pad keys in Transmit mode, read commands (Cursor, Output Network, Attribute, and Status Lines), Create Screen, and Transmit Answerback Message.

The output network is set as follows:

Input Device	Changes the Network as follows:
Keyboard	Display Added, Line 1 Off
Line 1	Turned Off
Line 2	Unchanged
Line 3	Unchanged

The above settings assume that the Keyboard's Communication Line is Line 1 (default). If changed, the network would be set up with the new Keyboard's Communication Line turned off rather than Line 1.

Note that Local mode is intended for off-line operation when NO computer access is required. (Block mode should be used for off-line data entry with subsequent transmission to the host.) The following commands will have no effect in Local mode: Display/Transmit Status, Read Address, Read Attribute Word, Read Output Network, Transmit/Transmit All Line/ Field/Window, Create Screen, Initiate Break, Transmit Answerback Message and Function Keys and Cursor Pad Keys in Transmit mode.

2.7.3 Generalized Networking

The Set Output Network command provides a generalized capability for defining the output network for each device. Since this command applies to the device on which it is received, function routing is required for setting the output network for other devices. This command returns the programmable ACK message character if successful; otherwise, the programmable NAK message character is returned. If requested from the keyboard no additional action is taken if successful. The keyboard bell is rung if unsuccessful. The ACK and NAK characters can be modified or suppressed through use of the Change Message Character command. The Set Output Network command can be used to override the output networks configured by the commands listed above (Remote/Local, Block/Character and Half/Full Duplex). For example, this command can be used to turn off character transmission from the keyboard. This would not change the status line display for the above modes.

2.7.4 Commands Changing Auxiliary Communication Lines Networks.

Several commands are provided which change output networks for auxiliary communications:

Attach Printer (CTRL-PRINT or MC })

> Changes all output networks so that characters which are transmitted to the display will also be transmitted to Line 2.

Detach Printer (CTRL-SHIFT-PRINT or MC ~)

> Changes all output networks so that characters are not transmitted to Line 2.

Attach Tape (CTRL-TAPE or MC @)

> Changes all output networks so that characters which are transmitted to the display will also be transmitted to Line 3.

Detach Tape (CTRL-SHIFT-TAPE or MC ^)

> Changes all output networks so that characters are not transmitted to Line 3.

Print Line/Window (SHIFT-PRINT, PRINT, MC | or MC {)

> On completion, changes all output networks so that characters are not transmitted to Line 2.

Message to Tape (TAPE or MC `)

> On completion, changes all output networks so that characters are not transmitted to Line 3.

Define Keyboard's Communication Line

> Sets up keyboard communications with the specified line and turns off keyboard communications with the previous Keyboard's Communication Line.

2.7.5 Networking Notes

1. Only characters are networked to other devices according to the transmitting device's output network. Command sequences are executed by the terminal and not networked. Illegal command sequence characters or those with errors are networked after the point at which the error is detected.

2. Control code commands are networked (since they are characters). If the display is on for that device, they will be either executed or (if in Transparent mode) displayed.

2.7.6 Related Commands

Chapter 3 Section	Command
3.8 Multiple Devices	Set Output Network
3.8 Multiple Devices	Read Output Network
3.8 Multiple Devices	Attach Printer
3.8 Multiple Devices	Detach Printer
3.8 Multiple Devices	Attach Tape
3.8 Multiple Devices	Detach Tape
3.4 Mode Setting	Character
3.4 Mode Setting	Block
3.4 Mode Setting	Full Duplex
3.4 Mode Setting	Half Duplex
3.4 Mode Setting	Remote
3.4 Mode Setting	Local

2.8 Restoring and Storing the Terminal Configuration

2.8.1 Non-Volatile Memory

When the CONCEPT 108/APL8 terminal is turned on, the terminal's configuration will be set to the configuration stored in permanent Non-Volatile Memory (NVM). The factory default settings of this configuration are described in Figure 2-4.

The entire terminal configuration except for the contents and attributes of display memory, programmable function keys and keyboard lock status can be stored in the terminal's Non-Volatile Memory (NVM).

The terminal has the capability, via the use of the Latent Expression, to perform a user specified sequence of operations on power up or reset. Typical uses of the Latent Expression are to program function keys, to display a message on the screen, or to provide some information to the host computer system. The maximum 80 character Latent Expression is executed whenever the terminal is powered up or reset and may be stored in NVM. It is executed as if the stored characters were typed on the keyboard. For information on programming the Latent Expression, see Section 2.9 and the appropriate sections of Chapter 3.

The terminal may also be programmed with a maximum 20 character Answerback Message (storeable in NVM). The command to transmit the Answerback Message is industry standard and is typically used to identify the terminal to a host computer system. The Answerback Message will be transmitted to the requesting communications line or to the Keyboard's Communication Line if requested from the keyboard whenever a ^E (ASCII chart location 5) or a Transmit Answerback Message command (MC Sp :) is received by the terminal. For information on programming the Answerback Message, see Section 2.9 and the appropriate sections of Chapter 3.

Figure 2-4
Factory Default Settings

Category	Function	Default Condition	
General	Message Characters		
	-ESC	ASCII Chart Loc. 27	
	-ACK	ASCII Chart Loc. 6	
	-NAK	ASCII Chart Loc. 21	
	-SOM	Not used	
	-EOF	ASCII Chart Loc. 23	
	-EOL	ASCII Chart Loc. 13	
	-EOM	ASCII Chart Loc. 13	
	-FKID	ASCII Chart Loc. 28	
	-XON	ASCII Chart Loc. 17	
	-XOFF	ASCII Chart Loc. 19	
	-CPEOM	Not used	
	-DELCHR	Not used	
	Alert Line	Displayable	
	Prog. Status Message	None	
	ASCII Underline Char.	Change Underline Attribute	Changed in V3 See App. G
	Form Feed	Clear Screen	
APL/ASCII	Character Set	ASCII	
	Mode	Non-overstrike	
Mode Settings	User/Programmer	User	
	Text/Form	Text	
	Scroll/Page	Scroll	
	Character/Block	Character	
	Upper-lower/Caps	Upper-lower Case	
	Remote/Local	Remote	
	Transparent Mode	Off	
	Auto Linefeed	Off	
	Auto Tabs	Off	
	Auto Wraparound	On	
	Replace Char. Mode	Replace Character and Attribute	
Cursor Controls	Cursor Address	Home (0,0)	
	Cursor Type	Flashing Underline	
	Tab Settings	8,16,24,...,128,132	
	Margin Bell Offset	No margin bell	
Editing	Insert Mode	Off	
	Insert in Line/Window	Window	
	Clear Characteristics		
	- Attribute	non-display	
	- Character	Space (32)	
	- Mask	change non-display attribute	

Figure 2-4 (contd.)
Factory Default Settings

Display	Blinking	Off
	Reverse Video	Off
	Half-bright	Off
	Underline	Off
	Non-display	Off
	Protection	Off
	Screen Video	White characters on black background
	Protected Fields	Normal brightness
	Display Memory	Spaces with Non-display attribute set
	Attribute List	0
Multiple Devices	Output Networks	Keyboard: Disp,Line 1 on Lines 1,2,3: Display on
	FF Prior to Print	On
Transmission	Baud Rate	300 Baud
	Parity	None
	Duplex	Half
	Stop Bits	Two (2)
	Parity Chk Input	Off
	Transmission Delay	None
	Clear-to-Send Protocol	Line 1: Off Lines 2,3: On
	Buffer Overflow	Disabled
	Trailing Blanks	Suppressed
	Underlines	Transmitted
	Start of Print/Trans.	Home (0,0)
Screen Control	Display Memory	Entire physical memory
	Window	Entire display memory
	Window Number	0
	Start of Screen	Line 0
	Display Width	80 columns
Function Keys, Stored Data	Programmable Function Keys	Defaults (Figure 2-5)
	Latent Expression	None
	Answerback Message	None
Keyboard	Keyboard	Unlocked
	Bell	Enabled
	Keyboard Communication Line	Line 1
	Cursor Control Pad	Execute Mode

2.8.2 Restoring the Terminal Configuration

A command is provided which allows the user to reset the terminal to the current NVM configuration. This command is executed by typing the RESET key (shifted STAT key) or by typing the two keys MC , . This command is extremely powerful as it resets the entire terminal configuration including the programmable function keys and all of display memory.

For user convenience, a command is provided which resets the terminal's Non-Volatile Memory to the factory default configuration. This command should be used in emergencies when the exact configuration is not known and at other times when it is easier to configure the terminal this way. The terminal must be reset or powered off/on after this command is executed to set the current configuration to that stored in NVM. To execute this command, type the three characters MC Sp ~ .

2.8.3 Storing the Terminal Configuration

Two commands are provided which store the terminal configuration in Non-volatile Memory. The first command, Store Communication Configuration, saves the values of baud rate, parity, stop bits and half/full duplex. To execute this command, type the three characters MC Sp C. This command is the safest command to execute when changes are only being made to the communications settings. It provides the same functionality as the dip switches did on the older C100/C104 terminals. The second command, Store Configuration, saves the entire terminal configuration as previously described. To execute this command, type the three characters MC Sp S. The power of this command is illustrated by the fact that if executed when the terminal is in Local mode, every time the terminal is subsequently powered on or reset it will be placed in Local mode. The terminal may appear broken to the unknowledgeable user as host computer communications are cut off when the terminal is configured in this way.

A command is provided which displays on the terminal the exact contents of NVM. This command is primarily for factory use to determine whether NVM is functioning properly. Appendix B provides a detailed description of this display. To execute this command, type the three characters MC Sp a.

2.8.4 Related Commands

Chapter 3 Section	Command
3.11 Function Keys, Stored Data	Stored Data Display/Storage
3.11 Function Keys, Stored Data	Program Latent Expression
3.11 Function Keys, Stored Data	Execute Latent Expression
3.11 Function Keys, Stored Data	Program Answerback Message
3.11 Function Keys, Stored Data	Transmit Answerback Message
3.1 General	Reset
3.11 Function Keys, Stored Data	Factory Configuration Reset
3.11 Function Keys, Stored Data	Store Communications Config
3.11 Function Keys, Stored Data	Store Configuration
3.11 Function Keys, Stored Data	Display Stored Configuration

2.9 Function Keys and Other Stored Data

The standard set of programmable function keys on the CONCEPT 108/APL8 terminal come in a contrasting color and are located above the main pad. This set of eight keys consists of five keys labeled with the editing legends (INSRT, DEL CHAR, INS DEL LINE, CLEAR EOL EOP, SEND) and F1, F2, F3. Optionally, 11 additional keys can be added (located above and to the right of the main pad) and are labeled F4 through F14. Since each key allows both shifted and unshifted operation, the user actually has available 16 (optionally 38) unique function keys. All function keys have default configurations which are described below. All function keys, including the editing keys, are programmable to generate a user specifiable sequence of characters and/or commands. All function keys are reset to the default configurations whenever the terminal is powered up or reset.

2.9.1 Function Key Modes

Two function key operation modes are provided. The first of these, called Execute mode, executes the character/command sequence stored on the key as if the characters were typed on the keyboard. The normal networking and character processing for keyboard input will be performed. Execute mode for function keys is the standard mode for most users and is used for most conversational applications. Typical applications of Execute mode function keys are to store a sequence of characters which is to be used repetitively during a terminal session or to store a sequence of terminal commands which allow the user to change the terminal configuration easily. In the second mode of operation, called Transmit mode, when a key is depressed, the characters programmed on the key are sent to the Keyboard's Communication Line (default - Line 1) regardless of the keyboard's output network. Transmit mode function keys are most often used in Block mode applications where normal keyboard data are displayed on the screen (and not transmitted). The keys are used to notify the host computer of a user request to perform a specific operation.

2.9.2 Function Key Defaults

By default, the first five function keys are set to Execute mode (do not transmit any characters to the host computer) and perform the editing commands specified by their keytop legends. The remaining three (optionally 14 keys) are pre-programmed in Transmit mode with a specific set of character sequences. When depressed, each default Transmit function key transmits to the Keyboard's Communication Line (default-Line 1) the specified character preceded by the Function Key Identifier message character (FKID - by default FS, ASCII chart location 28) and followed by the End Of Message (EOM) character (carriage return, ASCII chart location 13 by default).

A list of the function key default settings is included as Figure 2-5.

Figure 2-5
Programmable Function Key Defaults*

KEY	X=Execute T=Transmit	Unshifted	Shifted
INSRT	X	Insert Mode on	Insert Mode off
DEL CHAR	X	Delete Character in Line /Field	Delete Character in Window
LINE INS/DEL	X	Insert Line	Delete Line
CLEAR EOL/EOP	X	Clear to End Of Line/Field	Clear to End Of Window
SEND	X	Transmit Line/Field	Transmit Window
F1	T	5	%
F2	T	6	&
F3	T	7	'
F4	T	8	(
F5	T	9	)
F6	T	:	*
F7	T	;	+
F8	T	<	,
F9	T	=	-
F10	T	>	.
F11	T	?	/
F12	T	@	C
F13	T	A	D
F14	T	B	E

*Default Transmit Function keys transmit a three key sequence which is the character specified in the table preceded by the FKID message character and terminated by the EOM message character.

2.9.3 Programming of Function Keys

Function keys can be programmed in two ways. The first method is intended to be used for programming function keys from the host computer and is compatible with the CONCEPT 100/104 terminals. This method is a command sequence which is executed by typing keys on the keyboard or transmitting characters to the terminal on a communication line. This command identifies the function key to be programmed, the function key mode (Transmit or Execute), and the character/commands to be programmed on the key. The second method, introduced with the CONCEPT 108, allows easier programming of function keys from the keyboard. In this method, the user types and edits on the display the characters/command sequences to be programmed on the key. When the user is satisfied that the characters/commands are correct, a second command is entered which programs the displayed sequence on the key.

2.9.4 Programming Function Key Examples

Example One: Program the word TEST followed by a carriage return (CR) onto F3. All characters including control codes (the carriage return) must be programmed on the key. The terminal does not make any assumptions concerning characters to be generated.

To program this example using method one, type the two characters MC 4 followed by four parameters as follows:

len - A numerical parameter indicating the length of the message to be programmed on the key. In this case the length is 5 and the parameter is % (ASCII Chart location 37).

key - A parameter indicating the key to be pressed. When entering this command from the keyboard, the actual key can be depressed. Figure 3-3 shows that F3 can also be specified by typing a 7.

mode - Execute mode is desired. Again from Section 3-11, execute mode is indicated by typing a # (ASCII chart location 35).

message - The five character message TEST followed by a carriage return is typed.

Recapping: the sequence to type is the ten characters
MC 4 % 7 # T E S T CR.

To program this example using method two, type on the screen the desired message to be programmed on the key preceded and followed by a delimiter character. The delimiter character can be any character not used in the message. After the first delimiter, a character is placed on the screen which indicates the function key mode: X for Execute mote, T for transmit mode. (Note, upper case is required.) If neither X or T is found, Execute mode will be assumed. No extra spacing should be used between delimiters as these spaces will also be programmed on the key. The carriage

return must be put up on the screen in transparent mode (MC T). Wrapping around to additional lines is allowed and no additional characters are added when a wrap around is encountered (i.e., this does not indicate a carriage return-line feed control code combination). Thus, this example should be typed on the display as follows:

/XTEST /

Then, position the cursor at the first delimiter, type the keys MC 6 and press F3.

Example Two: Program the command to Scroll Status Lines Forward (MC Sp d) on F1.

Using method one, the four parameters are:

len - The length is three and is indicated by typing a # (35)

key - Either press F1 or type 5

mode - Execute mode is indicated by typing a # (35)

message - MC Sp d

Recapping: type the eight characters MC 4 # 5 # MC Sp d.

Using method two, the scroll status command must be displayed on the screen. When programming Execute mode function keys from the display, the programmable Command Introducer character (default - ESCAPE, ASCII chart location 27) indicates the MULT CODE key. As with other control codes, the ESCAPE character can only be displayed on the screen when the terminal is in Transparent mode. This example can be displayed as follows:

/X d/ (Note: Space between ESCAPE and d)

Then, position the cursor at the first delimiter, type the two keys MC 6 and press F1.

Notes: As mentioned in Example Two, when programming Execute mode function keys, Command Introducer characters (which are by default the ESCAPE control code) are converted to MULT CODEs. If the application actually requires that this character be generated, the programming process would be as follows:

1. Change the Command Introducer via the Change Message Character command (see Section 2-12).
2. Program the function key using the ESCAPE character where needed. If this is done on a communication line, the new Command Introducer should be used.
3. Change the Command Introducer back to ESCAPE via the Change Message Character command.

The most common error encountered when programming Transmit mode function keys is caused by the CONCEPT terminal being set to an incorrect character length. The symptoms of this problem are that characters within the message appear to have been lost or not transmitted to the host computer. Please note the following:

1. For each character transmitted, the CONCEPT terminal transmits a single start bit, seven data bits, 0 or 1 parity bit, and 1 or 2 stop bits. This amounts to between nine and eleven total bits. See Appendix C for more details.

2. Selecting no parity causes no parity bit to be sent. If a parity bit is required one of the other parity selections must be made.

3. Selection of two stop bits is normal for baud rates of 300 and below. However, this convention is not strictly held to and the stop bit requirement should be verified if trouble is encountered.

Specifying an incorrect character length causes similar symptoms whenever a computer program uses Read commands (Read Cursor Position, Read Output Network, Read Attribute Word) or Transmit commands (Transmit Status Line, Transmit Line/Field/Window).

When programming function keys on the display in APL, specifying the function key mode is accomplished by displaying the APL equivalents of X and T (⊃ and ~).

2.9.5 Displaying Function Keys

The contents of any function key can be displayed on the screen by typing the two characters MC 2 and pressing the desired key. The contents will be shown with control codes displayed as their Transparent mode equivalents. MULT CODEs will be displayed as the Command Introducer character (default ESCAPE - ASCII chart location 27). In addition, the key being displayed and the amount of remaining function key storage space (in 256 character blocks and characters) are displayed on the Alert Status Line.

A second command is provided for displaying function keys which also places the terminal in Local and Transparent modes (for easier entry of control codes). This command is entered by typing the four characters MC Sp = Sp. The user must exit manually from Local and Transparent modes (MC 9 MC t). This command is useful for modification of a previously programmed function key.

2.9.6 Resetting Function Keys

Function keys may be reprogrammed and the contents changed whenever desired. In addition, individual keys can be reset to their default configuration, and all keys can be reset to their default configurations.

To set individual keys to their default configurations using the first method for programming function keys, specify the function key mode as either Default Transmit (type a space) or Default Execute (type an !). For example, to reset F1 to its default setting, type the five keys MC 4 Sp 5 Sp. Using the second method, the normal procedure is followed with only an X or T displayed between delimiters.

Type the two keys MC $ to reset all keys to their default configurations.

2.9.7 Function Key Memory

If programmed by method one, the maximum number of characters that can be stored on each function key is 3071. If programmed by method two, the total number of characters is limited by the amount of available display memory. Initially, four page terminals have 311 characters of function key memory and eight page terminals have 1143 characters of function key memory. The factory default programming of function keys does not use any function key memory.

The user may allocate pages of display memory for use as function key storage. Each page of memory adds more than 3800 characters of additional function key storage. Figure 2-6 lists available function key memory.

Figure 2-6
Available Function Key Memory

Display Pages	Four Page Unit	Eight Page Unit
1	11975	28359
2	8087	24471
3	4199	20583
4	311	16695
5	-	12807
6	-	8919
7	-	5031
8	-	1143

This memory allocation can be stored in NVM.

2.9.8 Executing Function Keys

A command is provided which allows function keys to be executed (pressed) under program control. If the request is for an Execute mode function key, the characters programmed on the key will be treated as if they were received on the requesting device. Examples of use of this capability are to execute a sequence of commands with a minimum of character transmission or to store large volumes of text using the function keys as temporary offline storage.

2.9.9 Programming, Displaying and Executing the Latent Expression

Commands are provided which allow manipulation of the Latent Expression in a manner similar to that used for function keys.

The Latent Expression can be programmed by typing the three characters MC Sp I followed by a beginning delimiter, the desired expression and an ending delimiter. The maximum length of the Latent Expression is 80 characters.

The Latent Expression can also be programmed from the display by typing the desired Latent Expression on the display preceded by a delimiter character and followed by a delimiter character. Control codes must be put up in their transparent mode form. Programmable Command Introducer characters (ESCAPE) are converted to MULT CODEs. See Section 2.9.4 for a technique for transmitting the programmable Command Introducer character. When the operator is satisfied that the typed information is correct, the cursor should be positioned at the first delimiter and the four characters MC Sp = (should be typed.

In both cases, after entry the Latent Expression must be stored in NVM via the Store Configuration command (MC Sp S).

The Latent Expression can be displayed by typing the four characters MC Sp = '. A second command is provided for displaying the Latent Expression which also puts the terminal in Local and Transparent modes (for easier entry of control codes). This command is entered by typing the four characters MC Sp = &. The user must manually exit Local and Transparent modes. Be careful to do this prior to storing the Latent Expression in NVM or the terminal will be 'permanently' in Local/Transparent mode.

The Latent Expression will be executed whenever the terminal is powered on or reset. In addition, a command is provided which executes the Latent Expression at any point during the terminal session. To execute this command, type the three characters MC Sp E.

2.9.10 Programming, Displaying and Executing the Answerback Message.

Commands are provided which allow manipulation of the Answerback Message in a manner similar to that used for the Latent Expression. The Answerback Message can be programmed by typing the three characters MC Sp H followed by a beginning delimiter, the desired Answerback Message and an ending delimiter. The maximum length of the Answerback Message is 20 characters.

The Answerback Message can also be programmed from the display by typing the desired Answerback Message on the display preceded by a delimiter character and followed by a delimiter character. Control codes must be put up in their Transparent mode form. If the programmable command

introducer character is entered, it will not be converted to MULT CODE. When the operator is satisfied that the typed information is correct, the cursor should be positioned at the first delimiter and the four characters MC Sp = % should be typed.

In both cases, after entry the Answerback Message must be stored in NVM via the Store Configuration Command (MC Sp S).

The Answerback Message can be displayed by typing the four characters MC Sp = $. A second command is provided for displaying the Answerback Message which also puts the terminal in Local and Transparent modes (for easier entry of control codes). This command is entered by typing the four characters MC Sp = #. The user must manually exit Local and Transparent modes. (Be careful to do this prior to storing in NVM.)

The Answerback Message will be transmitted to the requesting communication line or to the Keyboard's Communication Line if requested by the keyboard (default - Line 1) whenever a ^E is received on that line. In addition, a command is provided which transmits the Answerback Message. To execute this command type the three characters MC Sp :.

2.9.11 Related Commands

Chapter 3 Section	Command
3.11 Function Keys, Stored Data	Display Function Key
3.11 Function Keys, Stored Data	Program Function Key - Screen
3.11 Function Keys, Stored Data	Program Function Key - General
3.11 Function Keys, Stored Data	Execute Function Key
3.11 Function Keys, Stored Data	Reset All Function Keys
3.11 Function Keys, Stored Data	Stored Data Display/Storage
3.11 Function Keys, Stored Data	Program Latent Expression
3.11 Function Keys, Stored Data	Execute Latent Expression
3.11 Function Keys, Stored Data	Program Answerback Message
3.11 Function Keys, Stored Data	Transmit Answerback Message
3.11 Function Keys, Stored Data	Allocate Memory

2.10 Self Test

2.10.1 Self Test Execution

The CONCEPT 108/APL8 terminals provide five different self test operations. These tests are:

-Display Memory (RAM)
-Program Memory (ROM)
-Non-Volatile Memory (NVM)
-Communications Character
-Communications Controls

RAM, ROM and NVM tests are automatically performed whenever the terminal is powered up or reset. Specific tests can also be performed whenever desired through execution of the Self Test command. Self Test errors are displayed on the Alert Status Line. See Section 3.1 for details.

When executing the Self Test command, an option is provided which allows repeated execution of the command until an error is found or the terminal is reset or powered off.

The tests for communications characters and controls require attachment of a loopback connector (an RS232 type connector with pins 2-3 and 4-5 jumpered together). This connector is not provided with the terminal.

2.10.2 Related Commands

Chapter 3 Section	Command
3.1 General	Self Test

2.11 Additional Keyboard Functionality

2.11.1 Cursor Key Pad, Break Key and Back Tab Key.

The keys on the cursor key pad, the Break key and the Back Tab key normally execute their specified commands and do not transmit any characters.

Certain applications may require that these keys transmit a unique sequence of characters rather than execute their prespecified command. This can be accomplished by placing the cursor key pad in Transmit mode. When in Transmit mode each key will generate a unique character preceded by the programmable Command Introducer (default-Escape, ^[) and followed by the Cursor Pad End Of Message character (default - not used). Figure 2-7 lists the unique character generated by each key. On some of the keys it is not possible to distinguish between unshifted, shifted, control and control-shifted versions. To place the cursor pad in Transmit mode, type the two characters MC X. To return to Execute mode, the terminal must receive the two characters ESCAPE x from a communications line. This may be performed from the keyboard if a loopback connector is attached or if the host computer system will echo back the ESCAPE control code.

These keys may also be set both to execute their specified command and transmit the unique character sequences described above. To place the keyboard in Transmit and Execute mode, type the three Characters MC Sp X. Note: Do not set MULT CODE to Transmit and Echo, since command identifier characters will not be networked.

Other applications may require that the cursor pad keys, Break key and Back Tab key be disabled. When disabled, these keys will neither execute a command nor transmit a character sequence, but will sound the keyboard bell. To disable these keys, type the three characters MC Sp \.

Individual keys may be set to any of the different modes described above (Execute, Transmit, Execute and Transmit, Disable) through use of the Set Cursor Pad Keys command. If the key cannot be differentiated with respect to shifted, unshifted, control and control-shifted in the default state, it also cannot be differentiated through this command. The individual cursor key modes can be stored in NVM.

2.11.2 Keyboard Lock

The entire keyboard can be locked via the Keyboard Lock command. After it has been locked, the keyboard can only be unlocked through receipt of a keyboard unlock command on a communication line or by turning the terminal power off/on. The keyboard lock status will not be stored in NVM. If a key is pressed when the keyboard is locked, the keyboard bell will sound.

Figure 2-7

Cursor Key Pad - Transmission Mode Identifier Characters

KEY	Unshifted	Shifted	Control	Control-Shifted
MULT CODE	:	:	:	:
STAT/RESET	+	,	+	,
PRINT	{	|	}	~
PAGE	-	.	-	.
↑	;	;	;	;
TAPE	`	`	@	^
←	>	>	>	>
HOME	?	?	?	?
→	=	=	=	=
SCROLL	[	\	[	\
↓	<	<	<	<
TABSET/CLR	]	_	]	_

2.11.3 Keyboard Bell

A command is provided which disables the keyboard bell. This will not have any effect on the key click. The bell will be disabled for all commands which normally ring the bell. To disable the bell, type the three characters MC Sp b . Type the three characters MC Sp B to bring the bell back.

2.11.4 Related Commands

Chapter 3 Section	Command
3.12 Keyboard	Keyboard Lock
3.12 Keyboard	Keyboard Unlock
3.12 Keyboard	Keyboard Bell Enable
3.12 Keyboard	Keyboard Bell Disable
3.12 Keyboard	Set Cursor Pad to Transmit
3.12 Keyboard	Set Cursor Pad to Execute
3.12 Keyboard	Set Cursor Pad to Transmit & Execute
3.12 Keyboard	Disable Cursor Pad
3.12 Keyboard	Set Cursor Pad Keys-General

2.12 Programmable Message Characters

2.12.1 Usage

Terminal commands make use of a number of special characters. In order to provide the greatest flexibility and ease of use with a variety of computer and communications systems, these characters have been made user modifiable on the CONCEPT 108 terminals. These characters and their usage and default values are listed in Figure 2-8.

Different Command Introducer characters may be used for each device. See Section 2.13 - Multiple Attribute Lists - for a description of this capability. Message characters other than the Command Introducer apply to the entire terminal.

The Change Message Character command allows any of the above message characters to be changed. Entering a null (^@, ASCII Chart location 0) for any message character except for the delay character indicates that the message character is not to be used. Legal delay characters are all control codes (ASCII chart locations 0-31) and ASCII chart locations 123-127. Entering any other character indicates that the delay character is not to be defined.

2.12.2 Related Commands

Chapter 3 Section	Command
3.1 General	Change Message Character

Figure 2-8

Programmable Message Characters

Special Character	Usage	Default Values (Character, Control Code, ASCII Chart Location)
Command Introducer for Command Sequences (ESCAPE)	-Used to introduce all Command Sequences. -Precedes cursor pad keys when in Transmit mode.	ESC ^[27
Acknowledgement-terminal request completed (ACK)	Set Output Network Attach Printer Attach Tape	ACK ^F 6
Negative Acknowledgement - terminal request not completed (NAK)	Set Output Network Attach Printer Attach Tape	NAK ^U 21
Start of Message (SOM)	Block Transmit Commands and Read Commands - used to mark beginning of transmitted characters	Not Used
End of Field (EOF)	Block Transmit Commands - Used to mark end of field (unprotected group of characters). Also used in Function Routing.	ETB ^W 23
End of Line (EOL)	Block Transmit Commands - Used to mark the end of each line	CR ^M 13
End of Message (EOM)	Block Transmit Commands - Used to mark the end of message. Terminating character for Read commands and Transmit mode function keys.	CR ^M 13
Function Key Transmission Leadin (FKID)	Precedes the unique character used for each function key when in default Transmit mode.	FS ^\ 28

Figure 2-8 (contd).

Programmable Message Characters

Resume Transmission (XON)	Used both to restart suspended terminal output during a block transmit function execution (sent out by the host computer) or to restart terminal input if suspended via Buffer Overflow Control (sent out by the terminal).	DC1 ^Q 17
Suspend Transmission (XOFF)	Used both to suspend terminal output during block transmit function execution (sent out by the host computer) or to suspend terminal input via Buffer Overflow Control (sent out by the terminal).	DC3 ^S 19
Cursor Pad End of Message (CPEOM)	Follows the cursor pad keys when in Transmit mode	Not used
Delay Character - ignored (NULL)	A character which is ignored whenever it is encountered on a communications line. It may occur within command sequences without affecting the sequence. Used for timing.	Not used

2.13 Multiple Attribute Lists and Multiple Window Lists

2.13.1 Storage of Terminal Settings/Modes

Terminal settings and modes are stored in one of four different types of lists within the terminal. These lists are:

-Attribute Lists: Contain most mode and configuration settings. Figure 2-9 describes attribute list contents. Four different attribute lists may be defined (numbers 0-3). (See Figure 2-9 for attribute list contents.)

-Window Lists: Contain window related information as described in Figure 2-10. Four different window lists may be defined (numbers 0-3).

-Device Lists: These modes and configurations are stored for each device. Since there is one device list stored for each terminal device (keyboard and up to three communications lines), a maximum of four devices lists may be defined. To change any value, the appropriate command must be received on that device or be Function Routed to that device. Figure 2-11 lists the information stored in these lists.

-Terminal Wide List: All other mode settings and configurations apply to the entire terminal. They may be changed directly from any device. Figure 2-12 lists the information stored in this list.

Figure 2-9
Attribute List Contents

Command Introducer (Escape Character)
User/Programmer Mode
Text/Form Mode
Scroll/Page Mode
Transparent Mode On/Off
Auto-Wraparound On/Off
Auto-Tabs On/Off
Auto-Linefeed On/Off
Character Attribute Setting:
- Blink
- Reverse Video
- Half Bright
- Underline
- Non-Display
- Protection
- Character Set

Replace Character & Attribute/Character Only mode
Overstrike/Normal Mode (Selected through use of APL/ASCII Commands)

Figure 2-10
Window List Contents

Window Definition
Cursor Position
Start of Print/Transmit

Figure 2-11
Device List Contents

Attribute List Number
Window List Number
Insert Mode On/Off
Insert Type (Line/Window)
Output Network
Baud Rate
Parity
Stop Bits
CTS/RTS Protocol On/Off
Buffer Overflow Control On/Off
Parity Checking On Input On/Off

Figure 2-12
Terminal Wide List Contents

All Message Characters except for the Command Introducer (Escape)
Upper-Lower/Caps Lock
Remote/Local Mode
Character/Block Mode
Full/Half Duplex Mode
Text Tabs Settings
Clear Characteristics
Margin Bell Offset
Screen Normal/Reverse Video
Cursor Type - Underline / Reverse Video Block
Normal/Half Bright Protected Fields
Form Feed Prior to Print On/Off
Trailing Blank Suppression On/Off
Underline Transmission On/Off
Transmission Delay
Display Width - 80/132 Columns
Start of Screen
Latent Expression
Answerback Message
Memory Allocation
Keyboard Lock/Unlock
Keyboard Bell Enable/Disable
Cursor Pad Mode(s)
Form Feed to Clear Screen/Top of Page
ASCII Underline
Alert Line Displayable/Not Displayable
Programmable Function Keys
Keyboard Communication Line

Changed in V3 See App. G

2.13.2 Multiple Attribute List Usage

Four separate attribute lists may be defined (numbered 0-3). The terminal's default configuration has all devices using attribute list 0. A command is provided which lets a device select a specific attribute list (Attribute List Selection). Each list may be different from those used by other devices or a list may be shared by several devices.

There are two methods by which the contents of one device's attribute list can be changed through another device. The first is through use of the Function Routing command. The second method is to use the Select Attribute List command to select that attribute list; change the desired settings; and return to the original attribute list.

The ability to define multiple attribute lists can be used in two distinctly different ways:

- -The terminal can quickly and easily be changed to a completely different configuration and back again. For applications requiring this flexibility, the attribute lists would be set up one time and then the Attribute List Selection command would be used to switch between these lists.

- -Devices can be set up to use different attribute lists, thus allowing each device to have different mode settings, etc.

The user need not be concerned with these capabilities unless these types of functionality are required.

A second command is provided which copies a specified attribute list into the list used by the requesting device (Copy Attribute List). This command is useful for creating a list which is similar, but not identical, to a previously defined list.

2.13.3 Multiple Attribute List Example

Set up the terminal so that Line 1 uses attribute list 0 which is set to Programmer mode and the keyboard uses attribute list 1 which is set to User mode.

- -By default all devices use attribute list 0. Verify this by looking at the Keyboard and Line 1 Programmer Status Lines.

- -Set attribute list 0 to Programmer mode by typing the two characters MC U. Verify the change via the status lines.

- -Change the keyboard to attribute list 1 by using the Attribute List Selection command. Type the four characters MC Sp y !. The keyboard is now using attribute list 1 and Line 1 is using attribute list 0. Verify via the Programmer Status Lines.

- -Attribute list 1 still is set to the factory default which is User mode. Again, verify via the status lines (User and Programmer).

2.13.4 Multiple Cursors and Windows

Four separate windows may be defined (numbered 0-3). The terminal's default configuration has all devices using window 0. A command (Window Selection) is provided which lets a device select a specific window number. The window list selected for one device may be different than that used by other devices or a window list may be shared by several devices.

There are two ways to change a given device's window list through another device. The first is through the Function Routing command. A second method is to use the Select Window command to select that window list; change the window definition; and return to the original window list. When returned to the original window list, the cursor position will be the same as it was prior to the change.

As with attribute lists, the ability to define multiple windows and cursors can be used in two different ways:

- -The terminal can quickly and easily be changed between multiple window definitions.

- -Devices can be set up to use different windows.

The user need not be concerned with these capabilities unless this type of functionality is needed.

2.13.5 Multiple Cursors and Windows Example

Set up the terminal from the keyboard to have separate windows for the keyboard and for the main computer line. Make the keyboard's window be lines 0-95 and columns 0-39, and the computer's window be lines 0-95 and columns 40-79.

The keyboard's cursor (the one which is shown as either a blinking underline or a blinking block) must be visible at all times. This may come into play if you decide to set up another example with different window definitions.

- -All devices initially use window 0. Let this be the computers window. Define the window with a home position of 0,39 and 96 lines, 40 columns. Type the seven keys: MC v Sp G ^A Sp H

- -Set the keyboard window to window 1. To select window 1, type the four keys: MC Sp z !

- -Since all window definitions default to all of memory, define this window (window 1) with a home position of 0,0 and 96 lines, 40 columns. Type the seven keys: MC v Sp Sp ^A Sp H

- -Verify the correct window definitions via status lines. Type the status key to see the keyboard's window definition (displayed on the keyboard's User Status Line).

-Type the four keys MC / Sp ! to see the computer's window definition (displayed on the Line 1 User Status Line).

-Verify that the devices are using the correct window numbers via the status lines. Type the four keys MC / ! Sp to see the keyboard's window number (displayed on the keyboard's Programmer Status Line - for location see Figure 2-2). Type the four keys MC / ! ! to see the computer's window number (displayed on the Line 1 Programmer Status Line).

2.13.6 Related Commands

Chapter 3 Section	Command
3.1 General	Attribute List Selection
3.1 General	Copy Attribute List
3.1 General	Window Selection
3.11 Screen Control	Define Window

2.14 Using the Printer and Tape Ports

2.14.1 Printer Port

The CONCEPT terminal's second communication line (Line 2) is often used as an RS232 serial printer port for selective printing of characters that have been transmitted to the terminal. A keyboard key labelled PRINT can be used to perform a number of different printing operations:

PRINT: Prints (sends to Line 2) all characters in the current window from the home position up to but not including the cursor position. If the cursor is at the home position, the entire window will be printed. A Start of Print can be defined by positioning the cursor at the desired starting position and typing the two characters MC 1. After this the cursor should be returned to the correct ending position. Any control codes stored in the window are printed as spaces. If Form Feed Prior to Print is set (default) a Form Feed (^L, ASCII chart location 12) will be sent to the printer prior to execution of this command.

SHIFT-PRINT: (Executed by pressing the PRINT key while holding down the shift key) Prints all the characters in the current line from the beginning of the line up to but not including the cursor position. If the cursor is at the beginning of the line, the entire line is printed. Any control codes stored in the line are printed as spaces. If Form Feed Prior to Print is set (default), a Form Feed (^L, ASCII chart location 12) will be sent to the printer prior to execution of this command.

CONTROL-PRINT: (Executed by pressing the PRINT key while holding down the CTRL key) Attachs the printer port so that any characters which are sent to the display are also printed.

CONTROL-SHIFT-PRINT: (Executed by pressing the PRINT key while holding down the CTRL and SHIFT keys) Detachs the printer port so that displayed characters are not printed.

The communications interfacing requirements for the Printer Port are described in Appendix C. In order to have the best likelihood for direct compatibility with printers, the signal lines for the printer port are reversed from those on the main communications line.

If the keyboard bell should ring when executing any of the above commands, a control signal (Clear-to-Send) required by the printer port has not been received. First, check that the interface cabling is correct. Second, check whether the printer can provide the required Clear-to-Send signal. If not, the requirement for this signal can be turned off through use of the CTS/RTS Protocol Off command. To execute this command from the keyboard, with the terminal in Programmer mode, Function Route the required command to the printer port by typing the seven characters: MC Q " MC Sp v ^W.

For permanent reconfiguration, save the configuration in NVM by typing the three characters: MC Sp S.

If the terminal receives an XOFF programmable message character (default ^S, ASCII chart location 19) from the printer during the execution of either the Print Line or Print Window commands, the print operation will be suspended. This operation will be resumed when the XON programmable message character (default ^Q, ASCII chart location 17) is received. Thus, printers with this type of buffer overflow control are supported. The XON and XOFF characters can be changed via the Change Message Character command.

The CTS/RTS Protocol can also be used to control the printing operation. The print command will suspend printing if this protocol is enabled and the Clear-to-Send signal is not found.

2.14.2 Tape Port

The CONCEPT terminal's third communication line (Line 3) is often used as an RS-232 serial tape or floppy disk port for interfacing with this type of equipment. A key labelled TAPE can be used to perform a number of different operations:

TAPE: Sends to Line 3 all characters in the current window from the home position up to but not including the current cursor position. If the cursor is at the home position, the entire window will be transmitted. A Start of Transmit can be defined as described in Section 2.14.1.

CONTROL-TAPE: (Executed by pressing the TAPE key while holding down the CTRL key) Attachs the tape port so that any characters which are sent to the display are also transmitted to the tape port.

CONTROL-SHIFT-TAPE: (Executed by pressing the TAPE key while holding down the CTRL and SHIFT keys) Detachs the tape port so that displayed characters are not transmitted to the tape port.

As with the printer port, the communications interfacing requirements for the tape port are described in Appendix C. The signal lines for the tape port are exactly the same as those on the main communications line.

If the keyboard bell should ring when executing any of the above commands, a control signal (Clear-to-Send) required by the tape port has not been received. First, check that the interface cabling is correct. Second, check whether the floppy disk/tape can provide the required Clear-to-Send signal. If not, the requirement for this signal can be turned off through use of the CTS/RTS Protocol Off command. To execute this command from the keyboard (with the terminal in Programmer mode)

Function Route the required command to the tape port by typing the seven characters: MC Q # MC Sp v ^W.

For permanent reconfiguration, save the configuration in NVM by typing the three characters MC Sp S.

The same capabilities as found on the printer port using the XON and XOFF programmable message characters and the CTS/RTS Protocol for control of output are available for the tape port.

2.14.3 The Shared Printer Interface (SPI)

The CONCEPT Shared Printer Interface (SPI) is a separate peripheral device that enables computer users to extract additional cost/performance benefits from their peripheral equipment by sharing multiple CONCEPT 100 and APL series display terminals with a single printer or auxiliary device. In fact, the SPI can be used with any communications device for the purpose of sharing another device as long as the first device can supply a Request-to-Send RS-232 control signal when access to the shared device is desired.

Each Shared Printer Interface can accept from one to four inputs (CONCEPT terminals) and issues a single output -- either to a printer or to another SPI. In this way, multiple SPIs may be cascaded to allow more than four terminals to share a single device.

Note that when using an SPI, the CTS/RTS Protocol must be on for Line 2.

2.14.4 Related Commands

Chapter 3 Section	Command
3.8 Multiple Devices	All Commands

2.15 Full Screen Applications Functionality

Full Screen Applications are those applications which display an entire screen's worth of characters/data and allow the user to interact with this display as desired. These applications generally fall into two categories:

Text Editing/Word Processing Applications - The screen displays a selected number of lines of the current document. The user then can make changes directly to the displayed characters. Characters can be changed, inserted or deleted, sentences can be moved/modified and lines can be added, etc. In general, the modified document is immediately displayed on the screen.

Data Entry/Retrieval Applications - In these applications, the user is entering, editing or searching for specific data. A form is placed on the screen and user data are entered into specific areas. The user can move to any of these areas and make corrections. As with Text Editing Applications, changes in the data are immediately reflected on the screen.

2.15.1 Placing Data on the Screen

Current development of Full Screen Applications for both text editing and data entry/retrieval use three different techniques for placing data on the screen and interfacing with the host computer. This section is not intended to be a discussion of the pros and cons of these techniques -- the CONCEPT 108 terminal provides significant functionality which supports the development of applications using the technique of the user's choice. The three options can be briefly described as follows:

Full Duplex Conversational - In these applications, the host maintains complete control over the display. Characters that are entered from the keyboard are transmitted and not displayed. Instead, the host computer echos the characters back to the terminal while maintaining the applications data files. Commands usually consist of sequences of special characters (such as control codes or escape sequences). The host has the ability to prevent the placement of data in specific areas of the screen and to prevent the execution of unauthorized commands. These applications are most often developed on Full Duplex computers such as those manufactured by Digital Equipment Corporation and Data General.

Half Duplex Conversational - In these applications the user has control over the characters that are displayed on the screen. The host monitors all actions and typed characters and performs any necessary file maintenance. Commands consist of sequences of special characters (such as control codes or escape sequences). The user has the ability to place data anywhere on the screen. However, the host maintains control over unauthorized command execution. These applications are

most often developed on Half Duplex computers such as those manufactered by IBM and Univac.

Block Transmission - In these applications, the user has control over the characters that are displayed on the screen. In general the host computer does not know what actions or characters are being typed. When data/character entry and editing are complete, the host computer is notified and the screen contents are read. As with the other systems, commands consist of sequences of special characters. However, more flexibility in selection of these characters is available as communication to the host computer consists only of commands. Data/characters are transmitted to the host computer only when requested. Typically, some commands may be executed locally by the user while other commands are requested through the host computer. These applications can be developed on both Full and Half Duplex computers. On Full Duplex Systems, the terminal must be configured so that when characters are being transmitted to the host computer, the echoed characters do not damage the display contents or interfere with the block transmission process.

The remainder of this section describes these capabilities and indicates which techniques are likely to make use of them.

2.15.2 Commonly Used Functionality

The following CONCEPT 108 terminal capabilities are often used in Full Screen Applications.

Windows - Windows can be used in all types of Full Screen Applications for selection of a specific area of display memory. Windows can also be used as a form of 'super-protection' for areas of display memory.

Multiple Pages of Memory - Four and eight pages of memory can be used in all types of Full Screen Applications. Examples include: slow speed Data Entry/Retrieval Applications where screen formats are put up one time and selecting the appropriate format is accomplished via windows; and a text editing system where a full page of text is to be edited at one time.

Function Keys - Function keys can be used in all types of Full Screen Applications to send data or to perform commands. In Full Duplex conversational applications and some Half Duplex conversational applications, these keys can be programmed in Transmit mode to send the desired commands. When pressed these keys will transmit the programmed characters to the host computer. Other applications make use of the function keys in Execute mode for either executing commands (such as defining a window) or in Transmit mode for transmitting a command to the host computer.

Editing Commands - Extensive editing commands (insert, delete, clear etc.) are provided as described below. Editing commands can be executed both from the keyboard and from communication lines. Half Duplex Conversational and Block Transmission applications would make use of these commands from the keyboard, while Full Duplex conversational applications would make use of these commands from the communications lines.

Block Transmission Capabilities - An extensive group of block transmission commands are provided as described below. These commands are used in Block Transmission Applications to transmit any specified portion of the display memory to the host computer.

Cursor Controls - These commands allow the application to place characters at specified locations in display memory and also to be able to determine (Read) the current cursor position. This is important for all types of Full Screen Applications.

Protection - As described earlier, individual characters within display memory can be set to 'protected'. When the terminal is in User mode, characters cannot be typed into protected areas. Additionally, several block transmision commands are provided which will only transmit unprotected portions of display memory. Additional commands are provided which clear only unprotected areas of display memory. Protection is often used for data entry/retrieval Block Transmission Applications to define fields for data entry. The protected areas of the screen are used to store fixed data and the screen format. Protection may also be used in Half Duplex Conversational Applications to prevent data entry in certain areas of memory.

Cursor Pad Keys - Cursor pad keys can be configured so that they execute locally (Block Transmission Applications), transmit unique character sequences (Full Duplex Conversational Applications) or both execute and transmit (Half Duplex Conversational Applications). If more host computer system control is required, the entire cursor pad or individual cursor pad keys can be disabled.

Line Drawing - Forms can be drawn on the display using characters that are standard with the terminal. Commands are provided which minimize the number of characters required to generate a form. Characters and commands are described in more detail in Section 2.16.

Character Attributes - The character attributes described earlier can be used to effectively highlight or select characters within display memory.

Programmable Message Characters - These characters (particularly the EOF, EOL and EOM) are used in Block Transmission

Applications to allow the application to be adapted to the requirements of the host computer system while providing the necessary delimiter characters.

Create Screen - A command is provided (Create Screen) which transmits to the host computer the character sequences which would exactly recreate the current window including all characters, character attributes and line drawing characters. Thus, in the development of a forms application, the data entry format can be created locally and, when correct, the characters needed to create that format can be transmitted to the host computer or an auxiliary storage device.

2.15.3 Modes of Operation

Character/Block Mode - In Character mode, characters are transmitted to the host computer as they are typed on the keyboard. In Block mode, characters are displayed and not transmitted to the host computer. Character mode would be used by Half or Full Duplex Conversational Applications, while Block mode is used for Block Transmission Applications.

Text/Form Mode - These two modes configure the terminal for use by either Text Editing or Form/Data Entry Retrieval Applications. Selecting Text mode automatically selects Scroll mode (see below), selects typewriter tabs (specific columns), and the transmit line command causes all unprotected data on the line to be transmitted. Selecting Form mode automatically selects Page mode (see below), form tabs (next unprotected area) and performs a field transmit when the Transmit Line command is executed. Form mode prevents execution of editing functions which would cause a line of data to move on the display (Insert and Delete Line). See Chapter 3 for detailed explanations of these commands.

Scroll/Page Mode - In Scroll mode, on bottom line overflow, all data in the window are scrolled up one line (the top line is lost). In Page mode, on bottom line overflow, display memory will not scroll, and the bottom line will be overwritten. Page mode is usually used in Block Transmission Applications while scroll mode is used for conversational applications. See Chapter 3 for detailed explanations of these commands.

2.15.4 Editing Data on the Screen

The following Editing commands are provided:

-Insert Character Mode (Line or Window)
-Delete Character (Line, Field or Window)
-Insert Line
-Delete Line
-Clear to End of Field, End of Line, End of Window

The editing commands may be executed from the keyboard (they are preprogrammed onto the first four function keys) or from any communication line.

Initially, display memory is cleared to 'blanks' (space characters with the nondisplay attribute on). The Insert and Delete Character commands will terminate when a blank is encountered. Although this feature is useful in many types of applications, those applications making extensive use of cursor positioning commands may end up with blanks sprinkled throughout memory. To avoid this problem, a command is provided which allows the user to define the clear character and attributes. Using this command, the default memory can be changed from blanks (untyped) to space characters with the nondisplay attribute off (typed). The clear character and attributes may be stored in NVM.

The individual commands are discussed in detail in Chapter 3.

2.15.5 Block Transmission of Data

Four commands are provided which allow block transmission of any selected portion of display memory. These commands are:

- -Transmit Line/Field
- -Transmit Window
- -Transmit All Line/Field
- -Transmit All Window

The commands above which are not labelled 'all' will transmit unprotected characters only, while those which are labelled 'all' will transmit both protected and unprotected characters. If the protection character attribute is not used, either command can be selected.

When the terminal is in Text mode, commands transmit from the beginning of Line/Window up to but not including the cursor position. If the cursor is at the beginning of the line/ window, the entire line/window is transmitted. In addition, a command is provided which sets the position for start of transmit (Start of Print/Transmit). If this position has been specified, transmission of a window will occur from that position up to but not including the cursor position. In Form mode, similar operations are performed but are applied to fields (unprotected areas of display memory). See Chapter 3 for details.

Many host computer systems are configured to transmit a control character (XOFF) to the terminal if data input buffers to that system are nearly full. On these systems, a second character (XON) is transmitted when their input buffers have been sufficiently emptied. The CONCEPT 108/APL8 terminals support this protocol. If an XOFF programmable message character (default ^S) is received during execution of a block transmit command, that command will be suspended. Transmission will resume when an XON programmable message character (default ^Q) is received.

Additionally, the terminal can be configured to support a Clear-To-Send protocol for transmission. In order to use this feature, modem controls must be provided on the communications equipment which is attached directly to the terminal. Under this protocol, data will not be transmitted to the host system unless a 'Clear-To-Send' signal is received from the communications hardware. This type of capability is generally available on Half Duplex modems and is not available through acoustic couplers. Once the terminal has been configured for the CTS-RTS protocol, no additional user interface is required. The protocol is handled through the hardware. The default configuration has this protocol turned off for Line 1 and turned on for Lines 2 and 3.

For systems/hardware which does not support the CTS/RTS protocol, the Set Transmission Delay command may be useful. The user can set a specified delay prior to execution of block transmission or other Read commands (Read Cursor, Attributes, Status, etc.). This delay should be set to be long enough to give half duplex systems adequate time to prepare for input.

Additional commands (Underline Transmit On/Off and Trailing Blank Suppress On/Off) are provided which allow the user to specify whether trailing blanks are suppressed during block transmission and whether underlines are to be transmitted.

Block transmission commands may be executed from the keyboard either via MULT CODE sequences or through use of the SEND key or from any communication line.

2.16 Graphics (Forms, Curve Approximation and Optional Character Set)

2.16.1 General

All graphical capabilities of the CONCEPT 108/APL8 terminals are derived from the use of special graphics characters in standard or optional character sets.

2.16.2 Line Drawing (Forms)

Twelve special line drawing characters are included within the standard ASCII character set. These characters include single, double, triple and spread double horizontal and vertical lines and are located in ASCII chart locations 0-11 (^@ through ^J).

The above characters are displayable when the terminal is in Transparent mode. In addition, two commands (Repeat Character Horizontal and Vertical) are available which are used to draw horizontal and vertical lines of arbitrary length into display memory. These commands do not require that the terminal be in Transparent mode when drawing control codes. In addition to line drawing, these commands can be used to generate strings of arbitrary length of any character.

Examples:

- -Draw a vertical double line of length 10. Position the cursor at the top of the desired line and (with the terminal in Programmer mode) type the four characters MC R ^C *.

- -Draw a horizontal spread line of length 20. Position the cursor at the left side of the desired line and (with the terminal in Programmer mode) type the four characters MC r ^D 4.

2.16.3 Continuous Curve Approximation

Twelve continuous curve approximation characters are included within the standard ASCII character set. These characters connect the bottom, middle and top of the left side of the character cell to all combinations on the opposite side. They are located in ASCII chart locations 16-27 (^P through ^[ ).

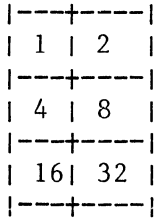
Additional software is not provided with the CONCEPT terminals for use of these characters.

2.16.4 Graphics Character Set (Optional)

The Graphics Character Set divides the character cell into 6 subcells (3 rows by 2 columns) and presents all combinations of these subcells. With this character set, the screen resolution is increased to 72 x 160. A layout of the character set is included in Appendix A. This character

set is typically used for screen shading, bar charts and banner characters.

A simple algorithm can be used to determine the location of any character within this character set. Give the following weights to each position in the character cell:



The location of the character containing a given set of subcells is equal to 64 plus the sum of the selected weights or:

Character Location = 64 + Sum of Weights

ASCII chart location 127 contains all subcells. Since this location is a control code (and thus only displayable in Transparent mode or through use of repeat character generation), the character is repeated in location 63. An algorithm which takes this into account is:

Character Location = 63 + MODULUS(1 + Sum of Weights , 64)

2.16.5 Additional Capabilities

Since the CONCEPT 108/APL8 terminals can support up to 4 separate character sets, users can design their own special character sets (in hardware). These character sets can be stored in a commercially available EPROM. Once inserted into the terminal circuit board, these character sets are available via the Select Character Set command. Appendix A.4 describes this capability in detail.

2.16.6 Related Commands

Chapter 3 Section	Command
3.7 Display	Repeat Char. Horizontal
3.7 Display	Repeat Character Vertical
3.4 Mode Setting	Transparent Mode
3.7 Display	Select Character Set

2.17 Split Speed Option

The split speed option on the CONCEPT terminal allows for the independent setting of baud rates on the transmit and receive lines of the main communications interface (Line 1). The baud rate specified for Line 1 sets the rate for the 'receive' line, while the baud rate specified for Line 2 sets the rate for the 'transmit' line. The other communications parameters - parity and stop bits - are set at normal for Line 1 and apply both to 'receive' and 'transmit'.

In order to change the baud rate, the Set Baud Rate command (MC 0 baud) must be executed. The receive baud rate can be set normally for Line 1, while the transmit baud rate must be function-routed through Line 2.

For example, to configure the terminal to receive at 9600 baud and transmit at 1200 baud, the following sequences would be typed at the keyboard:

MC U	Programmer mode on
MC 0 .	Set Receive baud rate to 9600 baud
MC Q " MC 0 ' ^W	Set Transmit baud rate to 1200 baud by function routing to line 2 (MC Q ") the baud rate command (MC 0 ')

The same actual baud rate must be used both for the transmit rate on Line 1 and both the transmit and receive rates for Line 2, if it is present.

2.17.1 Related Commands

Chapter 3 Section	Command
3.10 Communications	Set Baud Rate
3.8 Multiple Devices	Function Route

Chapter 3

Command Reference

This chapter presents a complete list and functional description of all CONCEPT 108 terminal commands. Terminal commands are either control codes or command sequences. Control codes are generated from the keyboard by pressing the control key (CTRL) while simultaneously pressing another key. Command sequences are generated from the keyboard by typing the MULT CODE key followed by a one- or two- character command identifier and any required input parameters. Command sequences from the communication line(s) replace the MULT CODE key with the Command Introducer message character (default - escape control code, ^[, ASCII chart location 27).

Commonly used commands such as cursor controls, print, and editing commands have special keys (for example, HOME, PRINT, INSRT) which, when pressed, generate the required control code or command sequence. These commands can be executed either by pressing the special key or by typing the required control code/command sequence.

Each command is presented first with a one-line summary that corresponds to the entry on the Concept 108 Reference Card (DN 1300-8104-1). The columns are:

1. Command Name/Description

2. Special Key - 'k' indicates unshifted key; 'K' indicates shifted key; '^k' indicates control unshifted keys; '^K' indicates control shifted key; blank indicates no special key exists.

3. Programmer/User Mode - 'P' indicates that the command is executable only in Programmer mode; blank indicates that it is executable either in Programmer or User mode.

4. Command Applicability - 'W' indicates a command which utilizes or affects the window number in use; 'A' indicates a command which utilizes or affects the attribute list in use; 'D' indicates a command which applies only to the device that issued the command; 'T' indicates a command which applies to the terminal as a whole.

5. Command Sequence - 'MC' indicates a command sequence which must be preceded by typing the MULT CODE key from the keyboard or transmitting the Command Introducer character from the communications line (default is the ASCII escape character - ASCII chart location 27). The one- or two- character command identifier is listed next. If two characters are required, they are shown separated by commas; however, no separator should be used when executing the commands. Note: 'Sp' indicates the space character (ASCII chart location 32); 'rub' indicates the rubout character (ASCII chart location 127); and '^' indicates a control code (ASCII chart locations 0-31).

6. Command Identifier - The location of each command identifier in the ASCII chart is listed. The ASCII character/code chart, quite useful when programming, is included in Appendix A and on the reverse side of the Reference Card.

7. Required Input Parameters - Each input parameter is listed, separated by commas. Parameters are one or two characters (keystrokes) in length. When multiple parameters are required, no separator is used between parameters. The required format is discussed separately below the command description.

1	2	3	4	5	6	7
Self Test			T	MC Sp,?	32,63	test

Performs the self test(s) indicated by the parameter 'test'. If all requested tests are successful, the message NO ERROR will be displayed on the Alert Line; otherwise, the appropriate error code(s) will be displayed:

1	Program ROM #1
2	Program ROM #2
3	Program ROM #3
4	Program ROM #4
5	Display Memory (RAM)
6	Non-volatile Memory (NVM)
7	Communications Characters
8	Communications Controls

The user has the option of requesting a 'loop until failure' test. If this has been requested the desired tests will be repeated until an error is detected or the command is terminated by a RESET; no messages will be displayed on the Alert Line during the test.

Input Parameter:

'test' - The self test(s) to be performed. The single character used to identify a test is the character whose position in the ASCII chart is equal to 64 plus the value of the desired tests. 'test' values are as follows:

1	Program ROM Test
2	Non-volatile Memory (NVM) Test
4	Display Memory (RAM) Test
8	Communications Characters Test
16	Communications Control Test
32	Loop until Failure

NOTE: a loop-back connector is required for the two communications tests. This connector should have pin 2 connected to pin 3, and pin 4 connected to pin 5.

Example:

To test RAM and ROM, type the four characters: MC Sp ? E.

Reset	K		MC ,	44	

Resets the terminal, as follows:

- Suspends all executing functions
- Clears all input/output communications buffers
- Resets all function keys to default modes
- Performs an NVM self test
- Clears display memory to spaces with the nondisplay attribute set
- Homes all cursors in all windows
- Clears the programmable Alert Line Status Message
- Resets all other variables/modes to the values stored in nonvolatile memory

When complete, the Latent Expression (if any) is executed as though the execution were requested by the keyboard.

If the NVM self test fails, the terminal will attempt to reset NVM to the factory default settings. If successful, the message 'Non-volatile Memory Successfully Reset' will be displayed on the Alert Line; if not, an NVM self test error (6) will be indicated.

Change Message Character		P	TA	MC o	111	mess,char

Changes the programmable message character specified by 'mess' to the new value 'char'. A separate escape character (ESC) applies to each device in the terminal. All other message characters apply to all devices. The negative acknowledgement (NAK) for requests from the keyboard is not changeable and is the bell code (^G).

Setting any of the following message characters to a NUL (^@, ASCII chart location 0) will cause them not to be used: ACK,NAK,SOM,EOF, EOL,EOM,FKID,CPEOM.

The programmable delay character will not be used if an invalid character is specified for 'char'. Invalid programmable delay characters are ASCII chart locations 32-123.

Input Parameters:

'mess' - The message character to be changed:

ESC = Sp (ASCII chart location 32)	EOM = & (38)
ACK = ! (33)	FKID = ' (39)
NAK = " (34)	XON = ((40)
SOM = # (35)	XOFF =) (41)
EOF = $ (36)	CPEOM = * (42)
EOL = % (37)	DLY = + (43)

'char' - the new value for the message character

Example:

To cause the ACK character not to be used, type the four characters: MC o ! ^@.

To change the delay character to be a rubout, type the four characters: MC o + rub.

Attribute List Selection		P	DA	MC Sp,y	32,121	n	Changed in V3 See App. G

Changes the Attribute List number to 'n' for the requesting device. By selecting a new Attribute List all of the device attributes specified in Figure 2-9 are set to the values specified in the new list and thus may be changed.

Input Parameters:

'n' specifies the Attribute List to use:

Attribute List 0 = Sp (ASCII chart location 32)
Attribute List 1 = ! (33)
Attribute List 2 = " (34)
Attribute List 3 = # (35)

Example:

To select Attribute List 1, type the four characters: MC Sp y !.

Copy Attribute List		P	DA	MC Sp,Y	32,89	n

Copies the entire contents of Attribute List 'n' into the Attribute List currently being used by the requesting device. As with the Attribute List Selection command above, all of the device attributes specified in Figure 2-9 are set to the values specified in list 'n' and thus may be changed.

Input Parameters

'n' - specifies the Attribute List number to be copied. See Attribute List Selection command above for valid values of 'n'.

Example:

To switch to using Attribute List 1 (see Attribute List Selection command) and copy the contents of Attribute List 0, type the eight characters: MC Sp y ! MC Sp Y Sp.

Window Selection		P	D	MC Sp,z	32,122	n

Changes the Window List number to 'n' for the requesting device. By selecting a new Window List number the window definition, cursor position, and Start of Print/Transmit will be changed.

Input Parameter:

Window List 0 = Sp (ASCII chart location 32)
Window List 1 = ! (33)
Window List 2 = " (34)
Window List 3 = # (35)

Example:

To select Window List 1, type the four characters: MC Sp z !.

3.2 APL/ASCII Commands

1	2	3	4	5	6	7
APL Mode			A	MC 0	48	

Selects APL mode, APL character set (number 3) and Overstrike mode.

1	2	3	4	5	6	7
APL Mode - ALternate			A	^N	14	

Selects APL mode, APL character set (number 3) and Overstrike mode.

NOTE: This command will also be networked according to the output network specification of the input device.

1	2	3	4	5	6	7
ASCII Mode			A	MC)	41	

Selects ASCII mode, ASCII character Set (number 0), and Non-overstrike mode.

1	2	3	4	5	6	7
ASCII Mode - Alternate			A	^O	15	

Selects ASCII mode, ASCII character set (number 0), and Non-overstrike mode.

NOTE: This command will also be networked according to the output network specification of the input device.

3.3 Status Information Commands

1	2	3	4	5	6	7
User Status	k		T	MC +	43	

Displays the User Status Line for the keyboard. If any Status Line or the Alert Line is already displayed, this command displays a blank line or the Background Status Line, if defined (see below).

Scroll Status Lines Forward			T	MC Sp,d	32,100	

Causes the next Status Line to be displayed. The order of display of the lines is:

User Status Line - Keyboard
User Status Line - Line 1
User Status Line - Line 2
User Status Line - Line 3
Programmer Status Line - Keyboard
Programmer Status Line - Line 1
Programmer Status Line - Line 2
Programmer Status Line - Line 3
Tabs Settings Line
Message Characters - Keyboard
Message Characters - Line 1
Message Characters - Line 2
Message Characters - Line 3
Alert Line

Scroll Status Lines Backward			T	MC Sp,D	32,68	

Causes the previous Status Line to be displayed. The order of the Status Lines is defined in the Scroll Status Lines Forward command.

Display/Transmit Status		W	MC /	47	sline,dev

Displays or transmits the requested status line for the specified device. If this command is received from the keyboard the line will be displayed on the 25th line of the display. If it is received on a communication line, it will be transmitted to that line. The data transmitted are always 132 characters long and are preceded by the SOM message character (if defined) and terminated by the EOM message character (if defined). Appendix F presents the contents of the data transmitted.

While a status line transmission is in progress, the currently displayed status line will be removed and any new status line display requests will be ignored. Any other status line transmission requests will be suspended until the currently executing one is complete. When the transmission is finished the original status line will be re-displayed.

Input Parameters:

'sline' - The status line to be displayed/transmitted, as follows:

User = Sp (ASCII chart location 32)
Programmer = ! (33)
Tabs Settings = " (34)
Message Characters = # (35)
Alert Line = $ (36)

'dev' - The device whose status is to be displayed/transmitted, as follows:

Keyboard = Sp (ASCII chart location 32)
Line 1 = ! (33)
Line 2 = " (34)
Line 3 = # (35)

Note that although the Tabs Settings and Alert Lines are not device dependent, the 'dev' parameter must be inputted (use a space).

If an illegal value for 'dev' is read, the status for the requesting device is displayed/transmitted. In this way, a remote computer can always determine over what line it is physically communicating. Use a rubout (ASCII chart location 127), for example.

Example:

To display the Programmer Status Line for the keyboard, type the four characters: MC / Sp !.

To display the Tabs Setting Status Line, type the four characters: MC / " Sp.

To transmit the Programmer Status Line for Line 2 to a program, transmit from the program the four characters: ESC / ! ".

To transmit the Programmer Status Line to a program, when the program need not know which physical communication line it is running on, transmit from the program the four characters: ESC / ! rub.

Status Line Display Off			T	MC Sp,.	32,46	

Sets the Status Line to a blank line or the Background Status Line, if defined (see below).

Set Alert Line Message		P	T	MC Sp,*	32,42	del,msg,del

Sets the Alert Line message to 'msg', causing the Alert Line to be displayed.

Input Parameters:

'del' - A delimiter character which is used in pairs to mark the beginning and ending of a message. This may be any character, but it must be different than every intervening character in the message.

'msg' - The status message. Maximum length is 40 characters. All control codes and rubouts will be displayed as though the terminal was in Transparent mode.

Example:

To display the message 'Please logoff now' from a computer program, transmit the following 22 characters: ESC Sp * / P l e a s e Sp l o g o f f Sp n o w /.

Alert Line Displayable		P	T	MC Sp,G	32,71	

Allows the Alert Line to be displayed automatically when any of the following occurs:

- Keyboard locked
- Alert line message set
- Function keys displayed
- Self test executed
- Self test error detected during power-up/reset

Example:

If a program is running which often locks and unlocks the keyboard, it may be undersirable to have the LOCK message and Alert Line 'flashing'. To prevent the automatic display, transmit from the program the three characters: ESC Sp g.

Alert Line Not Displayable		P	T	MC Sp,g	32,103	

Prevents the Alert Line from being displayed automatically when any of the above occurs.

Set Background Status Line		P	T	MC Sp,;	32,59	n

Sets the Background Status Line to the current cursor line in window 'n'. When a Status Line or Alert Line has not been requested or a Status Line Display Off has been issued, this line will be displayed as the 25th line. If the contents of the specified line is changed (via scrolling or character input, for example), then the data displayed as the Background Status Line will also change.

Note that the line to be displayed is based on the current cursor position in window 'n' at the time this command is issued. A different line can be displayed by moving the cursor in window 'n' and re-issuing the command.

Input Parameter:

'n' - The window number whose cursor position is to be used as the source for the Background Status Line, as follows:

```
Window List 0 = Sp (ASCII chart location 32)
Window List 1 = ! (33)
Window List 2 = " (34)
Window List 3 = # (35)
```

Specifying an illegal value for 'n' (other than those listed above) will return the Background Status Line to the default condition of a blank line. For example, MC Sp ; rub will return the Background Status Line to a blank line.

Example:

Assume you wish to always display the contents of Window 1 on the 25th line. Window 1 will be used by programs as a 'help' window, and presents a one-line summary of the program being executed. First, select and define Window 1 as a one-line window at the end of display memory (home position of 95,0, 1 line by 80 columns, assuming a 4-page terminal); then type the following 10 characters: MC Sp z ! MC v rub Sp ! p. Then specify that the Background Status Line is the current line in Window 1; and type the four characters: MC Sp ; !. Programs that wanted to display a help message could then select Window 1, transmit the message, and return to Window 0.

3.4 Mode Setting Commands

1	2	3	4	5	6	7
User			A	MC u	117	

Selects User mode, preventing execution of certain terminal commands (those marked with a capital 'P' in column 3).

If the user attempts to type in a protected area of the screen while in User mode, the keyboard bell will sound.

Programmer			A	MC U	85	

Selects Programmer mode, allowing execution of all terminal commands and typing in both protected and unprotected areas.

Text		P	A	MC f	102	

Selects Text mode, and automatically selects Scroll mode (MC s). Tab (Back Tab) executes a typewriter tab to the next (previous) tab stop. Also affects block transmission commands and Insert/Delete Line (see below). See Scroll below for the effects of selecting Scroll mode.

Form		P	A	MC F	70	

Selects Form mode and automatically selects Page mode (MC S). Tab (Back Tab) executes a form tab to the next (previous) unprotected field. Also affects block transmission commands and Insert/Delete Line (see below). See Page below for the effects of selecting Page mode.

Scroll		P	A	MC s	115

Selects Scroll mode. When a Linefeed is performed in the bottom line of the window, all data in the window are 'scrolled' up one line (the top line is lost) and the bottom line is cleared. When a Reverse Linefeed is performed in the top line of the window, all data in the window are 'scrolled' down one line (the bottom line is lost) and the top line is cleared.

The top or bottom line is cleared to the clear character using the clear attribute (default - space with the nondisplay attribute set).

NOTE: See the discussion at the beginning of Section 3.6, Editing Commands, for the processing associated with clearing a line of data.

Page		P	A	MC S	83

Selects Page mode. Display memory and cursor remain in place both when a Linefeed is executed in the bottom line of a window or a Reverse Linefeed is executed in the top line of the window. Bottom/top line data are therefore overwritten; thus, Linefeed and Reverse Linefeed are not executed.

Character			T	MC 7	55

Selects Character mode. If in Remote mode, characters are transmitted as they are typed on the keyboard to the keyboard's communication line (default - Line 1). If in Local mode, this mode has no effect. See Section 2.7.

Block			T	MC &	38

Selects Block mode. Characters typed on the keyboard are displayed but not transmitted. If in Local mode, this command has no effect. See Section 2.7.

Upper/Lower Case		T	MC 5	53	

Selects Upper/Lower Case mode, displaying the full upper-lower character set. Applies to the keyboard only, regardless of the device issuing the command.

Caps Lock		T	MC %	37	

Selects Caps Lock mode, which converts lower case characters to their upper case form. Characters received from the keyboard are converted prior to their being displayed and/or transmitted. Command Identifiers and parameters are NOT converted to the upper case form. Applies to the keyboard only, regardless of the device issuing the command.

Characters in ASCII chart locations 97 through 122 (a-z) are converted to locations 65 through 90 (A-Z).

Full Duplex		T	MC 8	56	

Selects Full Duplex mode. If in Remote mode, characters typed on the keyboard are transmitted to the keyboard's communication line (default - Line 1) but not displayed. If in Local mode, this command has no effect. See Section 2.7.

Half Duplex		T	MC *	42	

Selects Half Duplex mode. If in Remote mode, characters typed on the keyboard are transmitted to the keyboard's communication line (default - Line 1) and 'echoed' to the display. If in Local mode, this command has no effect. See Section 2.7.

Remote		T	MC 9	57	

Selects Remote mode. Characters typed on the keyboard are transmitted on the keyboard's communication line (default - Line 1) and, if in half duplex, 'echoed' to the display. Characters from the keyboard's communication line are sent to the display. See Section 2.7.

Local			T	MC (	40	

Selects Local mode. Characters typed on the keyboard are sent to the display only. Characters are not sent to the keyboard's communication line. Characters received from the keyboard's communication line are not displayed on the screen. Command sequences, though, are processed. See Section 2.7.

Transparent Mode Off			A	MC t	116	

Selects normal handling of control codes.

Transparent Mode On		P	A	MC T	84	

Selects Transparent mode. Control codes are treated as normal characters appearing in their display representation shown in Appendix A. The only exception is the ESC t sequence which will reset Transparent mode. Command introducer characters are not displayed until the following character is received. Control code display representations can also be generated through use of the repeat character generation commands.

Auto Wraparound Off		P	A	MC Sp,w	32,119	

Prevents automatic wraparound when a window boundary is reached for the following commands:

- 'Normal' character input
- Cursor up/down/left/right
- Backspace

NOTE: When typing in the right most column of the window, the cursor will not wraparound to the next line, causing characters typed there to replace the previous character. The actual characters typed will still be transmitted using the output networks.

Auto Wraparound On		P	A	MC Sp,W	32,87

Allows automatic cursor wraparound when a window boundary is reached for the above commands.

Auto Linefeed Off		P	A	MC 1	108

Selects normal handling of carriage return.

Auto Linefeed On		P	A	MC L	76

Selects auto linefeed causing an automatic linefeed to be performed internally after receipt by the terminal of a Carriage Return (^M, ASCII chart location 13).

NOTE: The linefeed will only be executed internally; it will NOT be networked to output devices along with the carriage return.

Auto Tab Off		P	A	MC b	98

Eliminates automatic tabbing.

Auto Tab On		P	A	MC B	66

Selects Auto Tab mode. When the cursor moves into a protected location, a form tab (Form mode) or text tab (Text mode) is automatically executed.

3.5 Cursor Control Commands

1	2	3	4	5	6	7
Carriage Return	k		W	^M	13	

Returns the cursor to the left margin of the current line. If Auto Linefeed mode is on, a linefeed will also automatically occur (but will not be networked with the carriage return character).

NOTE: This command will also be networked according to the output network specification of the input device.

Line Feed	k		W	^J	10	

Moves the cursor down one line in the same column position. If the cursor is presently on the bottom line of the window, the action is determined by the Page/Scroll mode selection described above. If an internal linefeed has just been executed due to character wraparound at the end of the previous line, the linefeed will not be executed (though it still will be transmitted through the output network).

NOTE: This command will also be networked according to the output network specification of the intput device.

Reverse Linefeed			W	MC Sp,L	32,76	

Moves the cursor up one line in the same column position. If the cursor is presently on the top line of the window, the action is determined by the Page/Scroll mode selection described above.

Backspace	k		W	^H	08	

Moves the cursor back one space. If at the left most position of the line, the cursor wraps around to the last column of the previous line. The backspace is inoperable when the cursor is in the home position.

NOTE: This command will also be networked according to the output network specification of the input device.

Tab	k	W	^I	09	

Text Mode - moves the cursor to the next tab stop. If none is encountered, the cursor is positioned at the right margin.

Form Mode - moves the character to the next field (the next unprotected character after a protected character). Characters are processed in line order, from left to right. If no more fields are found, the cursor is positioned at the end of the window.

NOTE: This command will also be networked according to the output network specification of the input device.

Back Tab	K	W	MC '	39	

Text Mode - moves the cursor to the previous tab stop. If none is encountered, the cursor is positioned at the left margin.

Form Mode - moves the cursor to the previous field (unprotected character after a protected character). Characters are processed in reverse line order, from right to left. If no previous field is encountered, the cursor is positioned in the home position.

Tab Set	k	WT	MC]	93	

Sets a text tab stop at the current cursor column.

Tab Clear	K	WT	MC _	95	

Clears the text tab stop at the current cursor column.

Clear All Tabs		WT	MC Sp,_	32,95	

Clears all text tab stops.

Cursor Up	k		W	MC ;	59	

Moves the cursor up one line in the same column position. If the cursor is presently at the top line of the window it will wraparound to the bottom line of the window (unless Auto Wraparound is turned off).

Cursor Down	k		W	MC <	60	

Moves the cursor down one line in the same column position. If the cursor is currently at the top line of the window it will wraparound to the bottom line of the window (unless Auto Wraparound is turned off).

Cursor Right	k		W	MC =	61	

Moves the cursor right one column on the same line. If the cursor is currently on the right margin of the window, the cursor will wraparound to the left margin (column 0) of the next line. If the cursor was also on the bottom line of the window, it will wraparound to the top line of the window (that is, the home position), unless Auto Wraparound is turned off.

Cursor Left	k		W	MC >	62	

Moves the cursor left one column on the same line. If the cursor is currently at the left margin of the window (column 0) the cursor will wraparound to the right margin of the previous line. If the cursor was also on the top line of the window (that is, the home position) it will wraparound to the bottom line (unless Auto Wraparound is turned off).

Home	k		W	MC ?	63	

Moves the cursor to the home position (upper left-hand corner of the window - line 0, column 0).

Write Address		P	W	MC a	97	line,col

Positions the cursor at address 'line' and 'col'. If either parameter is invalid (less than 0 or greater than or equal to the number of lines/columns in the window) that portion of the address will remain unchanged.

For example, issuing a Write Address command with an illegal 'line' number and a legal 'col' number will move the cursor to column 'col' on the current line.

Input Parameters:

'line' - specifies the desired line number. This is a numerical parameter, as described in Section 2.1.2 and Figure 2-1. To be considered valid, 'line' must be greater than or equal to 0 and less than the number of lines in the window.

'col' - specifies the desired column number. This is a numerical parameter, as described in Section 2.1.2 and Figure 2-1. To be considered valid, 'col' must be greater than or equal to 0 and less than the number of columns in the window.

Example:

To postion the cursor at line 10, column 10, type the four characters: MC a * *.

To position the cursor at line 100, column 15, type the five characters: MC a ^A $ /.

To move the cursor to column 79 on the current line, type the four characters: MC a ^C o. Note that a ^C is an illegal line number.

Read Address		P	W	MC A	65	

Transmits to the requesting communication line (or keyboard's communication line if requested by the keyboard) the cursor address, as in the Write Address command above. The transmission of 'line' and 'col' is preceded by the programmable SOM message character (if defined) and terminated by the programmable EOM message character (if defined). 'line' and 'col' are numerical parameters, as described in Section 2.1.2 and Figure 2-1.

Example:

Assume that the SOM message character is not defined (default) and the EOM message character is a carriage return (^M, default). If the cursor is at the home position (line 0, column 0), the following 3 characters will be transmitted: Sp Sp ^M. If the cursor is at line 100, column 15, the following 4 characters will be transmitted: ^A $ / ^M.

NOTE: Since spaces (ASCII chart location 32) can often be sent as part of the cursor address, a computer program which reads the address should be sure to allow for a leading space. This may be a problem with some systems/languages which may truncate leading spaces.

End of Text		W	MC p	112	

Moves the cursor to the last character position in the window which is not a space (ASCII chart location 32).

Set Cursor to Underline		T	MC w	119	

Sets the cursor to a flashing underline.

Set Cursor to Block		T	MC W	87	

Sets the cursor to a flashing reverse video block.

1	2	3	4	5	6	7

Many editing commands 'clear' a particular area of display memory by using the clear character and clear attribute (default - spaces with the nondisplay attribute set).

The Define Clear Characteristics command (see below) is provided to allow the user to change the effect of those commands that 'clear' memory. Clearing memory works as follows:

> The clear character (default - space, ASCII chart location 32) is placed in display memory.
>
> The current video display attribute is found and used as the initial attribute. The clear mask determines which display attributes are to be changed from that base, and the clear attribute specifies the new values. This modified attribute is then placed in display memory.

Examples:

> Default Terminal Configuration (clear character is space; clear mask changes nondisplay attribute; clear attribute sets nondisplay on): Each cleared position is changed to be a nondisplayed space. If the position showed reverse video characters before, they will appear as reverse video, nondisplayed spaces.
>
> Clear character is space; clear mask changes nondisplay attribute; clear attribute sets nondisplay off: Each cleared position is changed to be a displayed space. The reverse video attribute, as above, will still be retained. This combination is often used when in text editing systems and Insert mode is on, since Insert mode terminates upon encountering a nondisplayed space (blank).
>
> Clear character is a rubout; clear mask changes nondisplay attribute; clear attribute sets nondisplay on: Each cleared position is changed to be a nondisplayed rubout (a control code). Other video attributes, as above, will still be retained. This combination may be used in an application where the host computer must distinguish between fields not entered by the user (they will be transmitted as rubouts) and those spaced-over by the user (they will be transmitted as spaces). In both cases, though, the screen will appear the same to the user since the nondisplay attribute is on.

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Form Feed		W	^L	12	

Clears all data in the window (both protected and unprotected) using the clear character and attribute, as described above. The cursor is homed.

NOTE: This command will also be networked according to the output network specification of the input device.

Insert Mode On	k	D	MC ^P	16	
(Alternate Form)		D	MC Sp,0	32,48	

Sets Insert mode. As characters are entered, characters starting at the current cursor position are right shifted up to the first 'blank' (nondisplayed space) with line wraparound if necessary (if the Insert Type is Insert in Window). The entered character and the current attributes are placed in the vacated position and the cursor is moved one position to the right. In User mode right shifting terminates on encountering a protected character. If no blank is found before the end of window or a protected location (User mode) is encountered, the last character is lost.

NOTE: Insert mode is turned on only for the requesting device. For example, turning Insert mode on from Line 1 will NOT light the Insert light on the keyboard and will NOT put the keyboard into Insert mode. Instead, the Function Route command should be used to have Line 1 put the keyboard into Insert mode.

Example:

A program wishes to put the keyboard into Insert mode and have the LED light on the INSRT key on the keyboard. The program should transmit the following six characters: ESC Q Sp ESC ^P ^W.

Insert Mode Off	K	D	MC ^@	0	
(Alternate Form)		D	MC Sp,Sp	32,32	

Resets the device to normal character entry with entered characters replacing or overstriking existing characters.

NOTE: Insert Mode is turned off only for the requesting device (see above).

Example:

A program wishes to turn off Insert mode for the keyboard and turn the LED off. The program should transmit the following six characters: ESC Q Sp ESC ^@ ^W.

Delete Character in Line/Field	k		W	MC ^Q	17	
(Alternate Form)			W	MC Sp,1	32,49	

Deletes the character at the current cursor position. All characters from the right of the cursor up to the first nondisplayed space or right margin of the line (whichever is encountered first) are left shifted one character position. The right most position is cleared using the clear character and attribute (default - spaces with the nondisplay attribute set; see the beginning of this section).

In User mode, left shifting terminates on encountering a protected character.

Delete Character in Window	K		W	MC ^A	01	
(Alternate Form)			W	MC Sp,!	32,33	

Same as Delete Character in Line/Field, except left shifting will continue across lines if necessary until the right margin of the last line is encountered.

Insert Line	k		W	MC ^R	18	
(Alternate Form)				MC Sp,2	32,50	

In Text mode, the data on the current line and below are scrolled down one line and the current line is cleared using the clear character and attribute (default - spaces with the nondisplay attribute set; see the beginning of this section). The bottom line is lost. In Form mode, this command has no effect.

Delete Line	K		W	MC ^B	02	
(Alternate Form)			W	MC Sp,"	32,34	

In Text mode, subsequent lines are scrolled up one line, replacing the current line. The bottom line of the window is cleared using the clear character and attribute (default - spaces with the nondisplay attribute set; see the beginning of this section). In Form mode, this command has no effect.

Clear Unprotected to End of Line/Field	k		W	MC ^S	19	
(Alternate Form)			W	MC Sp,3	32,51	

In Form mode, unprotected characters from the current cursor position to the first protected character position are cleared using the clear character and attribute (default - spaces with the nondisplay attribute set; see the beginning of this section). Clearing will continue across multiple lines if necessary.

In Text mode, unprotected characters from the cursor position to the right margin are cleared.

Clear Unprotected to End of Window	K		W	MC ^C	03	
(Alternate Form)			W	MC Sp,#	32,35	

All unprotected characters from the cursor position to the end of the window are cleared using the clear character and attribute (default - spaces with the nondisplay attribute set; see the beginnng of this section).

Clear All to End of Line/Field		P	W	MC ^U	21	
(Alternate Form)		P	W	MC Sp,5	32,53	

In Text mode, clears all characters (both protected and unprotected) from the cursor position to the end of line using the clear character and attribute (default - spaces with the nondisplay attribute set; see the beginning of this section).

In Form mode, unprotected characters from the current cursor position to the first protected character position are cleared, using the clear character and attribute (default - spaces with the nondisplay attribute set; see the beginning of this section). Clearing will continue across multiple lines, if necessary (same as Clear Unprotected to End of Field).

Clear All to End of Window		P	W	MC ^E	05
(Alternate Form)		P	W	MC Sp,%	32,37

Clears all characters (both protected and unprotected) from the cursor position to the end of the window, using the clear character and attribute (default - spaces with the nondisplay attribute set; see the beginning of this section).

Set Insert Type		P	D	MC ^G	07	intype
(Alternate Form)		P	D	MC Sp,'	32,39	intype

Defines the Insert Type to be used for the requesting device, based on 'intype'. When the device is in Insert mode, the Insert Type determines whether the character right shifting will stop at the end of the current line (!) or wraparound all lines to the end of the window (Sp, default).

NOTE: The Insert Type is changed only for the requesting device.

Input Parameter:

'intype' - The Insert Type to be used: Insert in window = Sp (ASCII chart location 32); Insert in line = ! (33). Note that all values other than Sp (32) will be assumed to mean Insert in Line.

Example:

A computer program wishes to change the keyboard to use Insert in Line. The program should send the following seven characters: ESC Q Sp ESC ^G ! ^W.

Define Clear Characteristics		P	T	MC ^H 08	m,w,char
(Alternate Form)		P	T	MC Sp,(32,40	m,w,char

Defines the clear character and attribute used by the following commands which clear/erase a portion of display memory (see the discussion at the beginning of this section):

- Linefeed/Reverse Linefeed
- Insert/Delete Line
- Form Feed
- Delete Character in Line/Field/Window
- Clear Unprotected to End of Line/Field/Window
- Clear All to End of Line/Field/Window

The user may either use all or part of the requesting device's current attributes as the clear attribute. Specific attributes can be superceded by a user-defined attribute as follows:

The parameter 'm' specifies which attributes are to be taken from the clear attribute specifically (as opposed to the current attribute). Attributes not specified in 'm' will retain their current attribute values.

The parameter 'w' is the setting of the selected clear attribute.

The clear attribute to be used is determined by taking the current attribute word as the base and changing those attributes specified in 'm' to their corresponding values in 'w'.

Input Parameters:

'm' - The attributes which are to be affected. The single character used is the character whose position in the ASCII chart is equal to 64 plus the value of the selected attributes:

1 = display/non-display
2 = blink on/off
4 = underlining
8 = protection
16 = brightness control
32 = normal/reverse video

'w' - The desired attribute settings. The single character used is the character whose position in the ASCII chart is equal to 64 plus the values of the selected attributes (see Figure 3-1):

1 = non-display	0 = display
2 = blink on	0 = blink off
4 = underline on	0 = underline off
8 = unprotected	0 = protected
16 = half bright on	0 = half bright off
32 = reverse video on	0 = normal video

'char' - The actual clear character to be placed in memory. Any value may be used, including control codes.

Example:

To change the characteristics to clear to displayed spaces, type the five characters: MC ^H A @ Sp.

To change the characteristics to clear to nondisplayed rubouts, type the five characters: MC ^H A A rub.

Set Margin Bell Offset			T	MC Sp,+	32,43 margin

Sets a margin bell which is sounded whenever a character is entered that is 'margin' columns from the right-hand margin of the window. A single value applies to all windows. Setting an offset of zero (Sp) will disable the margin bell.

Input Parameter:

'margin' - specifies the number of columns offset from the right-hand window margin at which point the bell is to be sounded. 'margin' is a numerical parameter as defined in Section 2.1.2 and Figure 2-1.

Example:

To set the bell to ring when the cursor is 8 columns from the right margin (that is, column 72 when in default configuration), type the four characters: MC Sp + (.

To disable the margin bell (the default case), type the four characters: MC Sp + Sp.

NOTE: If the keyboard bell has been disabled, the margin bell will never ring.

SEE APPENDIX G: Form Feed - Clear Screen, Form Feed - Top of Page.

V3 Change

FIGURE 3-1
Attribute Word Values

The parameter 'w' specifies the desired attribute settings. The single character used is the character whose position in the ASCII chart is equal to 64 plus the values of the selected attributes:

1 = non-display (secure)
0 = display

2 = blink on
0 = blink off

4 = underline on
0 = underline off

8 = unprotected
0 = protected

16 = half bright on
0 = half bright off (normal)

32 = reverse video on
0 = normal video

The chart to the right lists all possible values for attribute settings, the corresponding ASCII character ('CHAR') and its ASCII chart location ('LOC').

VIDEO	BRIGHT	PRTCT	UNDERLINE	BLINK	DISPLAY	CHAR	LOC
Normal	Normal	Yes	No	Off	Yes	@	64
Normal	Normal	Yes	No	Off	No	A	65
Normal	Normal	Yes	No	On	Yes	B	66
Normal	Normal	Yes	No	On	No	C	67
Normal	Normal	Yes	Underline	Off	Yes	D	68
Normal	Normal	Yes	Underline	Off	No	E	69
Normal	Normal	Yes	Underline	On	Yes	F	70
Normal	Normal	Yes	Underline	On	No	G	71
Normal	Normal	No	No	Off	Yes	H	72
Normal	Normal	No	No	Off	No	I	73
Normal	Normal	No	No	On	Yes	J	74
Normal	Normal	No	No	On	No	K	75
Normal	Normal	No	Underline	Off	Yes	L	76
Normal	Normal	No	Underline	Off	No	M	77
Normal	Normal	No	Underline	On	Yes	N	78
Normal	Normal	No	Underline	On	No	O	79

VIDEO	BRIGHT	PRTCT	UNDERLINE	BLINK	DISPLAY	CHAR	LOC
Normal	Half	Yes	No	Off	Yes	P	80
Normal	Half	Yes	No	Off	No	Q	81
Normal	Half	Yes	No	On	Yes	R	82
Normal	Half	Yes	No	On	No	S	83
Normal	Half	Yes	Underline	Off	Yes	T	84
Normal	Half	Yes	Underline	Off	No	U	85
Normal	Half	Yes	Underline	On	Yes	V	86
Normal	Half	Yes	Underline	On	No	W	87
Normal	Half	No	No	Off	Yes	X	88
Normal	Half	No	No	Off	No	Y	89
Normal	Half	No	No	On	Yes	Z	90
Normal	Half	No	No	On	No	[	91
Normal	Half	No	Underline	Off	Yes	\	92
Normal	Half	No	Underline	Off	No	]	93
Normal	Half	No	Underline	On	Yes	^	94
Normal	Half	No	Underline	On	No	_	95

VIDEO	BRIGHT	PRTCT	UNDERLINE	BLINK	DISPLAY	CHAR	LOC
Reverse	Normal	Yes	No	Off	Yes	`	96
Reverse	Normal	Yes	No	Off	No	a	97
Reverse	Normal	Yes	No	On	Yes	b	98
Reverse	Normal	Yes	No	On	No	c	99
Reverse	Normal	Yes	Underline	Off	Yes	d	100
Reverse	Normal	Yes	Underline	Off	No	e	101
Reverse	Normal	Yes	Underline	On	Yes	f	102
Reverse	Normal	Yes	Underline	On	No	g	103
Reverse	Normal	No	No	Off	Yes	h	104
Reverse	Normal	No	No	Off	No	i	105
Reverse	Normal	No	No	On	Yes	j	106
Reverse	Normal	No	No	On	No	k	107
Reverse	Normal	No	Underline	Off	Yes	l	108
Reverse	Normal	No	Underline	Off	No	m	109
Reverse	Normal	No	Underline	On	Yes	n	110
Reverse	Normal	No	Underline	On	No	o	111

VIDEO	BRIGHT	PRTCT	UNDERLINE	BLINK	DISPLAY	CHAR	LOC
Reverse	Half	Yes	No	Off	Yes	p	112
Reverse	Half	Yes	No	Off	No	q	113
Reverse	Half	Yes	No	On	Yes	r	114
Reverse	Half	Yes	No	On	No	s	115
Reverse	Half	Yes	Underline	Off	Yes	t	116
Reverse	Half	Yes	Underline	Off	No	u	117
Reverse	Half	Yes	Underline	On	Yes	v	118
Reverse	Half	Yes	Underline	On	No	w	119
Reverse	Half	No	No	Off	Yes	x	120
Reverse	Half	No	No	Off	No	y	121
Reverse	Half	No	No	On	Yes	z	122
Reverse	Half	No	No	On	No	{	123
Reverse	Half	No	Underline	Off	Yes	|	124
Reverse	Half	No	Underline	Off	No	}	125
Reverse	Half	No	Underline	On	Yes	~	126
Reverse	Half	No	Underline	On	No	Rub	127

1	2	3	4	5	6	7
Blink On		P	A	MC C	67	

Sets the blink indicator in the device's attribute list.

Blink Off		P	A	MC c	99	

Resets the blink indicator in the device's attribute list.

Reverse Video On		P	A	MC D	68	

Sets the reverse video indicator in the device's attribute list.

Reverse Video Off		P	A	MC d	100	

Resets the reverse video indicator in the device's attribute list.

Half Bright On		P	A	MC E	69	

Sets the half bright indicator in the device's attribute list.

Half Bright Off		P	P	MC e	101	

Resets the half bright indicator in the device's attribute list.

Underline On		P	A	MC G	71	

Sets the underline indicator in the device's attribute list.

Underline Off		P	A	MC g	103	

Resets the underline indicator in the device's attribute list.

Non-display On		P	A	MC H	72	

Sets the non-display indicator in the device's attribute list.

Non-display Off		P	A	MC h	104	

Resets the non-display indicator in the device's attribute list.

Protection On		P	A	MC I	73	

Sets the protection indicator in the device's attribute list.

Protection Off		P	A	MC i	105	

Resets the protection indicator in the device's attribute list.

Select Character Set		P	A	MC j	106	cset

Selects the character set specified by 'cset'. If optional character sets are not present, all characters from that set selection will not be displayed, although they will exist in display memory. Overstrike mode will NOT be selected automatically if the APL character set is selected in this manner.

NOTE: If overstrike mode has been selected, Select Character Set should NOT be used until non-overstrike mode has been selected (via the ASCII Mode command).

Input Parameter:

'cset' - specifies the new character set. Allowable values are:

Changed in V3. See App. G

Character	ASCII Chart Location	Status Line	Normal Usage
Sp	32	ASC	ASCII
!	33	CH1	Graphics
"	34	CH2	-
#	35	CH3	APL

Example:

To select the Graphics character set, type the three characters: MC j !.

Reverse Screen Video		T	MC k	107	

Sets the display screen to black characters on a white background. Does not apply to an individual window.

Normal Screen Video		T	MC K	75	

Sets the display screen to white characters on a black background. Does not apply to an individual window.

Half Bright Protected Fields		T	MC M	77	

Displays all protected character positions at half intensity.

Normal Intensity Protected Fields		T	MC m	109	

Displays all protected character positions at their specified intensity.

Set Attribute Word		P	A	MC N	78	w

Sets the current video attribute to 'w'.

Input Parameter:

'w' - the new attribute. The single character used is the character whose position in the ASCII chart is equal to 64 plus the values of the selected attributes (see Figure 3-1):

1 = non-display	0 = display
2 = blink on	0 = blink off
4 = underline on	0 = underline off
8 = unprotected	0 = protected
16 = half bright on	0 = half bright off
32 = reverse video on	0 = normal video

Example:

To set the attribute to reverse video, unprotected, type the three characters: MC N h.

Read Attribute Word		P	A	MC n	110	

Causes the device's attribute word, preceded by the SOM message character (if defined) and terminated by the EOM message character (if defined), to be transmitted to the requesting device. If initiated by the keyboard, the sequence is transmitted to the keyboard's communications line. The single character transmitted is the character whose position in the ASCII chart is equal to 64 plus the values of the selected attributes, as defined in Set Attribute Word (see Figure 3-1).

Example:

Assuming the SOM message character is not defined , the EOM message character is a ^M (default), and the current attribute is reverse video/unprotected, the following two characters will be transmitted: h ^M.

Set Attribute of Block		P	W	MC J	74	m,w,lns,cls

Sets selected attributes of a rectangular block of display memory. The value of 'm' specifies which attributes are to be affected. 'w' is the setting for the selected attributes. The block is defined by the cursor in the upper left corner and the number of lines ('lns') and the number of columns ('cls').

Input Parameters:

'm' - specifies the attributes to be affected. The format of 'm' is defined in the 'Define Clear Characteristics' command.

'w' - specifies the settings of the selected attributes. The format is described in Set Attribute Word and Figure 3-1.

'lns' - the number of lines in the block. This is a numerical parameter as defined in Section 2.1.2 and Figure 2-1. 'lns' must be less than or equal to the number of lines remaining in the window.

'cls' - the number of columns in the block. This is a numerical parameter as defined in Section 2.1.2 and Figure 2-1. 'cls' must be less than or equal to the number of columns remaining in the window.

Example:

To change a block of display that is 24 lines by 80 columns to reverse video, type the following six characters: MC J ` ` 8 p.

To change the same block to be protected, type the six characters: MC J H A 8 p

Repeat Character Horizontal		P	W	MC r	114	char,len

Generates the character 'char' repeatedly in the horizontal direction 'len' times, starting at the current cursor position. The cursor is then positioned one column after the last repeated character. Display versions of control codes can be generated in this manner.

Input Parameters:

'char' - the character to be repeated. May be any character, including control codes.

'len' - the number of times to repeat. This is a numerical parameter as defined in Section 2.1.2 and Figure 2-1. 'len' must be less than or equal to the number of columns remaining on the line (that is, the cursor will not automatically wraparound to the next line).

Example:

To display horizontal line (the ^A character) 80 columns in length, type the four characters: MC r ^A p.

Repeat Character Vertical		P	W	MC R	82	char,len

Generates the character 'char' repeatedly in the vertical direction 'len' times starting at the current cursor position. The cursor is then positioned in the same position as the last repeated character. Display versions of control codes can be generated in this manner.

Input Parameters:

'char' - the character to be repeated. May be any character, including control codes.

'len' - the number of times to repeat. This is a numerical parameter as defined in Section 2.1.2 and Figure 2-1. 'len' must be less than or equal to the number of lines remaining in the window (that is, the cursor will not automatically wraparound to the top of the window).

Example:

To display a wide, vertical bar (the ^J character) 24 times, type the 4 characters: MC R ^J 8.

Replace Character and Attribute Mode		P	A	MC Sp,r	32,114	

Enables Replace Character and Attribute mode. When in this mode characters are displayed on the screen using the device's current attribute settings (which may not be the same as the attribute currently at that position on the screen). This is the default mode of operation.

Replace Character Only Mode		P	A	MC Sp,R	32,82

Enables Replace Character Only mode. When in this mode characters displayed on the screen are changed, but the attributes currently present on the screen are not.

Character and Attribute Display			W	MC Sp,A	32,65

Displays seven lines of a preset test pattern for each of four potential character sets. Each line presents a different combination of display attributes. If the character set is not present within the terminal the characters will appear as blanks, although the attributes changes will still be visible.

NOTE: Most of the lines are protected. If in User mode, attempting to type over the display will sound the keyboard bell.

SEE APPENDIX G: Set Underline to Change Attribute and Set Underline to Normal Character. V3 Change

1	2	3	4	5	6	7
Function Route		P	MC Q	81		dev,msg,EOF

Routes the message 'msg' to operate as if it came from device 'dev'. The message may consist of characters and/or commands. In this way one device can set/reset attributes or modes for another device.

Input Parameters:

'dev' - The device from which 'msg' is presumed to originate, as follows:

Keyboard = Sp (ASCII chart location 32)
Line 1 = ! (33)
Line 2 = " (34)
Line 3 = # (35)

'msg' - The actual message. May be any character/command, up to a maximum length of 15 characters.

'EOF' - the programmable end of field message character (default - ^W, ASCII chart location 23)

Note that the characters within 'msg' will not actually be processed until the EOF is entered or the maximum message length is reached.

Example:

To change the baud rate for Line 2 to 1200 baud, type the seven characters: MC Q " MC O ' ^W.

Set Output Network		P	D	MC Y	89	network

Sets the requesting device's output network. If successful, the ACK sequence (programmable ACK message character, if defined, followed by the programmable EOM character, if defined) is sent to the requesting device (nothing is returned if requested from the keyboard). If unsuccessful, the NAK sequence (programmable NAK message character, if defined, followed by the programmable EOM character, if defined) is sent to the requesting device (the bell is sounded if requested from the keyboard).

Specifying the display as part of the network is always successful. If a communication line is requested, the success depends on the CTS/RTS Protocol setting for that line:

- CTS/RTS Protocol On - The RTS line is held high. If CTS is also a high level, the command is successful; otherwise, the command is unsuccessful.

- CTS/RTS Protocol Off - The command is always successful.

Input Parameter:

'network' = the desired output network. The format is described in Figure 3-2.

Example:

To have a computer program (running on Line 1) set its output network to go directly to Line 2, the program should transmit the three characters: ESC Y $. Note that the program should have a 'read' statement which accepts the ACK or NAK sequence, and deals with it accordingly. If the program wishes to 'ignore' the results, the ACK and NAK characters should be disabled with the Change Message Character command (MC o ! ^@ and MC o " ^@).

Read Output Network		P	D	MC y	121	

Transmits a single character describing the device's output network to the requesting line (keyboard's communication line if requested by the keyboard). The format of the output network is described in Figure 3-2. The character transmitted is preceded by the SOM message character (if defined) and terminated by the EOM message character (if defined).

Example:

Assuming that the SOM message character is not defined , the EOM message character is a ^M (default), and the output network for Line 1 is only Line 2, the following two characters would be transmitted if Line 1 requested the Read: $ ^M.

Figure 3-2

Network Word Values

The parameter 'network' specifies the device(s) which are to receive output from the requesting device. The single character used is the character whose position in the ASCII chart is equal to 32 plus the value(s) of the selected device(s):

16 = Display
8 = Line 1
4 = Line 2
2 = Line 3

The chart below lists all possible values for output networks, the corresponding ASCII character and its ASCII chart location.

DISPLAY	LINE 1	LINE 2	LINE 3	CHARACTER	LOCATION
On	On	On	On	>	62
On	On	On	Off	<	60
On	On	Off	On	:	58
On	On	Off	Off	8	56
On	Off	On	On	6	54
On	Off	On	Off	4	52
On	Off	Off	On	2	50
On	Off	Off	Off	0	48
Off	On	On	On	.	46
Off	On	On	Off	,	44
Off	On	Off	On	*	42
Off	On	Off	Off	(	40
Off	Off	On	On	&	38
Off	Off	On	Off	$	36
Off	Off	Off	On	"	34
Off	Off	Off	Off	Sp	32

Attach Printer	^k	DT	MC }	125	

Attaches the printer (Line 2) as an auxiliary device for all characters destined for the display. This is determined by examining the network words for the keyboard, Line 1, and Line 3. If the display is on, then Line 2 is also turned on.

If Line 2 is available (CTS/RTS Protocol is off, or the printer responds with a high CTS when RTS is raised), the ACK sequence (as in Set Output Network) is sent (nothing is returned if requested by the keyboard) and Line 2 is added to the appropriate output networks. If Line 2 is not available (CTS/RTS Protocol is on and the printer does not respond with a high CTS to a raised RTS), the NAK sequence (as in Set Output Network) is sent (the keyboard bell is sounded if requested from the keyboard).

Example:

A program wishes to attach the printer as a 'slave' device and issues the Attach Printer command: ESC }. The program should then have a 'read' statement to receive the ACK or NAK sequence and act accordingly.

Detach Printer	^K	DT	MC ~	126	

Detaches the printer (line 2) as an auxiliary device. Line 2 is turned 'off' for the output networks of the keyboard, Line 1, and Line 3.

NOTE: The ACK or NAK sequences are not transmitted as part of this command, since the command is always successful (even if the printer was not previously attached).

Print Window	k	W	MC {	123	

Performs an Attach Printer command (will transmit ACK or NAK sequence as above). Transmits to the printer (Line 2) all characters from the beginning of the line containing the Start of Print/Transmit (default - home position) up to but not including the cursor position. If the cursor is at or before the line containing the Start of Print/Transmit, characters from the beginning of the window to the end of the window are printed. If the cursor is positioned after the Start of Print/Transmit but in the first column of any line, the entire line is printed.

Control characters are replaced with spaces (ASCII chart location 32). If in Form mode, protected characters are also replaced with spaces.

Underlined characters to be printed result in character, backspace, underline, if Underline Transmission is on; otherwise, just the character is printed.

Changed in V3 See App. G

The printing sequence is terminated with a carriage return, line feed and two rubouts. If Form Feed Prior to Print is on, a Form Feed (^L) followed by 16 rubouts is transmitted prior to the data.

The cursor is returned to its original position and a Detach Printer command is executed when printing is complete.

Print Line	K	W	MC		124	

Performs an Attach Printer command (will transmit ACK or NAK sequence as above). Transmits to the printer (Line 2) all data from the beginning of the line up to but not including the cursor position. If the cursor is positioned at the beginning of the line, the entire line is printed.

Control characters are replaced with spaces (ASCII chart location 32). If in Form mode, protected characters are also replaced with spaces.

Underlined characters to be printed result in character, backspace, underline, if Underline Transmission is on; otherwise, just the character is printed.

Changed in V3 See App. G

The printing sequence is terminated with a carriage return, line feed and two rubouts. If Form Feed Prior to Print is on, a Form Feed (^L) followed by 16 rubouts is transmitted prior to the data.

The cursor is returned to its original position and a Detach Printer command is executed when printing is complete.

Form Feed Prior to Print On			T	MC Z	90	

Changed in V3 See App. G

Causes a Form Feed (^L) and 16 rubouts to be transmitted to the printer (line 2) prior to every Print Line/Window command.

Form Feed Prior to Print Off			T	MC z	122	

Turns off the Form Feed Prior to Print.

Attach Tape	^k		DT	MC @	64	

Attaches the tape (line 3) as an auxiliary device for characters destined for the display. This is determined by examining the output networks for the keyboard, Line 1, and Line 2. If the display is on, then Line 3 is also turned on. If Line 3 is available (CTS/RTS Protocol is off, or the tape responds with a high CTS when RTS is raised), the ACK sequence (as defined in Set Output Networke) is sent (nothing is returned if requested by the keyboard) and Line 3 is added to the appropriate output networks. If Line 3 is not available (CTS/RTS Protocol is on and the tape does not respond with a high CTS to a raised RTS), the NAK sequence (as defined in Set Output Network) is sent (the keyboard bell is sounded if requested from the keyboard).

Detach Tape	^K		DT	MC ^	94	

Detaches the tape (line 3) as an auxiliary device. Line 3 is turned off for the output networks of the keyboard, Line 1, and Line 2.

Message to Tape	k		W	MC `	96	

Performs an Attach Tape command (sends ACK or NAK sequence, as described above). If successful, performs a Transmit All Window command to Line 3 (regardless of the device issuing the command). Performs a Detach Tape command when transmission is complete.

3.9 Transmission Commands

1	2	3	4	5	6	7
Set Baud Rate	P		D	MC 0	79	baud

Sets the baud rate on the requesting communication line (or keyboard's communication line if requested by the keyboard).

Input Parameter:

'baud' - the baud rate:

50 = Sp (ASCII chart location 32)	1800 = ((40)
75 = ! (33)	2000 =) (41)
110 = " (34)	2400 = * (42)
135 = # (35)	3600 = + (43)
150 = $ (36)	4800 = , (44)
600 = & (38)	7200 = - (45)
1200 = ' (39)	9600 = . (46)

Example:

To set the baud rate for the keyboard's communication line (default - Line 1) to 1200 baud, type the three characters: MC 0 '.

Set Parity			P	D	MC P	80	parity

Sets the parity for the requesting line (or keyboard's communication line if requested by the keyboard).

Input Parameter:

'parity' - the parity

No parity	= Sp (ASCII chart location 32)
Even	= ! (33)
Odd	= " (34)
Mark	= # (35)
Space	= $ (36)

See Appendix C for the definition of the bit configurations which result from the various parity/stop bit combinations.

Example:

To set the parity for the keyboard's communication line (default - Line 1) to even parity, type the three characters: MC P !.

Set Stop Bits		P	D	MC Sp,<	32,60 sbits

Sets the number of stop bits for the requesting line (or keyboard's communication line if requested from the keyboard).

Input Parameter:

'sbits' - specifies the number of stop bits:

1 stop bit = ! (ASCII chart location 33)
2 stop bits = " (34)

See Appendix C for the definition of the bit configurations which result from the various parity/stop bit combinations.

Example:

To set the keyboard's communication line (default - Line 1) to have 1 stop bit, type the four characters: MC Sp < !.

Clear to Send/Request to Send Protocol On		P	D	MC Sp,V	32,86

Enables CTS/RTS Protocol for the requesting device (or keyboard's communication line if requested from the keyboard). In this mode, RTS is only held high if a device is networked to the requesting device. Also, CTS must be high for any transmission to occur over this line.

Clear to Send/Request to Send Protocol Off		P	D	MC Sp,v	32,118

Disables CTS/RTS Protocol for the requesting device (or keyboard's communication line if requested from the keyboard). In this mode, RTS is always held high. Also, CTS is not required for transmission.

Example:

To disable the CTS/RTS Protocol for the printer port (Line 2), using Function Routing from the keyboard, type the seven characters: MC Q " MC Sp v ^W.

Buffer Overflow Control On		P	D	MC Sp,F	32,70

Enables Buffer Overflow Control for the requesting device (or keyboard's communication line if requested from the keyboard). When the device's input buffer is one-half full, the programmable XOFF character will be automatically transmitted back to the host computer. When the buffer decreases to one-quarter full, the programmable XON character will be transmitted. See Appendix D for a discussion of timing considerations and buffering.

Example:

To enable buffer overflow control for the keyboard's communication line (default - Line 1), type the three characters: MC Sp F.

Buffer Overflow Control Off		P	D	MC Sp,f	32,102

Disables Buffer Overflow Control for the requesting device (or keyboard's communication line if requested from the keyboard).

Parity Check of Input Data On		P	D	MC Sp,P	32,80

Enables Parity Checking of Input Data for the requesting device (or keyboard's communication line if requested from the keyboard). If a parity or framing error is detected on incoming data, the erroneous character will be converted to a tilda (~, ASCII chart location 126).

Example:

To enable parity checking for the keyboard's communication line (default - Line 1), type the three characters: MC Sp P.

Parity Check of Input Data Off		P	D	MC Sp,p	32,112

Disables Parity Checking of Input Data for the requesting device (or keyboard's communication line if requested from the keyboard).

Transmit Line/Field	k		W	MC ^T	20	
(Alternate Form)			W	MC Sp,4	32,52	

Text Mode

Transmits to the requesting line (or keyboard's communication line, if requested from the keyboard) unprotected characters from the beginning of the line, up to, but not including, the cursor position. If the cursor is at the beginning of the line (column 0), all unprotected characters on the line are transmitted.

The programmable SOM message character, if defined, precedes all transmission.

If defined, the programmable EOF message character (default - ^W, ASCII chart location 23) is transmitted upon encountering a protected character after an unprotected character. The transmission sequence is terminated with the programmable EOM message character (default - ^M, ASCII chart location 13), if defined. If both the EOF and EOM message characters could be sent (when the last character in a line is protected, for example), only the EOM message character will be sent (if defined).

If Underline Transmission is on (the default), underlined and unprotected characters result in the transmission of character, backspace, and underline. If Underline Transmission is off, just the actual character is sent.

If Trailing Blank Suppression is on, all trailing spaces (ASCII chart location 32) are suppressed and not transmitted.

The cursor is returned to its original position upon completion.

Form Mode

Transmits to the requesting line (or keyboard's communication line, if requested from the keyboard) all unprotected characters after the first previous protected character, or the start of the window if no previous protected characters were found, to the first protected character at or after the cursor position (or end of the window, if no following protected characters are found).

The programmable SOM message character, if defined, precedes all transmission.

If the unprotected characters within the field cross a line (the right hand margin of the window), the programmable EOL character (default - ^M, ASCII chart location 13) will be transmitted (if defined) at the end of each line. The transmission sequence is terminated with the programmable EOM message character (default - ^M, ASCII chart location 13), if defined. If both the EOL and EOM message characters could be sent, only the EOM message character will be sent (if defined).

Underlined character transmission and trailing blank suppression will be handled as above.

The cursor is returned to its original position upon completion.

NOTE: A completely empty line or field (with Trailing Blank Suppression on) will transmit only the EOM character.

Transmit Window	K	W	MC ^D	04	
(Alternate Form)		W	MC Sp,$	32,36	

Transmits to the requesting line (or keyboard's communication line if requested from the keyboard) all unprotected characters from the Start of Print/Transmit (default - home position) up to but not including the cursor position. If the cursor is at or before the Start of Print/Transmit, the unprotected characters from the cursor position to the end of the window are transmitted.

The programmable SOM message character, if defined, precedes all transmission.

If defined, the programmable EOF message character (default - ^W, ASCII chart location 23) is transmitted upon encountering a protected character after an unprotected character. If unprotected characters cross a line (the right hand margin of the window), the programmable EOL character (default - ^M, ASCII chart location 13) will be transmitted (if defined) at the end of each line. The transmission sequence is terminated with the programmable EOM message character (default - ^M, ASCII chart location 13), if defined.

If both the EOF and EOL message characters could be potentially sent (when a field ends at the right margin of the window), only the EOF will be sent. If both the EOF and EOM message characters could be potentially sent, only the EOM message character will be sent.

Underlined character transmission and trailing blank suppression are handled as in Transmit Line/Field.

The cursor is returned to its original position upon completion.

Transmit All Line		P	W	MC ^V	22
(Alternate Form)		P	W	MC Sp,6	32,54

The programmable SOM message character, if defined, precedes all transmission.

Transmits to the requesting line (or keyboard's communication line if requested from the keyboard) all characters from the beginning of the line, up to, but not including, the cursor position. If the cursor is positioned at the beginning of the line (column 0), the entire line is transmitted. Transmission is terminated with the programmable EOM message character (default - ^M, ASCII chart location 13), if defined.

Underlined character transmission and trailing blank suppression are treated as in Transmit Line/Field.

The cursor is returned to its original position upon completion.

Transmit All Window		P	W	MC ^F	06
(Alternate Form)		P	W	MC Sp,&	32,38

Transmits to the requesting line (or keyboard's communication line if requested from the keyboard) all characters from the Start of Print/Transmit (default - home position) up to, but not including, the cursor position. If the cursor is at or before the Start of Print/Transmit all characters from the cursor position to the end of the window are transmitted.

The programmable SOM message character, if defined, precedes all transmission. The programmable EOL message character (default - ^M, ASCII chart location 13), if defined, is transmitted after all lines except for the last, which is terminated by the programmable EOM message character (default - ^M, ASCII chart location 13), if defined.

Underlined character transmission and trailing blank suppression are treated as in Transmit Line/Field.

The cursor is returned to its original position upon completion.

Create Screen		P	W	MC Sp,-	32,45	

Transmits to the requesting device (or keyboard's communication line if requested from the keyboard) the data and command sequences necessary to build the display currently shown in the device's window. The entire window is used, from the home position to the last position in the window.

The transmission is preceded with the following sequences in all cases:

- SOM message character (if defined)
- ESC 0 (APL Mode, to allow for potential overstrikes)
- ESC U (Programmer Mode)

The Write Address command (MC a) is used to position the cursor at the beginning of each non-blank area (that is, an area on the screen that did not result from a clear operation using the clear character and clear attribute). If the character set is different than the previous one, the Select Character Set command (MC j) is transmitted; if the attribute is different, the Set Attribute Word command (MC N) is transmitted. If the character is overstruck, the Reverse Video On (MC D) or Reverse Video Off (MC d) commands are sent, as appropriate.

Control codes and rubouts are transmitted using the Repeat Character Horizontal command with a repeat count of one.

When the transmission is complete, the following sequence is always sent:

- ESC) (ASCII Mode)
- ESC N H (Set Attribute Word to 'normal')
- EOM character (if defined)

Trailing Blank Suppression On		P	T	MC Sp,T	32,84	

Enables trailing blank suppression for the following commands:

- Transmit Line/Field
- Transmit Window
- Transmit All Line/Field
- Transmit All Window

Spaces (ASCII chart location 32) which are 'trailing' (on the right-hand edge of a line or field) are not transmitted.

Trailing Blank Suppression Off		P	T	MC Sp,t	32,116	

Disables trailing blank suppression for the commands listed above. All characters within a line or field will be transmitted, including all spaces.

Underline Transmission On		P	T	MC Sp,U	32,85	

Enables underline transmission for the commands list in Trailing Blank Suppression On, plus Print Line and Print Window. This causes the three (3) character sequence 'character', 'backspace', 'underline' to be transmitted for each 'character' on the screen which is underlined (has the underline attribute set on).

NOTE: Underlines entered in the ASCII character set while in non-overstrike mode are converted internally to the underline attribute. Only repeat character generation commands will actually place the ASCII underline character in display memory (although the underline character for non-ASCII character sets will be placed in display memory). Changed in V3 See App. G

Underline Transmission Off		P	T	MC Sp,u	32,117	

Disables underline transmission, as defined above. The underline attribute and underlined characters will be treated strictly as a video attribute (like Reverse Video or Half Bright, for example). Only the actual character will be transmitted. See the discussion above.

Set Start of Print/Transmit			W	MC 1	49	

Sets the Start of Print/Transmit to the current cursor position for all Print/Transmit Window requests.

Suspend Block Transmit		D	^S	19	

Suspends execution of the following commands (and hence transmission of data) for the communications line issuing the ^S command:

- Transmit/Transmit All Line/Field/Window
- Print Line/Window
- Create Screen
- Transmit Status Line
- Read Address/Attribute/Network
- Function Keys/Cursor Pad Keys in Transmit Mode

Transmission will resume when a ^Q is received. A ^S received at any time other than during the execution of these commands will have no effect. A ^S received from the keyboard will also have no effect.

Resume Block Transmit		D	^Q	17	

Resumes execution for any of the above commands which were suspended by a ^S. A ^Q received at a time other than during the execution of these commands will have no effect. A ^Q received from the keyboard will also have no effect.

Set Transmission Delay	P	T	MC Sp,.	32,44	delay

Specifies the time to delay prior to execution of block transmission commands (see Section 2.4.2).

This feature will allow users of half-duplex systems time for line turnaround after issuance of a transmission request (such as Read Address).

Input Parameter:

'delay' - the number of 100 millisecond units to delay. This is a numerical parameter as described in Section 2.1.2 and Figure 2-1. Valid values are between 0 (no delay) and 95 (9500 milliseconds).

Example:

To set the transmission delay to 1 second (10 100-millisecond units), type the four characters: MC Sp . *.

Initiate Break	k		D	MC rub	127	

Causes a 'break' or high level on the requesting communication line (keyboard's communication line if requested from the keyboard) for approximately 300 milliseconds.

Break can be initiated from the keyboard by pressing the BREAK key or by typing the sequence above.

This function has no effect in Local mode.

1	2	3	4	5	6	7
Display Width to 80 Columns			WA	MC !	33	

Changes the terminal's display width from 132 to 80 columns. If the current width is 80 columns, this command has no effect. Otherwise, the following occurs:

- The right-most 52 display columns are truncated.
- All windows are reset to the full display memory.
- All lines of display memory are saved.
- The bottom portion of memory is cleared.
- If any cursor was physically in columns 80-131, it will be moved left to column 79.
- All cursors after the adjustment above will remain physically in the same place in display memory.
- The status line will be cleared.

Display Width to 132 Columns			WA	MC "	34	

Changes the terminal's display width from 80 to 132 columns. If the current width is 132 columns, this command has no effect. Otherwise, the following occurs:

- The right-most 52 display columns are cleared.
- All windows are reset to the full display memory.
- If 'n' is the number of display pages allocated, then the previous 14n display lines are saved. If the cursor is within the beginning 14n lines, the first 14n lines are saved.
- If any cursor was beyond line 14n it will be moved up to line 14n-1.
- All cursors after the adjustment above will remain physically in the same place in display memory.
- The status line will be cleared.

Define Window		P	W	MC v	118	line, col, lns, cls

Defines a new window with home position of 'line', 'col' that is 'lns' lines long and 'cls' columns wide. The cursor is moved to the new home position.

The new window definition applies to the Window Number currently selected by the requesting device. The default is for all devices to use Window Number 0.

Input Parameters:

'line' - the line number of the home position. This is a numerical parameter as described in Section 2.1.2 and Figure 2-1. Numbering is relative to zero (the first line of the screen is number 0). The number must be greater than or equal to zero and less than the number of display lines allocated.

'col' - the column number of the home position. This is a numerical parameter as described in Section 2.1.2 and Figure 2-1. Numbering is relative to zero (the first column of the screen is number 0). The number must be greater than or equal to zero and less than the number of columns of display width currently configured.

'lns' - the number of lines in the window. This is a numerical parameter as described in Section 2.1.2 and Figure 2-1. The number must be greater than zero and less than or equal to the number of display lines currently allocated.

'cls' - the number of columns in the window. This is a numerical parameter as described in Section 2.1.2 and Figure 2-1. The number must be greater than zero and less than or equal to the number of columns of display width currently configured.

Example:

To define a window in the home position with 24 lines and 80 columns, type the six characters: MC v Sp Sp 8 p.

To define a window in the home position with 96 lines and 40 columns, type the seven characters: MC v Sp Sp ^A Sp H.

Page Up	K	W	MC .	46	

Moves the display up 24 lines. The display, however, will not move above the first line of the window currently used by the keyboard or the top line of display memory.

Page Down	k	W	MC -	45	

Moves the display down 24 lines. The display, however, will not move beyond the last line of the window currently used by the keyboard or the bottom line of display memory.

Scroll Up	K	W	MC \	92	

Moves the display up one line. The display, however, will not move above the first line of the window currently used by the keyboard or the top line of display memory.

Scroll Down	k	W	MC [	91	

Moves the display down one line. The display, however will not move beyond the last line of the window currently used by the keyboard or the bottom of display memory.

Start of Screen		P	W	MC V	86	line

Sets the first line of the display area to 'line', subject to 24 lines being available for display and at least one line of the window currently used by the keyboard being displayed.

Input Parameter:

'line' - the desired first line. Line numbering begins at zero (0), and is relative to the beginning of physical display memory. This is a numerical parameter as described in Section 2.1.2 and Figure 2-1.

Example:

Assuming the keyboard's window is defined to be a 96-line window, to cause the Start of Screen to be line 24 (that is, the second page of memory), type the three characters: MC V 8.

SEE APPENDIX G: Reset All Windows and Define Relative Window.

V3 Change

3.11 Function Keys and Stored Data Commands

1	2	3	4	5	6	7
Display Function Key		P	W	MC 2	50	k

Displays the contents of the key identified by 'k', starting at the current cursor position. The display starts with a fixed delimiter ('|') and a character which indicates the mode of the key: 'T' = Transmit mode; 'X' = Execute mode. In APL, the equivalent characters (⊃ and ~) are displayed. The actual contents of the key is then displayed in Transparent mode, followed by the same delimiter ('|'). An unprogrammed (default) key will be displayed as '|X|' or '|T|'.

The Alert Line will automatically be displayed to show the key being displayed and the remaining function key space, in terms of blocks (256 characters per block) and characters.

Input Parameter:

'k' - the key to be displayed. See Figure 3-3 for the format. If requested from the keyboard, the actual function key may be depressed.

Program Function Key - Screen		P	W	MC 6	54	k

Defines a character sequence to be associated with a programmable function key. The current cursor position is placed under the initial delimiter (any character). The next character may be used to indicate the mode of the key: 'T' = Transmit mode; 'X' = Execute mode; any other character implies execute mode and is taken as part of the actual character sequence. In APL, the equivalent characters (⊃ and ~) must be entered. Note that 't' and'x' do NOT indicate a specific mode. All characters which follow, up to but not including the ending delimiter, are taken as part of the character sequence. The ending delimiter is the first character encountered which matches the initial delimiter. The function will wraparound at the end of each line to the next line, and at the end of the window to the home position until a matching delimiter is found.

If the remaining function key space is less than the space needed to store the specified sequence, the bell will be sounded if requested from the keyboard (no response if requested from a communications line).

If the programmable Command Introducer character (default - escape, ASCII chart location 27) is read, it will be converted internally to a MULT CODE (MC) if Execute mode was specified.

Input Parameter:

'k' - indicates the key the sequence is to be associated with. See Figure 3-3 for the format. If requested by the keyboard the actual function key may be depressed.

Program Function Keys - General		P	T	MC 4	52	len,k,t,msg

Defines a character sequence to be associated with a programmable function key. If the programmable Command Introducer character (default - escape, ASCII chart location 27) is read within the sequence, it will be converted internally to a MULT CODE (MC) if Execute mode was specified. If the requested length is greater than the available space remaining, the command will be terminated after the mode parameter 't' (see below) is read.

Input Parameters:

'len' - the exact length of the message. This is a numerical parameter as described in Section 2.1.2 and Figure 2-1. Note that any length can be specified (even greater than 192) up to a maximum of 3071 (31*96 + 95) or the available function key space, whichever is less.

'k' - the key with which the message is to be associated. See Figure 3-3. If requested from the keyboard, the actual function key may be depressed.

't' - the mode of the key, as follows:

```
default transmit = Sp (ASCII chart location 32)
default execute  = ! (33)
transmit         = " (34)
execute          = # (35)
```

'msg' - the actual character message to be programmed on the key. This may consist of any combination of characters and/or command sequences. If the mode is set to default transmit (Sp) or default execute (!), a length of zero (Sp) should be used and no 'msg' should be entered.

Example:

To program F1 in Execute mode with the sequence 'logon', followed by a carriage return, type the 10 characters: MC & 5 # l o g o n ^M.

Figure 3-3

Function Key Parameters

KEY NUMBER	KEY	UNSHIFTED	SHIFTED
1	INSRT	0 (48)	Sp (32)
2	DEL CHAR	1 (49)	! (33)
3	LINE INS/DEL	2 (50)	" (34)
4	CLEAR EOL/EOP	3 (51)	# (35)
5	SEND	4 (52)	$ (36)
6	F1	5 (53)	% (37)
7	F2	6 (54)	& (38)
8	F3	7 (55)	' (39)
9	F4	8 (56)	((40)
10	F5	9 (57)	) (41)
11	F6	: (58)	* (42)
12	F7	; (59)	+ (43)
13	F8	< (60)	, (44)
14	F9	= (61)	- (45)
15	F10	> (62)	. (46)
16	F11	? (63)	/ (47)
17	F12	@ (64)	C (67)
18	F13	A (65)	D (68)
19	F14	B (66)	E (69)

The character to use is:

- Unshifted keys 1-19 (INSRT through F14) = ASCII chart locations 48-66

- Shifted keys 1-16 (INSRT through F11) = ASCII chart locations 32-47

- Shifted keys 17-19 (F12 through F14) = ASCII chart locations 67-69

Execute Function Key			D	MC Sp,e	32,101	k

'Executes' the specified function key. If the key is programmed in Execute mode, this is the same as if the programmed sequence were received from the requesting device. If the key is programmed in Transmit mode, the programmed sequence is transmitted to the requesting device (keyboard's communication line if requested by the keyboard).

Input Parameter:

'k' - the key to be executed. See Figure 3-3 for the format. If requested by the keyboard, the actual function key may be depressed.

Reset All Function Keys		P	T	MC $	36	

Resets all programmable function keys to their default sequences. See Figure 2-5 for the default sequences associated with each key.

Stored Data Display and Storage		P	WT	MC Sp,=	32,61	oper,k

Depending on the value of 'oper', either displays stored data values (that is, function key contents, latent expression or answerback message) on the screen or defines a character sequence to be associated with a stored data value. The values of 'oper' and the meanings are listed below:

Setup and Display Function Key - 'oper' = Sp (ASCII chart location 32): the terminal is changed to Local mode and Transparent mode and the current window is cleared using the Form Feed command. The contents of the key identified by the 'k' parameter are displayed, starting at the current cursor position (home). The command 'Display Function Key' defines the format of the display.

Display Function Key - 'oper' = ! (33): The contents of the key identified by the 'k' parameter are displayed, starting at the current cursor postion. See 'Display Function Key'.

Program Function Key - 'oper' = " (34): Defines a character sequence on the screen to be associated with a programmable function key. The processing is identical to the command 'Program Function Key - Screen' defined above.

Setup and Display Answerback Message - 'oper' = # (35): The terminal is changed to Local mode and Transparent mode and the current window is cleared using the Form Feed command. The contents of the current answerback message are displayed, starting at the current cursor position (home). The display starts with a fixed delimiter ('|'), followed by the actual contents of the key (displayed in Transparent mode), followed by the same delimiter ('|'). A default (no) answerback message will be displayed as '||'.

Display Answerback Message - 'oper' = $ (36): The contents of the current answerback message are displayed, starting at the current cursor position. The format of the display is defined above.

Program Answerback Message - 'oper' = % (37): Defines a character sequence to be saved as the terminal's answerback message. The current cursor position is placed under the initial delimiter (any character). All characters which follow, up to but not including the ending delimiter, are taken as part of the character sequence. The ending delimiter is the first character encountered which matches the initial delimiter. The function will wraparound at the end of each line to the next line, and at the end of the window to the home position until a matching delimiter is found. A maximum of 20 characters may be specified for the answerback message.

Setup and Display Latent Expression - 'oper' = & (38): The terminal is changed to Local mode and Transparent mode and the current window is cleared using the Form Feed command. The contents of the current latent expression are displayed, starting at the current cursor postion (home). The display format is the same as above.

Display Latent Expression - 'oper' = ' (39): The contents of the current latent expression are displayed, starting at the current cursor position. The format of the display is defined above.

Program Latent Expression - 'oper' = ((40): Defines a character sequence to be stored as the terminal's latent expression. The operation is the same as for 'Program Answerback Message' above. The maximum length of a latent expression is 80 characters. If the programmable escape character is read from the screen, it will be converted internally to a MULT CODE (MC).

If a 'program' operation has been requested and the space needed exceeds the maximum length allowed or available, the bell will be sounded if requested from the keyboard (no response if requested from a communications line).

NOTE: The Program Answerback Message and Program Latent Expression commands do NOT automatically change the values stored in nonvolatile memory; they must be stored explicitly via the Store Configuration (MC Sp S) command.

Input Parameters:

'oper' - the desired display/storage operation. Valid values are:

Setup and Display Function Key = Sp (ASCII chart location 32)
Display Function Key = ! (33)
Program Function Key = " (34)
Setup and Display Answerback Message = # (35)
Display Answerback Message = $ (36)
Program Answerback Message = % (37)
Setup and Display Latent Expression = & (38)
Display Latent Expression = ' (39)
Program Latent Expression = ((40)

'k' - the function key to be displayed/programmed. This parameter is required only for the first three (3) operations involving function keys. See Figure 3-3 for the format. If requested from the keyboard, the actual function key may be depressed.

Program Latent Expression		P	T	MC Sp,I	32,73	del,msg,del

Defines the terminal's latent expression to be the character sequence 'msg'. There is no default latent expression. For permanent storage, the latent expression must be stored in nonvolatile memory via the Store Configuration command (MC Sp S).

The latent expression stored in nonvolatile memory will be automatically executed by the terminal when the terminal is powered up or reset.

Input Parameters:

'del' - A delimiter character. Used in pairs to mark the beginning and end of a message. It may be any character, but must be different than every intervening character in the message.

'msg' - The actual latent expression including control codes and terminal command sequences. Maximum length is 80 characters. If the message length exceeds 80 characters, the first 80 characters will be used and the command will be terminated. When entering this command from the keyboard, the cursor pad keys, function keys, and the break and back tab keys should not be used.

Example:

To program the latent expression to program F1 in Execute mode with the message 'logon' followed by a carriage return, type the 16 characters: MC Sp I / MC 4 & 5 # l o g o n ^M /.

Execute Latent Expression		D	MC Sp,E	32,69	

Executes the terminal's latent expression, as defined by the Program Latent Expression or Stored Data Display and Storage commands above. Terminal commands and characters processed during the execution of the latent expression are executed as if they were received on the device which issued the Execute Latent Expression command.

Program Answerback Message		P T	MC Sp,H	32,72	del,msg,del

Defines the terminal's answerback message to be the character sequence 'msg'. There is no default answerback message. For permanent storage, the answerback message must be stored in nonvolatile memory via the Store Configuration command (MC Sp S).

Input Parameters:

'del' - A delimiter character. Used in pairs to mark the beginning and end of a message. It may be any character but must be different than every intervening character in the message.

'msg' - The answerback message including control codes such as carriage return, line feed etc. Maximum length is 20 characters. If the message length exceeds 20 characters, the first 20 characters will be used and the command will be terminated. When entering this command from the keyboard the cursor pad keys, function keys, and the break and back tab keys should not be used as they will not be interpreted correctly.

Example:

To program the answerback message to be 'C108' followed by a carriage return, type the 10 characters: MC Sp H / C 1 0 8 ^M /.

Transmit Answerback Message		D	^E	05	
(Alternate Form)		D	MC Sp,:	32,58	

Transmits the answerback message to the requesting communication line (the keyboard's communication line if requested from the keyboard). This message is created via the Program Answerback Message or the Stored Data Display and Storage commands above.

Store Communications Configuration in Nonvolatile Memory		T	MC Sp,C	32,67	

Saves the following settings in nonvolatile memory: baud rate, parity, stop bits and duplex (half or full), for all communication lines. This command will also change nonvolatile memory to Remote and Character modes. If unsuccessful, error number 6 will be displayed on the Alert Line.

Store Terminal Configuration in Nonvolatile Memory		T	MC Sp,S	32,83	

Saves the current terminal configuration as specified in Appendix B in nonvolatile memory. If unsuccessful error number 6 will be displayed on the Alert Line.

Display Terminal Configuration Stored in Nonvolatile Memory	P	W	MC Sp,a	32,97	

Displays the terminal configuration as stored in nonvolatile memory in a packed hexadecimal format. This format is detailed in Appendix B.

Reset Nonvolatile Memory to Factory Reset Configuration		T	MC Sp,~	32,126	

Resets nonvolatile memory to the factory reset configuration. This configuration is detailed in Figure 2-4. If successful the message 'Nonvolatile Memory Successfully Reset' will be displayed on the Alert Line; otherwise, error number 6 will be displayed.

Allocate Memory		P	T	MC Sp,/	32,47	pgs	

Allocates the terminal display memory between display pages and function key storage. The number of display lines and amount of available function key storage (in characters) for each configuration is as follows:

Pages	1	2	3	4	5	6	7	8
Display Lines								
80 columns	24	48	72	96	120	144	168	192
132 columns	N/A	28	42	56	70	84	98	112
Function Key Storage (total characters available)								
4 pages	11975	8087	4199	311	N/A	N/A	N/A	N/A
8 pages	28359	24471	20583	16695	12807	8919	5031	1143

The terminal will execute a full reset. This allocation may be stored in nonvolatile memory.

Input Parameter:

'pgs' - The number of pages of memory to be used for display. This is a numerical parameter, as described in Section 2.1.2 and Figure 2-1. An allocation request specifying one page with the terminal set to 132 columns is invalid and the request is ignored.

3.12 Keyboard Commands

1	2	3	4	5	6	7
Keyboard Lock		P	T	MC Sp,K	32,75	

Locks the keyboard. When a key is depressed, the bell rings. This mode can only be exited by turning the terminal off/on or receiving a Keyboard Unlock command on a communication line. This mode will NOT be stored in nonvolatile memory. Note that if the keyboard is locked and the bell is disabled, the keyboard user will not be able to tell directly that his input is being ignored.

Keyboard Unlock		P	T	MC Sp,k	32,107	

Unlocks the keyboard.

Keyboard Bell Enable		P	T	MC Sp,B	32,66	

Enables the keyboard bell.

Keyboard Bell Disable		P	T	MC Sp,b	32,98	

Disables the keyboard bell. The bell will not ring via the ^G command or through use of any terminal command which makes use of the bell.

Keyboard's Communication Line		P	T	MC Sp,)	32,41	dev

Specifies the communications line to which keyboard data are transmitted and to which 'transmission' commands apply when typed on the keyboard. This command changes the keyboard output network so that communication is set up with the specified device and communication is suspended with the original device. See Section 2.4.2. The factory reset value of the keyboard's communication line is the main communications line (Line 1).

The terminal will check for the presence of the CTS signal in response to a raised RTS if the CTS/RTS Protocol is on for the new communications line. If the CTS signal is not present, the keyboard bell will be sounded (if requested from the keyboard); however, the command will always be executed.

Input Parameter:

'dev' - the keyboard's communication line:

Line 1 = ! (ASCII chart location 33)
Line 2 = " (34)
Line 3 = # (35)

Set Cursor Pad to Transmit Mode		P	T	MC X	88

Sets the cursor pad keys as well as the Break and Back Tab keys to Transmit mode. In this mode, when a key is depressed, a single unique character identifier is transmitted, preceded by the keyboard's programmable escape message character (default - ESCAPE - ASCII chart location 27) and followed by the cursor pad end of message (CPEOM) message character, if defined (default - not defined). See Figure 2-7 for details.

Set Cursor Pad to Execute		P	T	MC x	120

Sets the cursor pad keys as well as the Break and the Back Tab keys to Execute mode. In this mode, when a key is depressed, the specified command is executed locally and no characters are transmitted.

Set Cursor Pad to Transmit and Execute Mode		P	T	MC Sp,X	32,88

Sets the cursor pad keys as well as the Break and Back Tab keys to Transmit and Execute mode. In this mode, the key identifying sequence is first transmitted and then the command is executed locally.

Disable Cursor Pad		P	T	MC Sp,\	32,92	

Disables all cursor pad keys as well as the Break and Back Tab keys. When one of these keys is struck, the keyboard bell is sounded and the key is ignored.

Set Cursor Pad Keys - General		P	T	MC Sp,x	32,120	ckey, clev, cmode

Allows individual cursor pad keys as well as the Break and Back Tab keys to be set to Transmit, Execute, Transmit and Execute, or Disable mode.

Input Parameters:

'ckey' - an individual cursor pad key. The possible keys, as labeled on the keyboard, the value for 'ckey', and the corresponding ASCII chart location are given below:

MULT-CODE	= Sp (32)	TAPE	= % (37)	↓	= * (42)
RESET/STAT	= ! (33)	←	= & (38)	TAB CLR/SET	= + (43)
PRINT	= " (34)	HOME	= ' (39)	BREAK	= , (44)
PAGE	= # (35)	→	= ((40)	BACK TAB	= - (45)
↑	= $ (36)	SCROL	=) (41)		

'clev' - The key level:

All levels	= Sp (ASCII chart location 32)
Unshifted	= ! (33)
Shifted	= " (34)
Control/unshifted	= # (35)
Control/shifted	= $ (36)

'cmode' - The key mode:

Transmit	= Sp (ASCII chart location 32)
Execute	= ! (33)
Transmit and execute	= " (34)
Disable	= # (35)

Example:

To disable the RESET key only (and not the STAT key), type the six characters: MC Sp x ! " #.

To disable all TAPE key functions, type the six characters: MC Sp x % Sp #.

Bell				^G	07	

Sounds the keyboard bell, if enabled.

NOTE: This command will be networked according to the output network specification of the input device.

1	2	3	4	5	6	7
(May not be supported in future products)						
Set Device Dependent			A	MC 3	51	

Selects Attribute List 0 (the default) for the requesting device.

This is the same as typing the four characters: MC Sp y Sp.

1	2	3	4	5	6	7
Set Device Independent			A	MC #	35	

Selects Attribute List 'n', with 'n' corresponding to the requesting device number as follows:

```
Requested by Keyboard => Select Attribute List 0 (MC Sp y Sp)
Requested by Line 1   => Select Attribute List 1 (MC Sp y !)
Requested by Line 2   => Select Attribute List 2 (MC Sp y ")
Requested by Line 3   => Select Attribute List 3 (MC Sp y #)
```

Then copies Attribute List 0 into Attribute List 'n' (MC Sp Y Sp).

1	2	3	4	5	6	7
Tie Window		P	W	MC q	113	tie

Selects the Window List as specified by the 'tie' parameter.

Input Parameter:

'tie' - the window to which to 'tie':

```
Keyboard (Sp) => Select Window currently selected by the keyboard
Line 1 (!)    => Select Window 1 (MC Sp z !)
Line 2 (")    => Select Window 2 (MC Sp z ")
Line 3 (#)    => Select Window 3 (MC Sp z #)
```

APPENDIX A

Character Sets

A.1 ASCII CHARACTER SET

FIGURE A-1

80-COLUMN ASCII CHARACTER SET

Standard character set. Control codes (characters 0-31 are displayable in transparent mode. Chart location is shown at top.

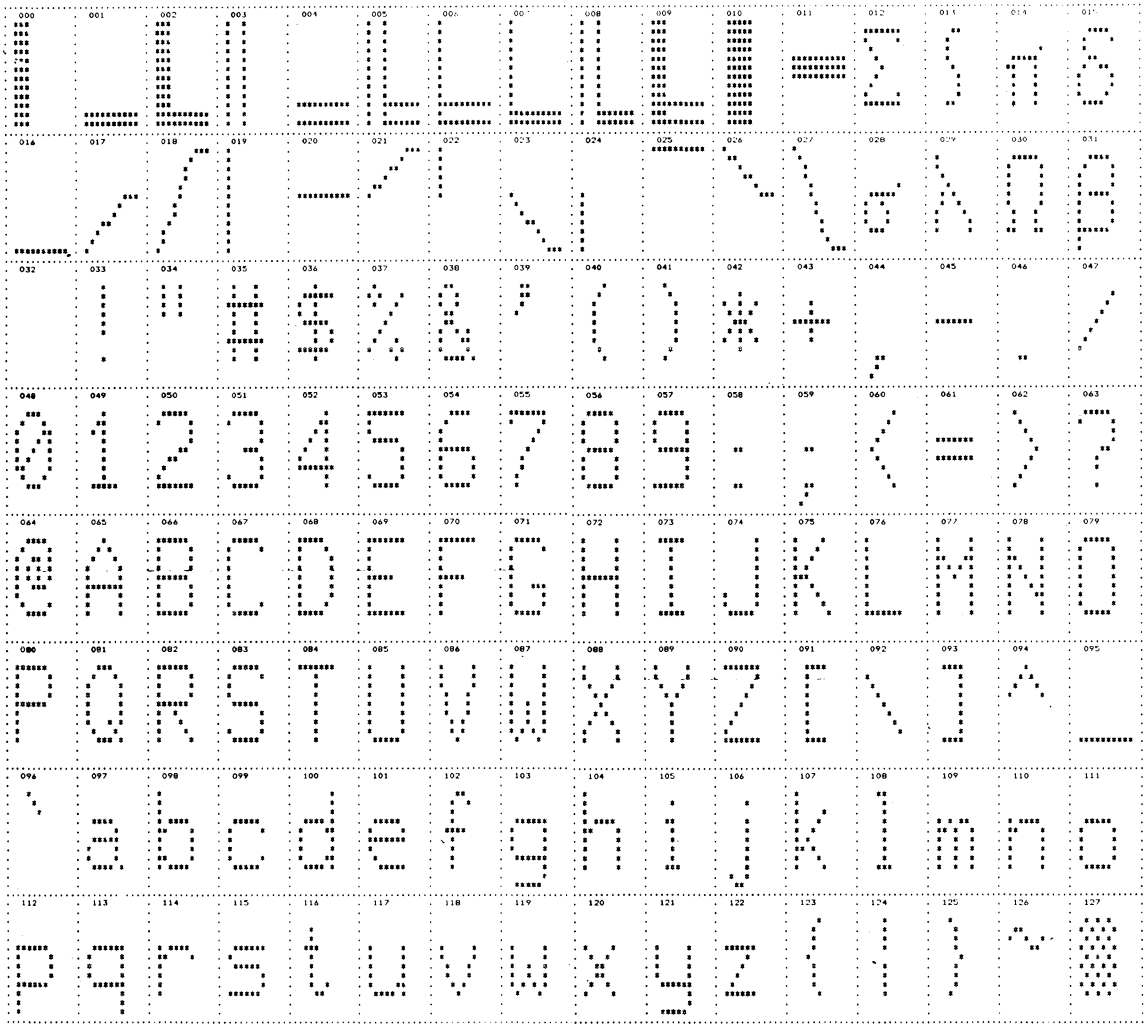
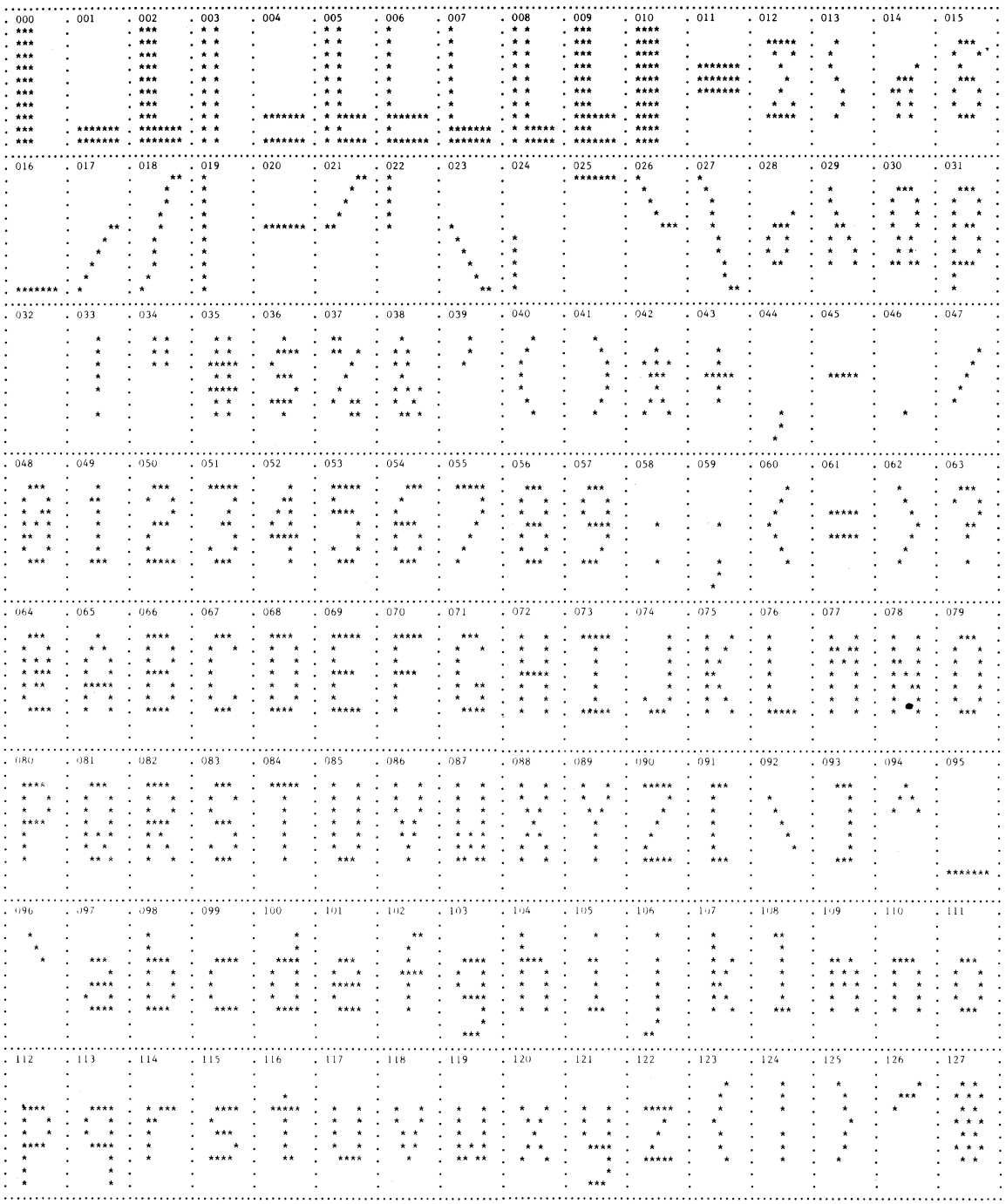


FIGURE A-2

132-COLUMN ASCII CHARACTER SET

Standard character set. Control codes (characters 0-31) are displayable in transparent mode. Chart location is shown at top.



A.2 APL Character Set

FIGURE A-3

80-COLUMN APL CHARACTER SET

Standard character set. Control codes (characters 0-31) are displayable in transparent mode. Chart location is shown at top.

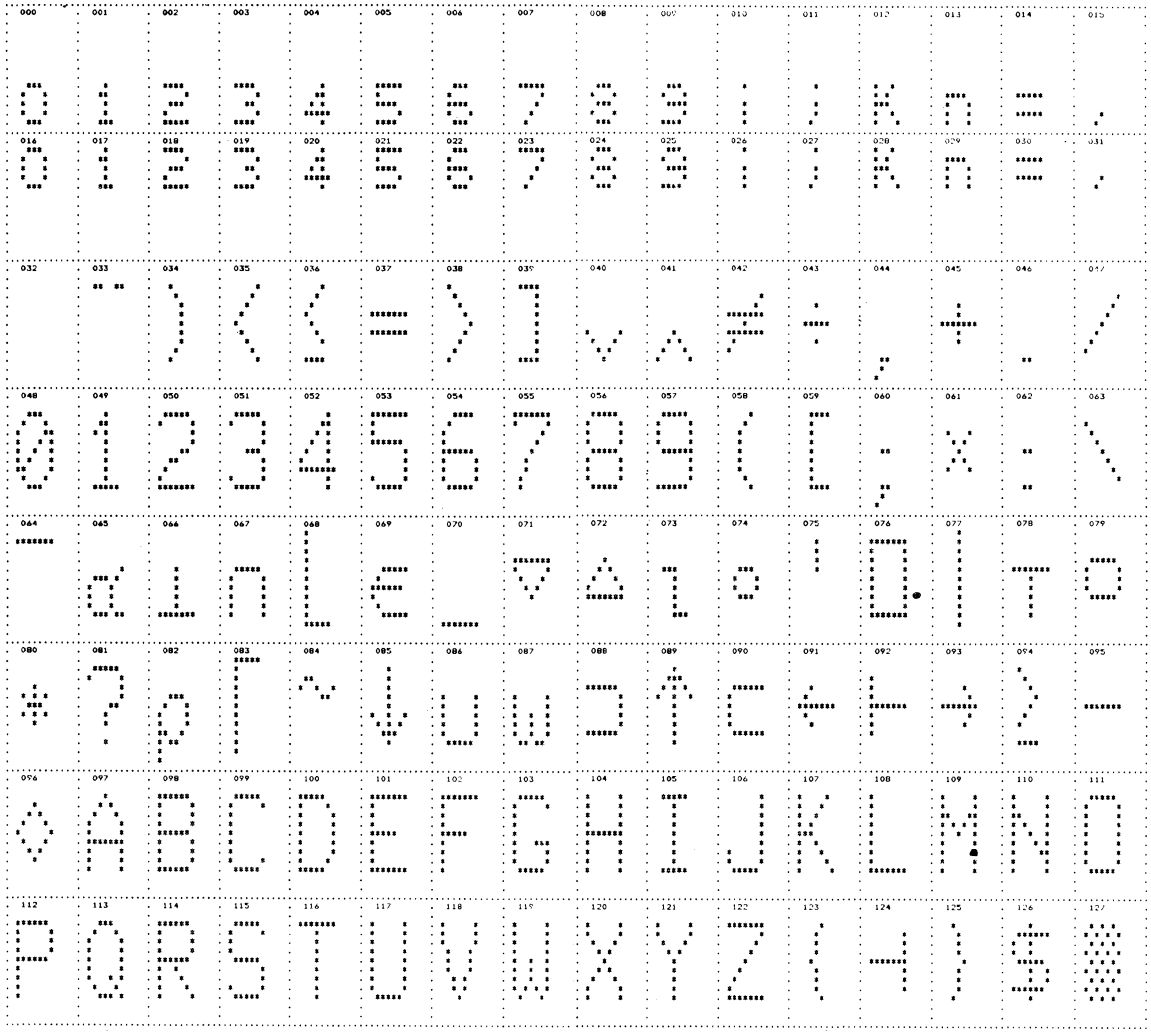


FIGURE A-4

132-COLUMN APL CHARACTER SET

Standard character set. Control codes (characters 0-31) are displayable in transparent mode. Chart location is shown at top.

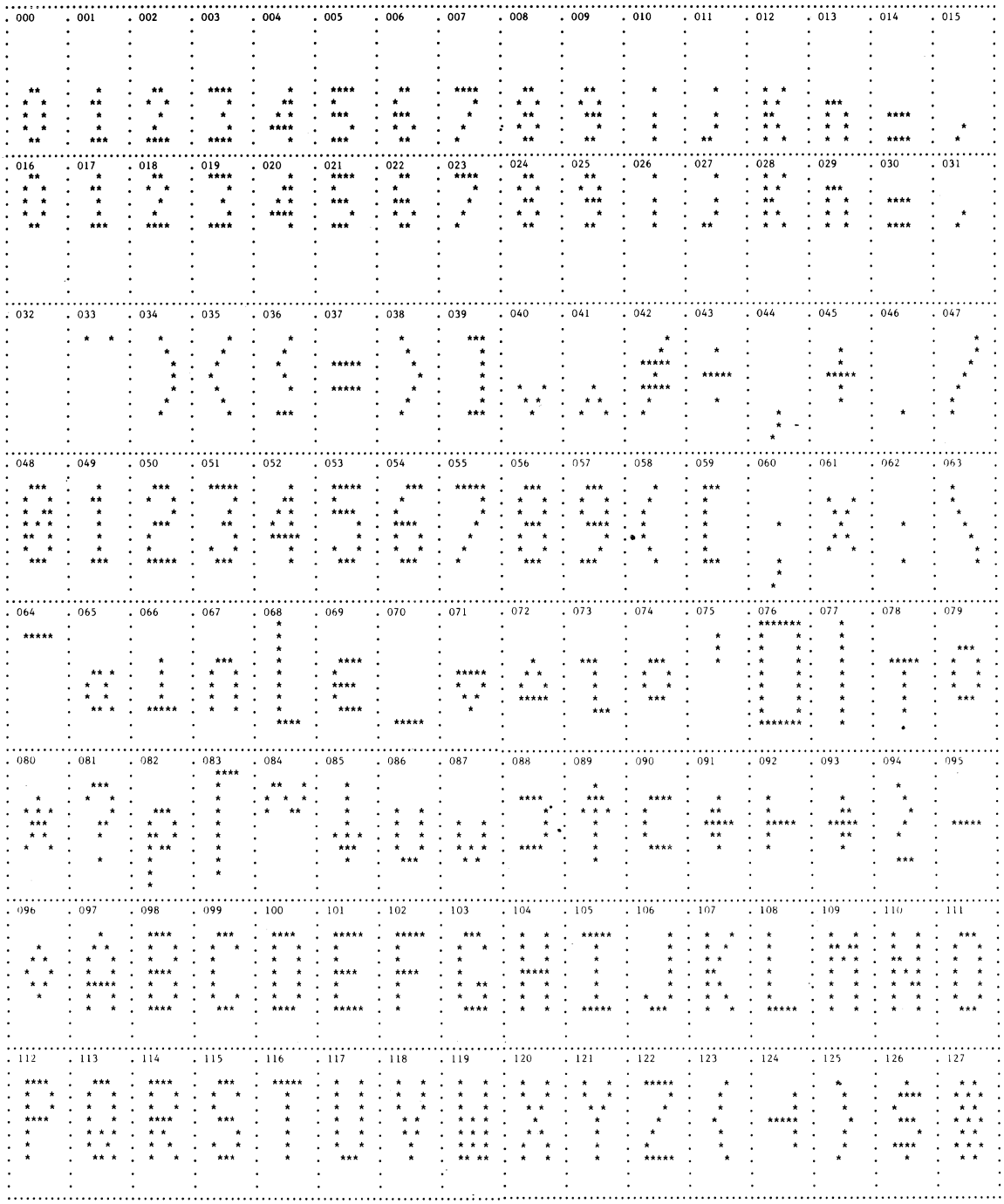


FIGURE A-5

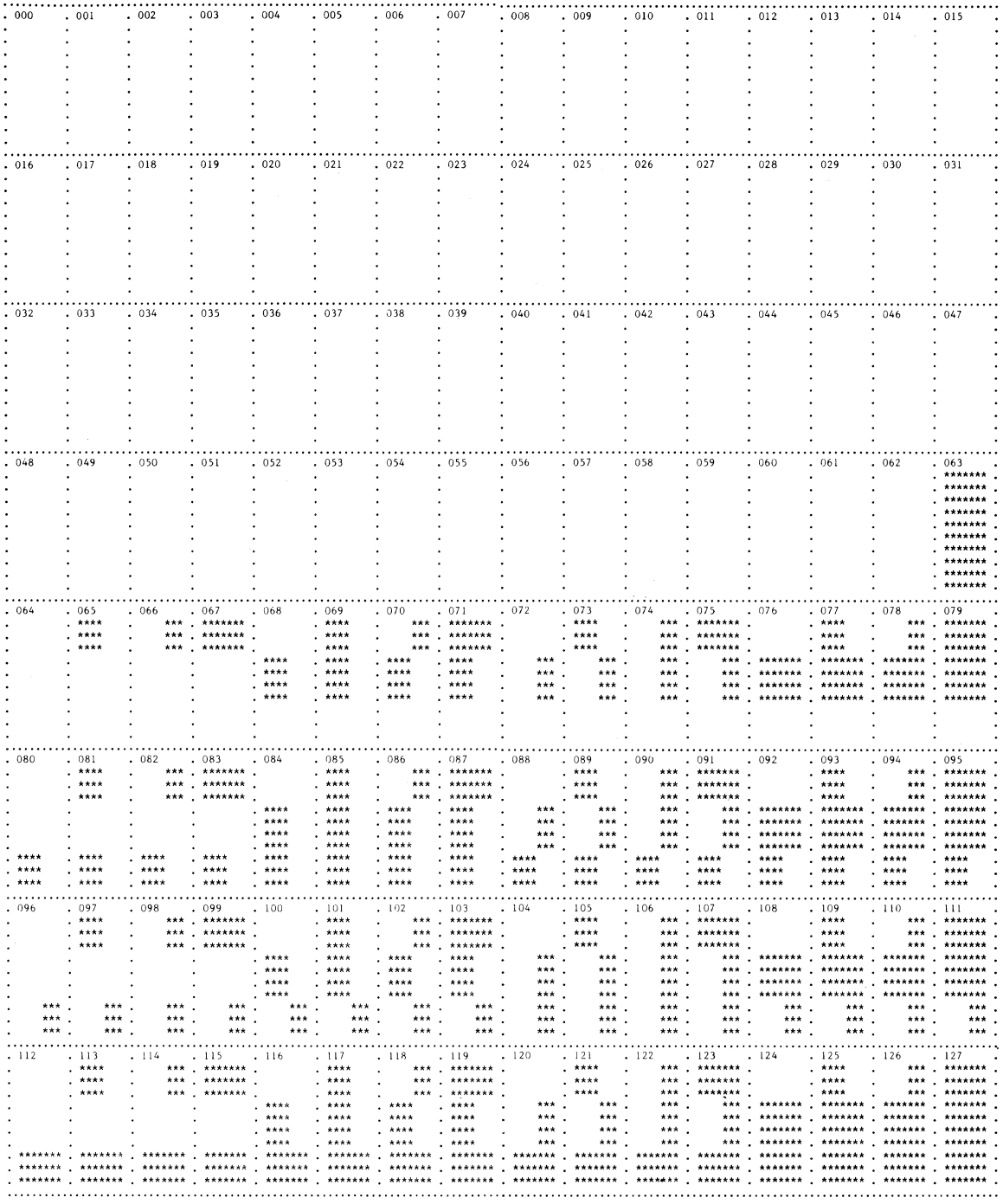
80-COLUMN GRAPHICS CHARACTER SET

Standard character set. Control codes (characters 0-31) are displayable in transparent mode. Chart location is shown at top.

FIGURE A-6

132-COLUMN GRAPHICS CHARACTER SET

Standard character set. Control codes (characters 0-31) are displayable in transparent mode. Chart location is shown at top.



A.4 Designing Your Own Character Set

This section will discuss the organization and construction of the concept 108 character sets. It is intended to assist those users who wish to create a customized character set.

When in 80 column mode, the terminal uses a '7x9' upper case character within a 10x12 dot cell. Lower case characters with descenders (gjpqy) use a '7x11'. The typical layout for a standard character is shown below (See also Figure A-7):

Dot row 1	-	Blank
Dot row 2	-	Character row 1
Dot row 3	-	Character row 2
Dot row 4	-	Character row 3
Dot row 5	-	Character row 4
Dot row 6	-	Character row 5
Dot row 7	-	Character row 6
Dot row 8	-	Character row 7
Dot row 9	-	Character row 8
Dot row 10	-	Character row 9
Dot row 11	-	Underline (attribute) and Lower Case Descender Character row 10
Dot row 12	-	Cursor (blinking underline) and Lower Case Descender Character row 11

Dot column 1	-	Character column 1
Dot column 2	-	Character column 2
Dot column 3	-	Character column 3
Dot column 4	-	Character column 4
Dot column 5	-	Character column 5
Dot column 6	-	Character column 6
Dot column 7	-	Character column 7
Dot column 8	-	Blank
Dot column 9	-	Same as dot column 8 (blank)
Dot column 10	-	Same as dot column 8 (blank)

Line drawing graphics characters use dot column 8 (and therefore 9 and 10) to generate continuous horizontal lines. Note that the duplication of the contents of column 8 into columns 9 and 10 is fixed (by hardware) and may not be changed by a redefinition of the character set. The dot rows used for the underline attribute (11) and the blinking underline cursor (12) are controlled by a special 32-byte PROM in hardware, which can be potentially modified for special purposes. This change would apply to ALL 7x9 character sets.

When in 132 column mode, the terminal uses a '5x7' character set within a 7x10 dot cell. Lower case characters with descenders use a '5x9'. The typical layout for a standard character is shown below (See also Figure A-8):

Dot row 1	-	Blank
Dot row 2	-	Character row 1
Dot row 3	-	Character row 2

Dot row 4	-	Character row 3
Dot row 5	-	Character row 4
Dot row 6	-	Character row 5
Dot row 7	-	Character row 6
Dot row 8	-	Character row 7
Dot row 9	-	Underline (attribute) and Lower Case Descender Character row 8
Dot row 10	-	Cursor (blinking underline) Lower Case Descender Character row 9

Dot column 1	-	Blank
Dot column 2	-	Character column 1
Dot column 3	-	Character column 2
Dot column 4	-	Character column 3
Dot column 5	-	Character column 4
Dot column 6	-	Character column 5
Dot column 7	-	Blank

Line drawing graphics characters use dot columns 1 and 7 to generate continuous horizontal lines. The dot rows used for the underline attribute (9) and the blinking underline cursor (10) are controlled by the same 32-byte PROM (as mentioned above), which can be modified independently of the 80 columns/7x9 settings. Again the change would apply to ALL 5x7 character sets.

PROM Organization

The storage media used in the terminal for the character sets is a custom-made 4096x8 (4K bytes) Read-Only Memory (ROM). The equivalent EPROM (Erasable Programmable ROM) is a TMS 2532, or any other compatible device, such as a MCM 2532 (Motorola). The Intel 2732 EPROM is NOT compatible.

Each ROM contains the definition of one character set for both 80 and 132 column modes. Each character occupies sixteen (16) 8-bit bytes in the PROM. Since there are 128 characters per character set, the total usage is:

16 bytes/character x 128 characters/set x 2 sets = 4096 bytes

The 80 column/7x9 character set is stored in the lower half of the ROM (locations 0-2047) and the 132 column/5x7 character set is stored in the upper half of the ROM (locations 2048-4095). The characters are stored in the ROM in numeric order within their respective 'half'. For example, a NULL (^@), with a decimal value of zero (0), is stored in locations 0-15 (80 columns) and 2048-2063 (132 columns). A capital 'A', with a decimal value of 65, is stored in locations 1040-1055 (80 columns) and locations 3088-3103 (132 columns).

Within the ROM a logical zero (0) implies that the dot should be 'on'; a logical one (1) implies that the dot should be 'off'. Since an erased EPROM has all values reset to '1', it would correspond to a totally 'blank' character set (all spaces). Within a byte, the high-order

(left-most) bit corresponds to the leftmost dot in the character. In 80 column/7x9 characters the first 8 columns (starting from the left) are specified by the user in the ROM; the contents of column 8 is automatically duplicated by the hardware into columns 9 and 10. In 132 columns/5x7 characters only the first 7 columns (starting from the left) are specified by the user in the ROM (that is, the 7 high-order bits of each byte).

In 80 column/7x9 characters, out of each 16 bytes allocated per character, the first 12 are specified by the user in the ROM; the last four (4) bytes for each character are ignored by the hardware and should all be 'off' (that is, logical 1's). In 132 column/5x7 characters, out of each 16 bytes allocated per character, the first 10 are specified by the user in the ROM; the last six (6) bytes for each character are ignored by the hardware and should all be 'off'.

See Figures A-9 and A-10 for binary coding examples.

Figure A-7 - 7x9 Character Example

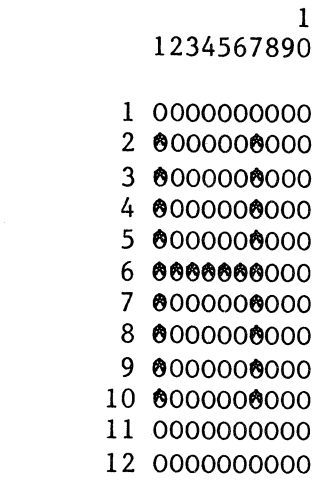


Figure A-8 - 5x7 Character Example

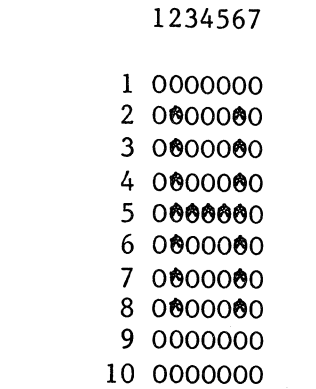


Figure A-9 - Binary Coding Example - 80 Columns

Line	Dots	Binary	Hex
1	0000000000	1111 1111	FF
2	●●●●●●●●●●	0000 0000	00
3	0000000●●●	1111 1110	FE
4	0●●●00●●●●	1000 1100	8C
5	0●●●●●●000	1000 0001	81
6	●0●0●0●000	0101 0101	55
-	-	-	-
-	-	-	-
13	-	1111 1111	FF
14	-	1111 1111	FF
15	-	1111 1111	FF
16	-	1111 1111	FF

Figure A-10 - Binary Coding Example - 132 Columns

Line	Dots	Binary	Hex
1	0000000	1111 1111	FF
2	●●●●●●●	0000 0001	01
3	000000●	1111 1101	FD
4	0●●●0●●	1000 1001	89
5	●0●0●0●	0101 0101	55
-	-	-	-
-	-	-	-
11	-	1111 1111	FF
12	-	1111 1111	FF
-	-	-	-
16	-	1111 1111	FF

APPENDIX B

Non-volatile Memory Display Format

The command sequence 'MC Sp a' displays the terminal configuration stored in non-volatile memory (NVM). The display is in hexadecimal notation, with the corresponding characters (ASCII) also displayed.

The display is organized with sixteen (16) bytes per line, together with the corresponding character equivalents. The display is 16 lines long, with the last line having only 15 bytes displayed (since only 255 bytes of NVM are used). Figure B-1 displays a sample NVM factory configuration for an 8-page terminal. Figure B-2 presents the format of the data as stored in NVM. Those items in Figures B-1 through B-5 with an asterisk (*) after their description contain some form of packed information, which is described below.

Text Tab Stops (TABSTP)

Each bit position corresponds to a logical column on the display. The bits are interpreted from left to right (high to low), with a '1' indicating that a tab has been set.

Device Tables (KBDTAB,U1DTAB,U2DTAB,U3DTAB)

Each device in the terminal contains information about the physical characteristics of that device, as well as information about its attributes, windows, etc. The contents of the device tables are shown in Figure B-3.

Window Tables (WDWTB0,WDWTB1,WDWTB2,WDWTB3)

The terminal allows for up to four (4) separate window/cursor definitions. Each device table contains a reference to one of these window tables. The contents of the window tables are shown in Figure B-4.

Attribute Lists (ATLST0,ATLST1,ATLST2,ATLST3)

The terminal allows for up to four (4) separate attribute lists to be maintained simultaneously. Each device table contains a reference to one of these attribute lists. The contents of the attribute lists are shown in Figure B-5.

System Status (SSTAT)

This variable describes overall system status information:

Bit 7 - Function key programming in progress (0/1, no/yes)
Bit 6 - CPU stack in use (0/1, no/yes)
Bit 5 - Character/Block mode (0/1, character/block)
Bit 4 - Full/half duplex (0/1, full/half)
Bit 3 - Suppress trailing blanks (0/1, no/yes)
Bit 2 - Remote/local mode (0/1, remote/local)
Bit 1 - Underline transmission as characters (0/1, no/yes)
Bit 0 - Form feed prior to print (0/1, no/yes)

Keyboard Status (KBDSTS)

Changed in V3 See App. G

This variable describes information about the keyboard.

Bits 7-5 - Unused
Bit 4 - Alert line displayable (0/1, yes/no)
Bit 3 - Unused
Bit 2 - Upper-lower/caps lock mode (0/1, upper-lower/caps lock)
Bit 1 - Bell enabled (0/1, no/yes)
Bit 0 - Keyboard enabled (0/1, no/yes)

Parity Checking on Input (PARCHK)

This variable indicates whether or not parity checking on input is enabled for the corresponding device; a '0' indicates disabled, and a '1' indicates enabled.

This variable and many others have a standard bit configuration to indicate the 'corresponding device', as follows:

Bits 7-5 - Unused
Bit 4 - Keyboard/display
Bit 3 - Line 1
Bit 2 - Line 2
Bit 1 - Line 3
Bit 0 - Unused

Hardware Control Register (PIBREG)

This variable interfaces to the terminal hardware to control various hardware-related features.

Bit 7 - Screen video (0/1, normal/reverse)
Bit 6 - Cursor (0/1, underline/block)
Bit 5 - Protected data (0/1, normal/half bright)
Bit 4 - Vertical sync time (0/1, no/yes)
Bit 3 - Display format (0/1, 80/132 columns)
Bit 2 - Meta key depressed (0/1, yes/no)
Bit 1 - Keyboard bell (normally 1; transition to 0 sound bell)
Bit 0 - Keyboard LED (0/1, off/on)

CTS/RTS Protocol (CTSRTS)

A '1' indicates that CTS/RTS protocol is enabled for the corresponding device; a '0' indicates that it is disabled.

Transmit Parity Control (TRNPAR)

A '0' indicates that the 8th data bit is set to '0' (space) for the data transmitted from the corresponding device; a '1' indicates that the 8th data bit is set to '1' (mark).

Buffer Overflow Control (XONXOF)

A '1' indicates that buffer overflow control is enabled for the corresponding device; a '0' indicates that it is disabled.

Device Number (TID)

A '1' indicates which device table this is.

Bit 4 - Keyboard
Bit 3 - Line 1
Bit 2 - Line 2
Bit 1 - Line 3

Communication Device (XMITMP)

A '1' indicates the device to which 'block' transmissions are sent. For the communications lines this is always equal to the Device Number (TID); for the keyboard this is the device changed by the 'Keyboard Communication Line' command. The format is the same as Device Number (TID).

Attribute List Reference (ATTNUM)

This variable indicates which attribute list is used by this device.

'E0' - Attribute list 0
'E8' - Attribute list 1
'F0' - Attribute list 2
'F8' - Attribute list 3

Network Word (MW1)

A '1' indicates that data received from this device is to be 'networked' to the corresponding device.

Device Characteristics (DCHAR)

This variable contains information about the physical characteristics of the device. For the keyboard, it contains the same information as the keyboard's communication line.

Bit 7 - Odd/even parity (0/1, odd/even)
Bit 6 - Data bits (0/1, 7/8; 8 used for mark/space parity only)
Bit 5 - Stop bits (0/1, 1/2 stop bits)
Bit 4 - Parity (0/1, off/on)
Bits 3-0 - Baud rate (0000 = 50 baud; . . . ; 1110 = 9600 baud)

Escape Character (ESCHAR)

The current value for this device's escape character.

Device Status (DSTAT)

This variable contains other device information.

Bit 7 - Insert mode (0/1, off/on)
Bit 6 - Insert in window/line (0/1, window/line)
Bit 5-4 - Unused
Bit 3 - Device is keyboard (0/1, no/yes)
Bits 2-0 - Unused

Window Status Byte (WSTAT)

A '1' in bit 0 indicates that this window table is being used by the keyboard.

Attribute Word (CSTAT)

This word contains the display attributes and character set.

Bit 7 - reverse video (0/1, off/on)
Bit 6 - Half-bright (0/1, off/on)
Bit 5 - Protection (0/1, on/off)
Bit 4 - Underline (0/1, off/on)
Bit 3 - Blink (0/1, off/on)
Bit 2 - Non-display (0/1, off/on)
Bit 1-0 - Character set (00, ASCII; 01, graphics; 11, APL)

Status Word 1 (STAT1)

This word contains various status information.

Bit 7 - Scroll/page mode (0/1, scroll/page)
Bit 6 - Text/form mode (0/1, text/form)
Bit 5 - Normal/overstrike (0/1, normal/overstrike)
Bit 4 - Auto linefeed (0/1, off/on)
Bit 3 - Auto tabs (0/1, off/on)
Bit 2 - Replace character mode (0/1, character and attribute/ attribute only)
Bit 1 - Transparent mode (0/1, off/on)
Bit 0 - User/programmer (0/1, user/programmer)

Status Word 2 (STAT2)

This word contains various status information.

Bits 7-1 - Unused
Bit 0 - Auto wraparound (0/1, off/on)

Figure B-1

Stored Configuration Display (Factory Reset)

```
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01  ................
01 10 08 00 E0 18 25 1B 20 00 01 08 08 08 00 E0  ....`.%. ......`
10 25 1B 20 00 01 00 04 04 00 E0 10 25 1B 20 00  .%. ......`.%. .
01 00 02 02 00 E0 10 25 1B 20 00 01 00 00 00 00  .....`.%. ......
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
00 A0 C0 00 00 C0 50 00 00 01 00 00 C0 50 00 00  . @..@P.....@P..
00 00 00 C0 50 00 00 00 00 00 C0 50 00 00 00 20  ...@P.....@P...
00 01 1B 20 00 01 1B 20 00 01 1B 20 00 01 1B 00  ... ... ... ....
00 00 00 00 00 20 FB 04 1A 03 00 02 06 08 50 C0  ..... {.......P@
00 00 00 00 00 06 15 00 17 0D 0D 1C 11 13 00 FF  ................
00 00 00 FF 00 00 00 00 00 00 00 00 00 00 00 00  ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 F0
```

Note: Control codes are displayed as a period ('.').

Figure B-2

Non-volatile Memory Format

ADDR	BYTES	NAME	DESCRIPTION
00	11	TABSTP	Text tab stops (*)
11	0B	KBDTAB	Keyboard device table (*)
1C	0B	U1DTAB	Line 1 device table (*)
27	0B	U2DTAB	Line 2 device table (*)
32	0B	U3DTAB	Line 3 device table (*)
3D	14	ANSBAK	Answerback message
51	02	KBDWDW	Keyboard window table
53	07	WDWTB0	Window table 0 (*)
5A	07	WDWTB1	Window table 1 (*)
61	07	WDWTB2	Window table 2 (*)
68	07	WDWTB3	Window table 3 (*)
6F	04	ATLST0	Attribute list 0 (*)
72	04	ATLST1	Attribute list 1 (*)
77	04	ATLST2	Attribute list 2 (*)
7B	04	ATLST3	Attribute list 3 (*)
7F	06	CPDMOD	Cursor pad modes (*)
85	01	CLRCHR	Clear character
86	01	CLRMSK	Clear mask (inverted)
87	01	CLRATT	Clear attribute
88	01	SSTAT	System status (*)
89	01	KBDSTS	Keyboard status (*)
8A	01	PARCHK	Parity checking on input (*)
8B	01	PIBREG	Hardware control register (*)
8C	01	CTSRTS	CTS/RTS protocol (*)

'ADDR' is the relative address, in hex, from the beginning of NVM

'BYTES' is the number of bytes, in hex, for this variable

'NAME' is the internal name used by the firmware

'DESCRIPTION' is the contents of that field. An asterisk (*) indicates that packed information is contained in this field

Figure B-2 (continued)

Non-volatile Memory Format

ADDR	BYTES	NAME	DESCRIPTION
8D	01	NPAGES	Display pages used
8E	01	NWIDTH	Display width
8F	01	NLINES	Display lines used
90	01	TRNDLY	Transmission delay
91	01	TRNPAR	Transmit parity control (*)
92	01	MGNBEL	Margin bell offset
93	01	ANSLNG	Length of answerback message
94	01	XONXOF	Buffer overflow control (*)
95	01	ACK	ACK character
96	01	NAK	NAK character
97	01	SOM	SOM character
98	01	EOF	EOF character
99	01	EOL	EOL character
9A	01	EOM	EOM character
9B	01	FKID	Function key lead-in character
9C	01	XON	XON character
9D	01	XOFF	XOFF character
9E	01	CPEOM	Cursor pad EOM character
9F	01	DELCHR	Delay character (*)
A0	03	CPDDIS	Cursor pad disabled modes (*)
A3	01	STSBAK	Background status line (*)
A4	01	LATLNG	Length of latent expression (*)
A5	50	LATADR	Latent expression
F5	08	-	Reserved
FE	01	NVRSUM	Checksum

'ADDR' is the relative address, in hex, from the beginning of NVM

'BYTES' is the number of bytes, in hex, for this variable

'NAME' is the internal name used by the firmware

'DESCRIPTION' is the contents of that field. An asterisk (*) indicates that packed information is contained in this field

Figure B-3 - Device Table

ADDR	BYTES	NAME	DESCRIPTION
00	01	TID	Device number (*)
01	01	XMITMP	Communication device (*)
02	01	WDWNUM	Window number
03	01	ATTNUM	Attribute list reference (*)
04	01	MW1	Network word (*)
05	01	DCHAR	Device characteristics (*)
06	01	ESCHAR	Escape character
07	01	CSTAT	Attribute word (*)
08	01	STAT1	Status word 1 (*)
09	01	STAT2	Status word 2 (*)
0A	01	DSTAT	Device status information (*)

Figure B-4 - Window Table

ADDR	BYTES	NAME	DESCRIPTION
00	01	WTOP	Top line in window
01	01	WLEFT	Leftmost column in window
02	01	WLINES	Number of lines in window
03	01	WWIDTH	Number of columns in window
04	01	XMTCOL	Start of print/transmit - column
05	01	XMTLIN	Start of print/transmit - line
06	01	WSTAT	Window status byte (*)

Figure B-5 - Attribute List

ADDR	BYTES	NAME	DESCRIPTION
00	01	CSTAT	Attribute word (*)
01	01	STAT1	Status word 1 (*)
02	01	STAT2	Status word 2 (*)
03	01	ESCHAR	Escape character

'ADDR' is the relative address, in hex, from the beginning of the table

'BYTES' is the number of bytes, in hex, for this variable

'NAME' is the internal name used by the firmware

'DESCRIPTION' is the contents of that field. An asterisk (*) indicates that packed information is contained in this field

APPENDIX C

Communications Interfaces

C.1 Basic Communications

The terminal transmits ASCII coded data in asynchronous format. Each character is transmitted serially and is composed of four (4) logical parts:

- Start bit (one bit, always present)
- Data bits (seven bits, always present)
- Parity bit (zero or one bits, depending on settings)
- Stop bits (one or two bits, depending on settings)

The various possible bit configurations and resultant character 'sizes' are shown in the table below:

CONFIGURATION		NUMBER OF BITS				
Parity	Stop Bits	Start	Data	Parity	Stop	Total
None	1	1	7	0	1	9
None	2	1	7	0	2	10
Odd	1	1	7	1	1	10
Odd	2	1	7	1	2	11
Even	1	1	7	1	1	10
Even	2	1	7	1	2	11
Mark	1	1	7	1	1	10
Mark	2	1	7	1	2	11
Space	1	1	7	1	1	10
Space	2	1	7	1	2	11

Signals are provided which conform to EIA standards for interfacing to data communications equipment. The back panel on the terminal contains from one to three 25 pin RS-232-C type connectors. They are male for Lines one (1) and three (3) and female for Line two (2); a six foot straight-through male-female extension cable is provided (for use with Line 1).

The table below lists the pin configuration, EIA circuit name, CCITT V.24 circuit name, and signal descriptions for all three communications interfaces.

Communications Interfaces Pin Assignments

Line	Pin Number	EIA Circuit	CCITT V.24	Description
1	1	AA	101	Protective Ground
	2	BA	103	Transmitted Data
	3	BB	104	Received Data
	4	CA	105	Request to Send (RTS)
	5	CB	106	Clear to Send (CTS)
	7	AB	102	Signal Ground
	20	CD	108	Data Terminal Ready (DTR)
2	1	AA	101	Protective Ground
	2	BB	104	Received Data
	3	BA	103	Transmitted Data
	4	CB	106	Clear to Send (CTS)
	5	CA	105	Request to Send (RTS)
	6	CC	107	Data Set Ready (DSR)
	7	AB	102	Signal Ground
	8	CF	109	Carrier Detect (CD)
3	1	AA	101	Protective Ground
	2	BA	103	Transmitted Data
	3	BB	104	Received Data
	4	CA	105	Request to Send (RTS)
	5	CB	106	Clear to Send (CTS)
	7	AB	102	Signal Ground
	20	CD	108	Data Terminal Ready (DTR)

Circuit Description

Protective Ground (AA,101) This conductor is electrically bonded to the machine frame.

Transmitted Data (BA,103) This conductor transmits data from the terminal to a mode, computer interface, or other communications device. The circuit is held in a marking condition during intervals between characters and at all times when no data are being transmitted. If the CTS/RTS Protocol is ON for this line, the Clear to Send circuit (CB,106) must be ON for data transmission to occur.

Received Data (BB,104) Signals on this circuit are received input from the modem, computer interface, or other communications device.

Request to Send (CA,105) When ON, this signal, which is generated by the terminal, indicates that the terminal is prepared to transmit data. The Request to Send line is maintained in an ON condition by the terminal if either of these conditions applies:

- The CTS/RTS Protocol is OFF for this line.
- This line is enabled in the network words of any device within the terminal.

Clear to Send (CB,106) When on, this signal, which is generated by the data communications equipment, indicates the data set is ready to transmit data. If the CTS/RTS Protocol is ON for this line, this signal is required for transmission of data and for successful 'attaching' of this line as an output device (via the Set Output Network, Attach Printer/Tape commands, for example).

Signal Ground (AB,102) This conductor establishes the common ground reference potential for all interchange circuits. This conductor is internally connected to protective ground (CA,101).

Data Terminal Ready (CD,108) This signal, provided by the terminal, is used to control switching of the data communications equipment to the communications channel. This circuit is held in the ON condition at all times when the terminal is powered up.

Data Set Ready (CC,107) and Carrier Detect (CF,109) These signals, provided by the terminal, are used to control switching of the data communications equipment to the communications channel. These circuits are internally jumpered together and are held in the ON condition at all times when the terminal is powered up.

C.2 Current Loop (20 Milliamp) Interface Option

When the CONCEPT terminal is ordered with the 20ma current loop option, it can be configured to operate in any of three modes - 20ma active, 20ma passive or RS-232 compatible. The mode selection is accomplished by setting two sets of DIP switches which are located on the interface option circuit board (mounted on the main circuit board inside the terminal case). The DIP switches are located on the top right hand corner of the circuit board in locations 'S1' and 'S2' (S1 is on top). DIP switch S1 controls the 'receive' line mode and S2 controls the 'transmit' line mode. The following tables specify the switch configurations for the three modes of operation; a '1' indicates the switch should be on; a '0' indicates the swtich should be off; and a 'X' indicates the switch is not used and may be in any position:

DIP Switch S1 (Receive)

	1	2	3	4	5	6	7	8
RS-232	0	0	0	0	0	0	1	X
20ma Passive	0	1	0	1	0	1	0	X
20ma Active	1	0	1	0	1	1	0	X

DIP Switch S2 (Transmit)

	1	2	3	4	5	6	7	8
RS-232	0	0	0	0	0	1	X	X
20ma Passive	0	1	0	1	0	0	X	X
20ma Active	1	0	1	0	1	0	X	X

The communication interface connector on terminals equipped with the 20ma current loop option is the standard 25-pin male connector, as defined above. The current loop signals are on the following pins:

Terminal Transmit +	Pin 18
Terminal Transmit -	Pin 25
Terminal Receive +	Pin 10
Terminal Receive -	Pin 11

APPENDIX D

Timing Considerations

In general, the CONCEPT terminal can process incoming data at a rate which does not require the insertion of fill characters or the execution of program delays. However, there are a few operations which involve moving a significant amount of data around and for which timing considerations are important.

D.1 Fill Characters

A user's program can either send the specified number of 'fill' characters or delay for the equivalent amount of time. Since the number of fill characters is proportional to the baud rate, the user may extrapolate for baud rates not listed in the accompanying tables.

A fill character can be a RUBOUT (ASCII chart location 127) or any control code (ASCII chart locations 0-31) which does not act as a command on the CONCEPT terminal (or does not have a special meaning if sent from the host computer). For example, a NUL (^@, ASCII chart location 0) may usually be used, but an ENQ (^E, ASCII chart location 5) should not be used, since it will cause the answerback message to be transmitted. Fill characters are read, processed and networked like any other characters. However, as long as the terminal is not in Transparent mode and the characters do not execute a terminal command, they are in essence ignored.

The CONCEPT terminal allows the user to specify a special programmable 'delay' character to be used exclusively for timing delays. When this character is received from a communications line it is immediately ignored, thereby reducing the overhead normally associated with processing and networking a character. If the delay character is specified and used, the values given in the accompanying charts may be approximately 10% less than the indicated values. Note that if a delay character is specified, it cannot be used in command sequences either as a command identifier or as a parameter.

D.2 Input Buffers

Each communications line in the terminal has an input buffer (255 characters for Line 1; 127 characters for Lines 2 and 3). This buffer is used to store incoming data if the terminal is 'busy' at the time the character is received. This will happen whenever the terminal is processing a command sequence which takes more than one character time to complete. To a degree, this allows the user to ignore timing considerations, since the timing charts assume a worst case situation in which the input buffer is totally full.

For example, assume we are executing a command from Line 1 that takes 200 character times to complete. Since the input buffer on Line 1 is 255 characters long, approximately 55 more characters could be received without the need for fill characters or delays. However, if 100 more characters were sent, some portion of them would be lost.

It is strongly recommended that all users adhere to the timing requirements stated in this Appendix. A system MAY work without fill characters, but there are no guarantees. A change in the workload on the host computer could cause a new problem which may have not been detected before. Problems arise when the user changes from a 300 baud, 4 page application (where the timing considerations are relatively minimal) to a 1200 baud, 8 page application, which may take 4-8 times as many fill characters depending on the commands used.

D.3 Buffer Overflow Control

Buffer Overflow Control provides one method for users to ignore timing considerations. If enabled, the terminal will transmit the programmable XOFF character (default ^S, ASCII chart location 19) when an input buffer is half full. When the buffer drops back to one-quarter full, the programmable XON character (default ^Q, ASCII chart location 17) is sent. If this protocol is supported by the host computer, the programmer will be able to ignore fill character requirements. This protocol operates on each communications line separately so that multiple computer applications can be supported.

The user should be sure that the particular application being run will ignore XON/XOFF characters transmitted by the CONCEPT terminal. Various text editors, for example, use ^S and ^Q as commands. In these cases Buffer Overflow Control may be disabled and re-enabled for other applications.

D.4 Fill Character Requirements - 80 Column Display

Figure D-1

Timing Chart - 80 Column Display

COMMAND/CONDITION	BAUD RATE					
	300	1200	2400	4800	9600	
Display Width to 132 Columns . full width window . line feed has not occurred in last line of window (scroll not performed)	0	2	4	8	16	
Display Width to 132 Columns . full width window . line feed has occurred in last line of window (scroll performed)	4	8	36	72	144	
Reset, Allocate Memory . 4 physical pages of memory	5	18	36	72	144	
Reset, Allocate Memory . 8 physical pages of memory	7	30	60	120	240	
Self Test - RAM . per physical page available	5	22	44	88	176	
Self Test - ROM	12	52	110	230	470	
Self Test - NVM	0	0	1	4	12	
Line Feed in Last Line of Window (Scrolling) . full-width (80 column) window . per page scrolled	0	0	0	0	1	
Line Feed in Last Line of Window (Scrolling) . not a full-width window . per page (24 lines) scrolled	1	4	8	16	32	
Insert Line, Delete Line, Reverse Line Feed . per page (24 lines) scrolled	1	4	8	16	32	
Insert Line, Delete Line, Reverse Line Feed . not a full-width window . per page (24 lines) scrolled	1	4	8	16	32	V3 Change
Insert Line, Delete Line, Reverse Line Feed . full-width (80 column) window . per page (24 lines) scrolled	0	0	0	1	2	V3 Change

Timing Chart - 80 Column Display (contd.)

COMMAND/CONDITION	BAUD RATE				
	300	1200	2400	4800	9600
Tab, Back Tab . Text mode . tabbing over 80 characters	0	0	0	2	4
Tab, Back Tab . Form mode . tabbing over 80 characters	0	0	2	4	8
End of Text . per page of text scanned (24x80)	2	6	12	24	48
Form Feed . per page (24 lines) cleared	1	4	8	18	36
Clear to End of Line/Field . 80 columns cleared	0	0	0	2	6
Clear to End of Window . per page (24 lines) cleared	3	13	26	52	104
Set Attribute of Block . per page (24x80) changed	0	1	2	4	8
Repeat Character Horizontal . repeat count of 80	0	0	0	1	3
Repeat Character Vertical . repeat count of 24	0	1	2	4	8
Delete/Insert Character in Line/Field/Window . per line (80 characters) moved	0	0	1	2	4
Store Terminal Configuration, Store Communications Configuration, Factory Configuration Reset	0	1	4	10	25
Display Function Key . 80 characters displayed	0	0	1	8	18

D.5 Fill Character Requirements - 132 Column Display

Figure D-2

Timing Chart - 132 Column Display

COMMAND/CONDITION	BAUD RATE					
	300	1200	2400	4800	9600	
Display Width to 80 Columns . full width window . line feed has not occurred in last line of window (scroll not performed)	0	2	4	8	16	
Display Width to 80 Columns . full width window . line feed has occurred in last line of window (scroll performed)	4	8	36	72	144	
Reset, Allocate Memory . 4 physical pages of memory	5	18	36	72	144	
Reset, Allocate Memory . 8 physical pages of memory	7	30	60	120	240	
Self Test - RAM . per physical page available	8	33	66	132	264	
Self Test - ROM	18	78	165	345	705	
Self Test - NVM	0	1	2	6	18	
Line Feed in Last Line of Window (Scrolling) . full-width (132 column) window . per page scrolled	0	0	0	1	2	
Line Feed in Last Line of Window (Scrolling) . not a full-width window . per page (24 lines) scrolled	3	9	18	36	72	
Insert Line, Delete Line, Reverse Line Feed . per page (24 lines) scrolled	3	9	18	36	72	
Insert Line, Delete Line, Reverse Line Feed . not a full-width window . per page (24 lines) scrolled	3	9	18	36	72	V3 Change
Insert Line, Delete Line, Reverse Line Feed . full-width (132 column) window . per page (24 lines) scrolled	0	0		2	4	V3 Change

Timing Chart - 132 Column Display (cont.)

COMMAND/CONDITION	BAUD RATE				
	300	1200	2400	4800	9600
Tab, Back Tab . Text mode . tabbing over 132 characters	0	0	2	4	8
Tab, Back Tab . Form mode . tabbing over 132 characters	0	2	4	8	16
End of Text . per page of text scanned (24x132)	3	9	17	34	68
Form Feed . per page (24 lines cleared)	2	8	16	36	72
Clear to End of Line/Field . 132 columns cleared	0	0	2	6	12
Clear to End of Window . per page (24 lines) cleared	5	23	46	92	184
Set Attribute of Block . per page (24x132) changed	1	3	6	11	22
Repeat Character Horizontal . repeat count of 132	0	0	1	4	8
Repeat Character Vertical . repeat count of 24	0	2	4	8	16
Delete/Insert Character in Line/Field/Window . per line (132 characters) moved	0	0	2	4	8
Store Terminal Configuration, Store Communications Configuration, Factory Configuration Reset	0	2	7	18	44
Display Function Key . 132 characters displayed	0	0	3	20	45

APPENDIX E

Summary of Escape Sequences and Control Codes

The tables below summarize in numerical order the control code and escape sequence functions. 'LOC' is the ASCII chart location of the control code or command identifier; 'SEQUENCE' is the equivalent ASCII character sequence; 'FUNCTION' is the name of the function; 'CATEGORY' is the name of the Chapter 3 section and 'PAGE' is the reference in that section where this function is defined.

Control Codes

LOC	SEQUENCE	FUNCTION	CATEGORY	PAGE
0	^@			
1	^A			
2	^B			
3	^C			
4	^D			
5	^E	Transmit Answerback Message	Function Keys	3-65
6	^F			
7	^G	Bell	Keyboard	3-70
8	^H	Backspace	Cursor Controls	3-18
9	^I	Tab	Cursor Controls	3-19
10	^J	Line Feed	Cursor Controls	3-18
11	^K			
12	^L	Form Feed	Editing	3-24
13	^M	Carriage Return	Cursor Controls	3-18
14	^N	APL Mode	APL/ASCII	3-7
15	^O	ASCII Mode	APL/ASCII	3-7
16	^P			
17	^Q	Resume Block Transmit	Transmission	3-52
18	^R			
19	^S	Suspend Block Transmit	Transmission	3-52
20	^T			
21	^U			
22	^V			
23	^W			
24	^X			
25	^Y			
26	^Z			
27	^[			
28	^\			
29	^]			
30	^^			
31	^_			

One-Character Escape Sequences

LOC	SEQUENCE	FUNCTION	CATEGORY	PAGE
0	MC ^@	Insert Mode off	Editing	3-24
1	MC ^A	Delete Character in Window	Editing	3-25
2	MC ^B	Delete Line	Editing	3-26
3	MC ^C	Clear Unprotected to EOW	Editing	3-26
4	MC ^D	Transmit Unprotected Window	Transmission	3-48
5	MC ^E	Clear All to EOW	Editing	3-27
6	MC ^F	Transmit All Window	Transmission	3-49
7	MC ^G	Set Insert Type	Editing	3-27
8	MC ^H	Define Clear Characteristics	Editing	3-28
9	MC ^I			
10	MC ^J			
11	MC ^K			
12	MC ^L			
13	MC ^M			
14	MC ^N			
15	MC ^O			
16	MC ^P	Insert Mode on	Editing	3-24
17	MC ^Q	Delete Char in Line/Field	Editing	3-25
18	MC ^R	Insert Line	Editing	3-25
19	MC ^S	Clear Unprotected to EOL/EOF	Editing	3-26
20	MC ^T	Trans Unprotected Line/Field	Transmission	3-47
21	MC ^U	Clear All to EOL/EOF	Editing	3-26
22	MC ^V	Transmit All Line/Field	Transmission	3-49
23	MC ^W			
24	MC ^X			
25	MC ^Y			
26	MC ^Z			
27	MC ^[			
28	MC ^\			
29	MC ^]			
30	MC ^^			
31	MC ^_			

One-Character Escape Sequences (continued)

LOC	SEQUENCE	FUNCTION	CATEGORY	PAGE
32	MC Sp	Two-Character Introducer		
33	MC !	Display Width 80 Columns	Screen Control	3-54
34	MC "	Display Width 132 Columns	Screen Control	3-54
35	MC #	Set Device Independent	C100/C104	3-71
36	MC $	Reset All Function Keys	Function Keys	3-61
37	MC %	Caps Lock	Mode Settings	3-15
38	MC &	Block Mode	Mode Settings	3-14
39	MC '	Back Tab	Cursor Controls	3-19
40	MC (	Local	Mode Settings	3-16
41	MC)	ASCII Mode	APL/ASCII	3-7
42	MC *	Half Duplex	Mode Settings	3-15
43	MC +	User Status	General	3-8
44	MC ,	Reset	General	3-4
45	MC -	Page Up	Screen Control	3-56
46	MC .	Page Down	Screen Control	3-56
47	MC /	Display/Transmit Status	Status	3-9
48	MC 0	APL Mode	APL/ASCII	3-7
49	MC 1	Start of Print/Transmit	Transmission	3-51
50	MC 2	Display Function Key	Function Keys	3-58
51	MC 3	Set Device Dependent	C100/C104	3-71
52	MC 4	Program Function Keys	Function Keys	3-59
53	MC 5	Upper/Lower Case	Mode Settings	3-15
54	MC 6	Program Function Key/Screen	Function Key	3-58
55	MC 7	Character Mode	Mode Settings	3-14
56	MC 8	Full Duplex	Mode Settings	3-15
57	MC 9	Remote	Mode Settings	3-15
58	MC :	One-Char. Introducer (MC)		
59	MC ;	Cursor Up	Cursor Controls	3-20
60	MC <	Cursor Down	Cursor Controls	3-20
61	MC =	Cursor Right	Cursor Controls	3-20
62	MC >	Cursor Left	Cursor Controls	3-20
63	MC ?	Home Cursor	Cursor Controls	3-20

One-Character Escape Sequences (continued)

LOC	SEQUENCE	FUNCTION	CATEGORY	PAGE
64	MC @	Attach Tape	Multiple Devices	3-43
65	MC A	Read Cursor Address	Cursor Controls	3-21
66	MC B	Auto Tab On	Mode Settings	3-17
67	MC C	Blink On	Display	3-31
68	MC D	Reverse Video On	Display	3-31
69	MC E	Half Bright On	Display	3-31
70	MC F	Form Mode	Mode Settings	3-13
71	MC G	Underline On	Display	3-31
72	MC H	Non-display On	Display	3-32
73	MC I	Protection On	Display	3-32
74	MC J	Set Attribute of Block	Display	3-35
75	MC K	Normal Screen Video	Display	3-33
76	MC L	Auto Linefeed On	Mode Settings	3-17
77	MC M	Half Bright Protected Fields	Display	3-33
78	MC N	Set Attribute Word	Display	3-34
79	MC O	Set Baud Rate	Transmission	3-44
80	MC P	Set Parity	Transmission	3-44
81	MC Q	Function Route	Multiple Devices	3-38
82	MC R	Repeat Character Vertical	Display	3-36
83	MC S	Scroll Mode	Mode Settings	3-14
84	MC T	Transparent Mode On	Mode Settings	3-16
85	MC U	Programmer Mode	Mode Settings	3-13
86	MC V	Start of Screen	Screen Control	3-57
87	MC W	Cursor to Blinking Block	Cursor Controls	3-22
88	MC X	Function Key Pad to Xmt	Function Keys	3-68
89	MC Y	Set Output Network	Multiple Devices	3-38
90	MC Z	Form Feed Prior to Prt On	Multiple Devices	3-43
91	MC [	Scroll Down	Screen Control	3-56
92	MC \	Scroll Up	Screen Control	3-56
93	MC]	Tab Set	Cursor Controls	3-19
94	MC ^	Detach Tape	Multiple Devices	3-43
95	MC _	Tab Clear	Cursor Controls	3-19

One-Character Escape Sequences (continued)

LOC	SEQUENCE	FUNCTION	CATEGORY	PAGE
96	MC	Message to Tape	Multiple Devices	3-43
97	MC a	Write Cursor Address	Cursor Controls	3-21
98	MC b	Auto Tab Off	Mode Settings	3-17
99	MC c	Blink Off	Display	3-31
100	MC d	Reverse Video Off	Display	3-31
101	MC e	Half Bright Off	Display	3-31
102	MC f	Text Mode	Mode Settings	3-13
103	MC g	Underline Off	Display	3-32
104	MC h	Non-display Off	Display	3-32
105	MC i	Protection Off	Display	3-32
106	MC j	Select Character Set	Display	3-32
107	MC k	Reverse Screen Video	Display	3-33
108	MC l	Auto Linefeed Off	Mode Settings	3-17
109	MC m	Norm Intensity Protect Flds	Display	3-33
110	MC n	Read Attribute Word	Display	3-34
111	MC o	Change Message Character	General	3-4
112	MC p	End of Text	Cursor Controls	3-22
113	MC q	Tie Window	Screen Control	3-71
114	MC r	Repeat Character Horizontal	Display	3-35
115	MC s	Page Mode	Mode Settings	3-14
116	MC t	Transparent Mode Off	Mode Settings	3-16
117	MC u	User Mode	Mode Settings	3-13
118	MC v	Define Window	Screen Control	3-55
119	MC w	Cursor to Blinking Underline	Cursor Control	3-22
120	MC x	Function Key Pad to Execute	Function Keys	3-68
121	MC y	Read Output Network	Multiple Devices	3-39
122	MC z	Form Feed Prior to Prt Off	Multiple Devices	3-43
123	MC {	Print to End of Window	Multiple Devices	3-41
124	MC |	Print to End of Line	Multiple Devices	3-42
125	MC }	Attach Printer	Multiple Devices	3-41
126	MC ~	Detach Printer	Multiple Devices	3-41
127	MC Rub	Initiate Break	Transmission	3-53

Two Character Escape Sequences

LOC	SEQUENCE	FUNCTION	CATEGORY	PAGE
32,0	MC Sp,^@			
32,1	MC Sp,^A			
32,2	MC Sp,^B			
32,3	MC Sp,^C			
32,4	MC Sp,^D			
32,5	MC Sp,^E			
32,6	MC Sp,^F			
32,7	MC Sp,^G			
32,8	MC Sp,^H			
32,9	MC Sp,^I			
32,10	MC Sp,^J			
32,11	MC Sp,^K			
32,12	MC Sp,^L			
32,13	MC Sp,^M			
32,14	MC Sp,^N			
32,15	MC Sp,^O			
32,16	MC Sp,^P			
32,17	MC Sp,^Q			
32,18	MC Sp,^R			
32,19	MC Sp,^S			
32,20	MC Sp,^T			
32,21	MC Sp,^U			
32,22	MC Sp,^V			
32,23	MC Sp,^W			
32,24	MC Sp,^X			
32,25	MC Sp,^Y			
32,26	MC Sp,^Z			
32,27	MC Sp,^[			
32,28	MC Sp,^\			
32,29	MC Sp,^]			
32,30	MC Sp,^^			
32,31	MC Sp,^_			

Two Character Escape Sequences (continued)

LOC	SEQUENCE	FUNCTION	CATEGORY	PAGE
32,32	MC Sp,Sp	Insert Mode Off	Editing	3-24
32,33	MC Sp,!	Delete Character in Window	Editing	3-25
32,34	MC Sp,"	Delete Line	Editing	3-26
32,35	MC Sp,#	Clear to EOW	Editing	3-26
32,36	MC Sp,$	Transmit Window	Transmission	3-48
32,37	MC Sp,%	Clear All to EOW	Editing	3-27
32,38	MC Sp,&	Transmit All Window	Transmission	3-49
32,39	MC Sp,'	Set Insert Type	Editing	3-27
32,40	MC Sp,(	Define Clear Characteristics	Editing	3-28
32,41	MC Sp,)	Keyboard Communication Line	Keyboard	3-67
32,42	MC Sp,*	Set Alert Line Message	Status	3-10
32,43	MC Sp,+	Set Margin Bell Offset	Editing	3-29
32,44	MC Sp,,	Set Transmission Delay	Transmission	3-52
32,45	MC Sp,-	Create Screen	Transmission	3-50
32,46	MC Sp,.	Status Line Display Off	Status	3-10
32,47	MC Sp,/	Allocate Memory	Function Keys	3-66
32,48	MC Sp,0	Insert Mode On	Editing	3-24
32,49	MC Sp,1	Delete Char in Line/Field	Editing	3-25
32,50	MC Sp,2	Insert Line	Editing	3-25
32,51	MC Sp,3	Clear to EOL/EOF	Editing	3-26
32,52	MC Sp,4	Transmit Line/Field	Transmission	3-47
32,53	MC Sp,5	Clear All to EOL/EOF	Editing	3-26
32,54	MC Sp,6	Transmit All Line	Transmission	3-49
32,55	MC Sp,7			
32,56	MC Sp,8			
32,57	MC Sp,9			
32,58	MC Sp,:	Transmit Answerback Message	Function Keys	3-65
32,59	MC Sp,;	Set Background Status Line	Status	3-11
32,60	MC Sp,<	Set Stop Bits	Transmission	3-45
32,61	MC Sp,=	Stored Data Display/Storage	Function Keys	3-61
32,62	MC Sp,>			
32,63	MC Sp,?	Self Test	General	3-3

Two Character Escape Sequences (continued)

	LOC	SEQUENCE	FUNCTION	CATEGORY	PAGE
V3 hange	32,64	MC Sp,@	Set Underline to Normal Char	Display	G-2
	32,65	MC Sp,A	Character/Attribute Display	Display	3-37
	32,66	MC Sp,B	Keyboard Bell Enable	Keyboard	3-67
	32,67	MC Sp,C	Store Communications Config.	Function Keys	3-65
	32,68	MC Sp,D	Scroll Status Line Backward	Status	3-8
	32,69	MC Sp,E	Execute Latent Expression	Function Keys	3-64
	32,70	MC Sp,F	Buffer Overflow Control On	Transmission	3-46
	32,71	MC Sp,G	Alert Line Displayable	Status	3-11
	32,72	MC Sp,H	Program Answerback Message	Function Keys	3-64
	32,73	MC Sp,I	Program Latent Expression	Function Keys	3-63
	32,74	MC Sp,J			
	32,75	MC Sp,K	Keyboard Lock	Keyboard	3-67
	32,76	MC Sp,L	Reverse Linefeed	Editing	3-18
V3 hange	32,77	MC Sp,M	Form Feed - Top of Page	Editing	G-2
	32,78	MC Sp,N			
	32,79	MC Sp,O			
	32,80	MC Sp,P	Parity Check on Input On	Transmission	3-46
	32,81	MC Sp,Q			
	32,82	MC Sp,R	Replace Character Only Mode	Display	3-37
	32,83	MC Sp,S	Store Configuration	Function Keys	3-65
	32,84	MC Sp,T	Trailing Blank Suppress On	Transmission	3-50
	32,85	MC Sp,U	Underline Transmission On	Transmission	3-51
	32,86	MC Sp,V	CTS/RTS Protocol On	Transmission	3-45
	32,87	MC Sp,W	Auto Wraparound On	Mode Setting	3-17
	32,88	MC Sp,X	Set Cursor Pad to Tran/Exec	Keyboard	3-68
	32,89	MC Sp,Y	Copy Attribute List	General	3-5
V3 hange	32,90	MC Sp,Z	Define Relative Window	Screen Control	G-3
	32,91	MC Sp,[			
	32,92	MC Sp,\	Disable Cursor Pad	Keyboard	3-69
	32,93	MC Sp,]			
V3 hange	32,94	MC Sp,^	Reset All Windows	Screen Control	G-3
	32,95	MC Sp,_	Clear All Tabs	Cursor Controls	3-19

Two Character Escape Sequences (continued)

LOC	SEQUENCE	FUNCTION	CATEGORY	PAGE	
32,96	MC Sp,`	Set Underline to Change Attr	Display	G-2	V3 Change
32,97	MC Sp,a	Display Stored Configuration	Function Keys	3-65	
32,98	MC Sp,b	Keyboard Bell Disable	Keyboard	3-67	
32,99	MC Sp,c				
32,100	MC Sp,d	Scroll Status Line Forward	Status	3-8	
32,101	MC Sp,e	Execute Function Key	Function Keys	3-61	
32,102	MC Sp,f	Buffer Overflow Control Off	Transmission	3-46	
32,103	MC Sp,g	Alert Line Not Displayable	Status	3-11	
32,104	MC Sp,h				
32,105	MC Sp,i				
32,106	MC Sp,j				
32,107	MC Sp,k	Keyboard Unlock	Keyboard	3-67	
32,108	MC Sp,l				
32,109	MC Sp,m	Form Feed - Clear Screen	Editing	G-2	V3 Change
32,110	MC Sp,n				
32,111	MC Sp,o				
32,112	MC Sp,p	Parity Check on Input Off	Transmission	3-46	
32,113	MC Sp,q				
32,114	MC Sp,r	Replace Char & Attr Mode	Display	3-36	
32,115	MC Sp,s				
32,116	MC Sp,t	Trailing Blank Suppress Off	Transmission	3-51	
32,117	MC Sp,u	Underline Transmission Off	Transmission	3-51	
32,118	MC Sp,v	CTS/RTS Protocol Off	Transmission	3-45	
32,119	MC Sp,w	Auto Wraparound Off	Mode Setting	3-16	
32,120	MC Sp,x	Set Cursor Pad Keys/General	Keyboard	3-69	
32,121	MC Sp,y	Attribute List Selection	General	3-5	
32,122	MC Sp,z	Window Selection	General	3-6	
32,123	MC Sp,{				
32,124	MC Sp,|				
32,125	MC Sp,}				
32,126	MC Sp,~	Factory Configuration Reset	Function Keys	3-65	
32,127	MC Sp,Rub				

APPENDIX F

Contents of Transmitted Status Requests

F.1 User Status Line Contents

COLUMN	CONTENTS	DESCRIPTION/POSSIBLE VALUES
2-3	Device	KB = keyboard L1 = Line 1 L2 = Line 2 L3 = Line 3
5-8	Baud Rate	
10-13	Duplex	FULL = full duplex HALF = half duplex
15-19	Stop Bits	1STOP = 1 stop bit 2STOP = 2 stop bits
21-24	Parity	NONE = no parity EVEN = even parity ODD = odd parity MARK = mark parity SPAC = space parity
26-28	Parity Checking on Input	OFF = no parity checking ON = parity checking
30-32	Remote/Local Mode	REM = Remote LOC = Local
34-37	User/Programmer Mode	USER = User PROG = Programmer
39-42	Block/Character Mode	BLOK = Block CHAR = Character
44-46	Upper-lower Case/Caps Lock	U/L = Upper-Lower CAP = Caps Lock
48-51	Cursor Position - Line	Followed by a delimiter (:)
52-54	Cursor Position - Column	

F.1 User Status Line Contents (cont'd)

Changed in V3 See App. G

COLUMN	CONTENTS	DESCRIPTION/POSSIBLE VALUES
56-58	Character Set	ASC = ASCII CH1 = alternate set 1 (graphics) CH2 = alternate set 2 CH3 = alternate set 3 APL = APL (character set 3 and overstrike mode enabled)
60-63	Window - Home (Line)	Followed by a delimiter (,)
64-67	Window - Home (Column)	Followed by a delimiter (,)
68-71	Window - Number of Lines	Followed by a delimiter (,)
72-74	Window - Number of Columns	
76-80	Software Version	
82-84	Display Width	080 = 80 columns 132 = 132 columns
86-92	Insert Mode	INS/OFF = insert mode off INS/ON = insert mode on
93-132	Unused	Spaces

Note: All unused columns are transmitted as spaces (ASCII chart location 32).

F.2 Programmer Status Line Contents

COLUMN	CONTENTS	DESCRIPTION/POSSIBLE VALUES
1	Device	K = keyboard 1 = Line 1 2 = Line 2 3 = Line 3
2	Communication Line	1 = Line 1 2 = Line 2 3 = Line 3
4	Remote/Local	R = Remote L = Local
5	User/Programmer	U = User P = Programmer
6	Block/Character	B = Block C = Character
8	Text/Form	T = Text F = Form
9	Scroll/Page	S = Scroll P = Page
10	Transparent Mode	T = on N = off
12-14	Cursor Position - Line	
16-18	Cursor Position - Column	
20	Attribute List Number	0-3
21	Window Number	0-3
22	Attribute Word	'w' parameter (See Fig. 3-1)
24	Network Word	'network' parameter (See Figure 3-2)
25	Character Set	0 = ASCII 1 = character set 1 (graphics) 2 = character set 2 3 = character set 3 (APL)
26	Display Pages Allocated	1-4 = four-page terminal 1-8 = eight-page terminal

F.2 Programmer Status Line Contents (cont'd)

COLUMN	CONTENTS	DESCRIPTION/POSSIBLE VALUES
28-30	Window - Home (Line)	
32-34	Window - Home (Column)	
36-38	Window - Number of Lines	
40-42	Window - Number of Columns	
44-46	Start of Screen	Line number (0 relative)
48	CTS/RTS Protocol	0 = off 1 = on
49	Upper-lower Case/Caps Lock	0 = Upper-Lower 1 = Caps Lock
50	Trailing Blank Suppression	0 = off 1 = on
52	Underline Transmission	0 = off 1 = on
53	Form Feed Prior to Print	0 = off 1 = on
54	Keyboard Bell	0 = disabled 1 = enabled
56	Insert in Line/Window	0 = window 1 = line
57	Parity Checking on Input	0 = off 1 = on
58	Buffer Overflow Control	0 = off 1 = on
60	Auto Linefeed	0 = off 1 = on
61	Auto Tabs	0 = off 1 = on
62	Replace Character Only / Character and Attribute	0 = replace character and attribute 1 = replace character only

F.2 Programmer Status Line Contents (cont'd)

COLUMN	CONTENTS	DESCRIPTION/POSSIBLE VALUES
63	Auto Wraparound	0 = off 1 = on
65	Clear Attribute	'w' input parameter (See Figure 3-1)
66	Clear Mask	'm' input parameter (See Figure 3-1)
67	Clear Character	
69-71	Margin Bell Offset	
73-75	Start of Print/Transmit - Line	
77-79	Start of Print/Transmit - Column	
81	Display Pages - Physical	4 = four page terminal 8 = eight page terminal
83-85	Display Lines Allocated	Display pages allocated (column 26) times 24 (80 column mode) or 14 (132 column mode)
87-89	Transmission Delay	100 milliseconds increments
90-132	Unused	Spaces

Note: All unused columns are transmitted as spaces (ASCII chart location 32).

F.3 Tabs Status Line Contents

COLUMN	CONTENTS	DESCRIPTION/POSSIBLE VALUES
1-132	Tab Set Indicator	period ('.') indicates a tab is set ; otherwise the units digit (0-9) of the current column number

F.4 Message Character Status Line Contents

COLUMN	CONTENTS	DESCRIPTION/POSSIBLE VALUES
2-3	Device	KB = keyboard L1 = Line 1 L2 = Line 2 L3 = Line 3
5-22	Status Line Name	'MESSAGE CHARACTERS'
24-26	Escape Character (ESC)	
28-30	Acknowledgement (ACK)	
32-34	Negative Acknowledgement (NAK)	
36-38	Start of Message (SOM)	
40-42	End of Field (EOF)	
44-46	End of Line (EOL)	
48-50	End of Message (EOM)	
52-54	Function Key Transmission Lead-in (FKID)	
56-58	Resume Transmission (XON)	
60-62	Suspend Transmission (XOFF)	
64-66	Cursor Pad End of Message (CPEOM)	
68-70	Delay Character (DELCHR)	

Note: All unused columns are transmitted as spaces (ASCII chart location 32).

F.5 Alert Line Contents

COLUMN	CONTENTS	DESCRIPTION/POSSIBLE VALUES
2-5	Keyboard Locked/Unlocked	LOCK = keyboard locked space = keyboard unlocked
41-80	Programmable Status Message	

Note: All unused columns are transmitted as spaces (ASCII chart location 32).

APPENDIX G

Release 3 (E3333/F3333) Software Enhancements

Release E3333/F3333 of the CONCEPT 108 software provides six new commands (documented on the following pages), plus the following changes:

The Attribute List Selection comamnd (MC Sp y) is now a User mode command. This makes it possible to set up an Attribute List with various modes and leave it in User Mode.

The Print Line (MC |) and Print Window (MC {) commands will perform a 500 millisecond delay after the Form Feed Prior to Print, rather than transmitting 16 rubout characters. Also, the final Carriage Return/Linefeed sequence will be followed by a 100 millisecond delay, rather than transmitting 2 rubouts. This was changed to accomodate certain printers that actually print the rubout character, rather than treating it as a delay character.

The Form Feed command has been changed to either execute a Clear Screen operation or Top of Page (3 Linefeeds and a Carriage Return) based on the value set by the two new commands.

The User Status Line display and transmission of the character set (field '1' in the documentation) has been changed to reflect fully both the character set selected and the overstrike mode setting. The possible values are:

ASC - Character set 0 (ASCII), non-overstrike mode
CH1 - Character set 1 (graphics), non-overstrike mode
CH2 - Character set 2, non-overstrike mode
CH3 - Character set 3, non-overstrike mode

OS0 - Character set 0, overstrike mode
OS1 - Character set 1, overstrike mode
OS2 - Character set 2, overstrike mode
APL - Character set 3 (APL), overstrike mode

Insert Line (MC ^R), Delete Line (MC ^B), and Reverse Linefeed (MC Sp L) have been speeded up when using a full-width window (80 or 132 columns). The required delay times are approximately the same as for a scrolling Linefeed (^J) for a full-width window (See Appendix D).

Nonvolatile Memory (NVM) now stores the Form Feed Clear Screen/ Top of Page option and the Set Underline to Change Attribute/Normal Character option. The NVM Display command of the Keyboard Status byte (KBDSTS) should now be changed to:

Bit 7 - Unused
Bit 6 - Form Feed Control (0/1, clear screen/top of page)
Bit 5 - ASCII Underline (0/1, change attribute/normal character)

Form Feed - Clear Screen			T	MC Sp,m	32,109	

Causes a Form Feed (^L) to clear all data in the window (both protected and unprotected) using the clear character and attribute. The cursor is then homed.

This is the default setting, and is stored in NVM.

Form Feed - Top of Page			T	MC Sp,M	32,77	

Causes a Form Feed (^L) to execute 3 Linefeeds (^J) and a Carriage Return (^M). Note that the ^L character will still be networked.

This mode is typically used when using the CONCEPT to examine a file normally intended for a line printer. This allows the user to see multiple pages of printer output on the CRT screen.

Set Underline to Change Attribute			T	MC Sp,`	32,96	

Causes the ASCII underline character (ASCII chart location 95) to set the Underline attribute on in the Attribute Word. Note that this only applies to the ASCII character set (0). This provides for true underlining capability, since the underline character is always non-destructive.

This is the default setting and is stored in NVM.

Set Underline to Normal Character			T	MC Sp,@	32,64	

Causes the ASCII underline character (ASCII chart location 95) to be treated as a 'normal' character. The underline character is therefore destructive and replaces the character at the current cursor location. (This is the only possible setting for character sets other than ASCII). True underlining can then only be accomplished by setting Underline On (MC G).

Reset All Windows		P	W	MC Sp,^	32,94

Resets all window definitions for all window numbers to be all of allocated display memory. Start of Print/Transmit is reset to the home position (line 0, column 0). The cursor is kept at the same physical location in memory.

Define 'Relative' Window		P	W	MC Sp,Z	32,90

Defines a new window with its home position equal to the Start of Print/Transmit and its lower right-hand corner equal to the current cursor position (which must be at or after the Start of Print/Transmit). The cursor is homed and the Start of Print/Transmit is reset to the home position.

(NOTE: Actual commands are listed in capital letters)

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