ITT Courier

270 INFORMATION DISPLAY SYSTEM

C270-III DISPLAY TERMINAL

2700

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REVISION LIST

The following pages in this manual have been revised. The date indicates the most current change for each page.

Page No.	Date
Appendix B	7/20/78
A3.4	10/17/78

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INTRODUCTION

1.1 SCOPE

The C270 Mod III Field Engineering Manual provides Courier field engineers with information to facilitate installation and maintenance of the C270 Mod III Terminal.

1.2 CONTENT

The contents of this manual have been divided into five sections. Listed below are the five sections and a brief description of each.

Section 1 - Introduction

Describes the scope and content of the manual, provides a general product description and references related publications.

Section 2 - Theory of Operation

Contains a general and functional theory of operation. Provides general and functional theory descriptions and a firmware functional description. Describes all operator and maintenance controls.

Section 3 - Installation

This section provides information for pre-installation planning, installation and initial check-out procedures of the C270.

Section 4 - Maintenance

Contains measurement and adjustment procedures, removal and replacement procedures, and cable interconnection and power distribution drawings.

Section 5 - Parts

This section contains parts lists, mechanical drawings, and necessary information for parts identification and replacement.

1.3 PRODUCT DESCRIPTION

The C270 is a microprocessor based, CRT/keyboard combination, data communication terminal available with 480, 960, or 1920 characters display size. The C270 can be configured in a local cluster using an LTC or VTLC controller. Remote clusters can be configured with the C270 using an RTC controller. (See Figure 1.1 System Configurator.)

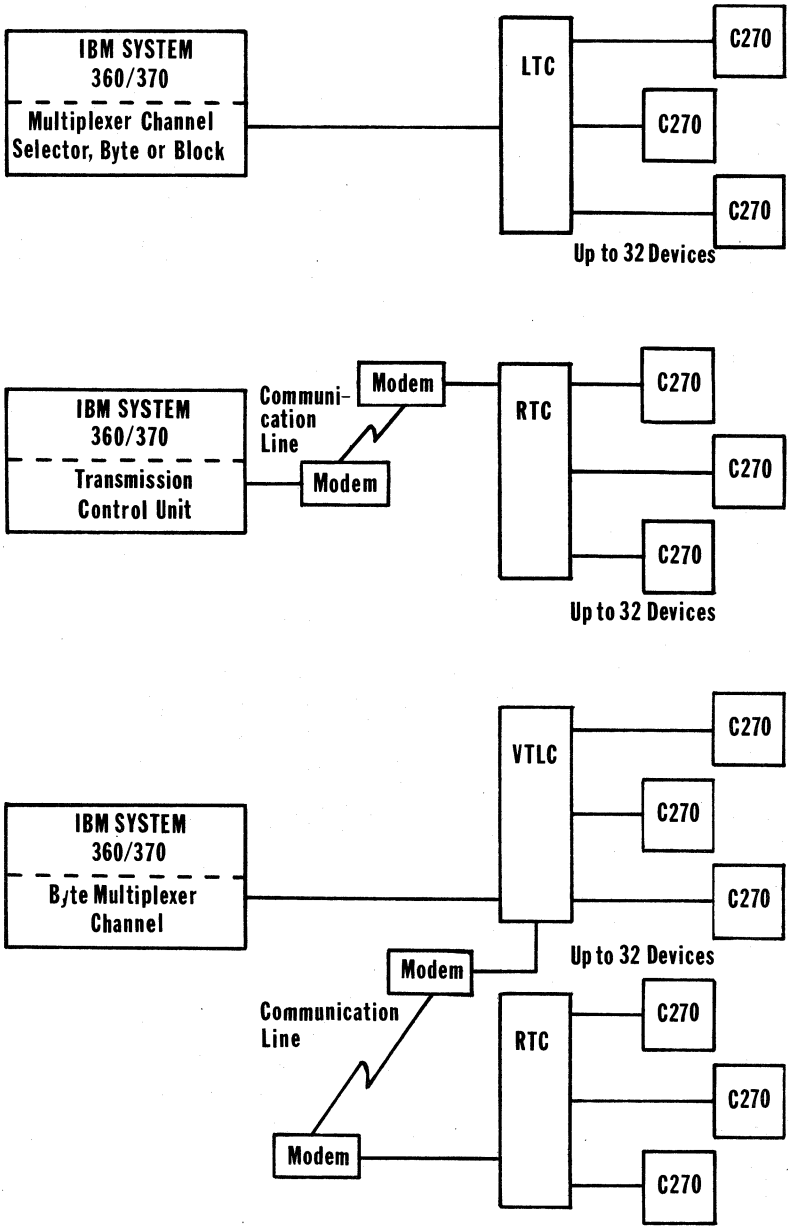


Figure 1.1 SYSTEM CONFIGURATOR

Figure 1.2 C270-III

1.4 MARKETING CONFIGURATION

The C270 Mod III can be equipped with the following options: Security Lock, Audible Alarm, Lower Case, Badge Reader, Light Pen, and APL. Any one of four keyboards can be used. These are the Typewriter, Data Entry, Typewriter with Numeric Pad, and Console keyboards. The keyboard can be either Standard of with the Cascade feature. The Keyboard Enhancement option can also be incorporated with any of the keyboards.

1.4.1 Security Lock

The Security Lock option requires the security lock be mounted on the Maintenance Panel and the cable connected to the proper connector. No strap or ROM changes have to be made.

1.4.2 Audible Alarm

The Audible Alarm option requires the audible alarm to be mounted and connected inside the keyboard housing.

1.4.3 Lower Case Display

The Lower Case Display option requires a ROM change on the display board and proper strap setting. Lower case cannot be included with the Data Entry keyboards.

1.4.4 Badge Reader

The Badge Reader option requires that the options board be installed plus an additional ROM on the CPU board.

1.4.5 Light Pen

The Light Pen option requires that the options board be installed plus an additional ROM on the CPU board.

1.4.6 Keyboards

Any one of the four keyboards can be installed with no other change required in the terminal.
NOTE: C270 II and C270 III keyboards are not interchangeable.

1.4.7 Keyboard Enhancement

The Keyboard Enhancement options requires a new keyboard to be installed. N-Key Rollover, type-ahead, and back tab repeat are provided with this option.

1.4.8 APL

See Appendix B for APL feature.

1.5 REFERENCES

Additional information may be obtained from the publications listed below.

A. Courier Product Description - Courier Publication Number 30-0003-00-00

B. Courier Field Engineering Manuals - Remote Terminal Controller (RTC), Local Terminal Controller (LTC), and Virtual Terminal Line Controller (VTLC)

C. 270 Information Display System Reference Manual - Courier Publication Number 30-0001-00-01

D. Field Engineer's Handbook - Publication Number FED-999-1-0

E. IBM 3270 Information Display System Component Description - IBM Publication Number GA-27-2749

THEORY OF OPERATION

2.1 SECTION OVERVIEW

This section is designed to give the Courier field engineer an understanding of how the C270 Mod III functions by presenting the general and functional theory of operation and associated block diagrams. Included are descriptions of controls, indicators, and the firmware.

2.2 GENERAL THEORY

The C270 is a microprocessor-controlled data communications terminal that provides a CRT display of data transmitted from a central data processing unit via a controller. The attached keyboard permits the user to enter, modify, or delete data on the display and cause the new or revised data to be returned to the processing system for storage or additional processing.

The C270 is designed for local system operation using the Local Terminal Controller (LTC) or Virtual Terminal Line Controller (VTLC) and for remote system operation using the Remote Terminal Controller (RTC).

2.3 OPERATOR AND MAINTENANCE CONTROLS

Indicators and controls for the terminal are located on the operator panel, maintenance panel, and keyboard. The following table and paragraphs provide a description of each.

Table 2.1 OPERATOR AND MAINTENANCE PANEL

Name	Type	Location	Description
System Ready	LED	Operator Panel	This indicator indicates the presence of any command on the terminal's coaxial cable.
System Available	LED	Operator Panel	This indicator is turned on by the device controller upon successful completion of any valid system command. It is turned off by any I/O pending condition.
Input Locked	LED	Operator Panel	This indicator lights if manual input is blocked. It is reset when the blocking condition is removed. If the terminal is selected for input-output operation, the Reset key on the keyboard will reset the indicator.

Table 2.1 OPERATOR AND MIANTENANCE PANEL (Continued)

Name	Type	Location	Description
Device Select	LED	Operator Panel	This indicator is on when the terminal is selected for input-output operations (comm locked).
Edit Mode	LED	Operator Panel	This indicator is turned on by the Insert Mode key switch on the keyboard. It indicates that the terminal is in an editing mode. It is reset by the Reset key on the keyboard.
Lower Case	LED	Operator Panel	This indicator lights if the terminal is in lower-case display mode. It is set by the L.C. push button and reset by the CLR push button.
Proc Mode	LED	Operator Panel	This indicator lights when the terminal is in local process mode. It is turned off by the CLR button.
Message Waiting	LED	Operator Panel	This indicator can be turned on by the device controller or the host CPU. It is turned off by the CLR push button.
Error	LED	Operator Panel	This indicator is turned on by the device controller or host CPU. It is turned off by the CLR push button.
L.C.	Momentary Pushbutton	Operator Panel	This button enables the lower-case display option, if the option is installed. (Available only with typewriter keyboards).
Proc	Momentary Pushbutton	Operator Panel	This push button places the terminal in local process mode and resets bit 3 of status word 1. This mode is used to allow off-line processing of data in future systems, where applicable. The mode is reset by the CLR push button.
Call	Momentary Pushbutton	Operator Panel	Not Used.

Table 2.1 OPERATOR AND MAINTENANCE PANEL (Continued)

Name	Type	Location	Description
CLR (Clear)	Momentary Pushbutton	Operator Panel	This push button turns off lower-case mode, local process mode, error indicator, and message waiting indicator. When depressed this push button will momentarily extinguish Sys Avail, Input Lock, Device Select, and Edit Mode but does not affect the functions associated with these LED's.
Power	On-Off Pushbutton	Operator Panel	This lighted push button is a push-push type of switch which turns the input power on and off. When power is on, the button lights.
Bright	Thumbwheel	Maintenance Panel	This control varies the overall intensity (brightness) of the CRT display.
Contrast	Thumbwheel	Maintenance Panel	This control varies the contrast between the normal and intensified fields by varying the non-intensified fields.
FE	Switch and Indicator	Maintenance Panel	This two-position switch and indicator is used to indicate maintenance activities to the device controller.
Security Lock	Key Switch	Maintenance Panel	This optional two-position, key activated switch disables keyboard input.
Clacker Control	Rotary	Keyboard Faceplate	This knob controls the volume of the "click" which is triggered by the software when a key switch operation is accepted.

2.3.1 Keyboard Operations

The keyboard functions fall into several related groups. (Refer to Figure 2.2). The following paragraphs describe each group in detail.

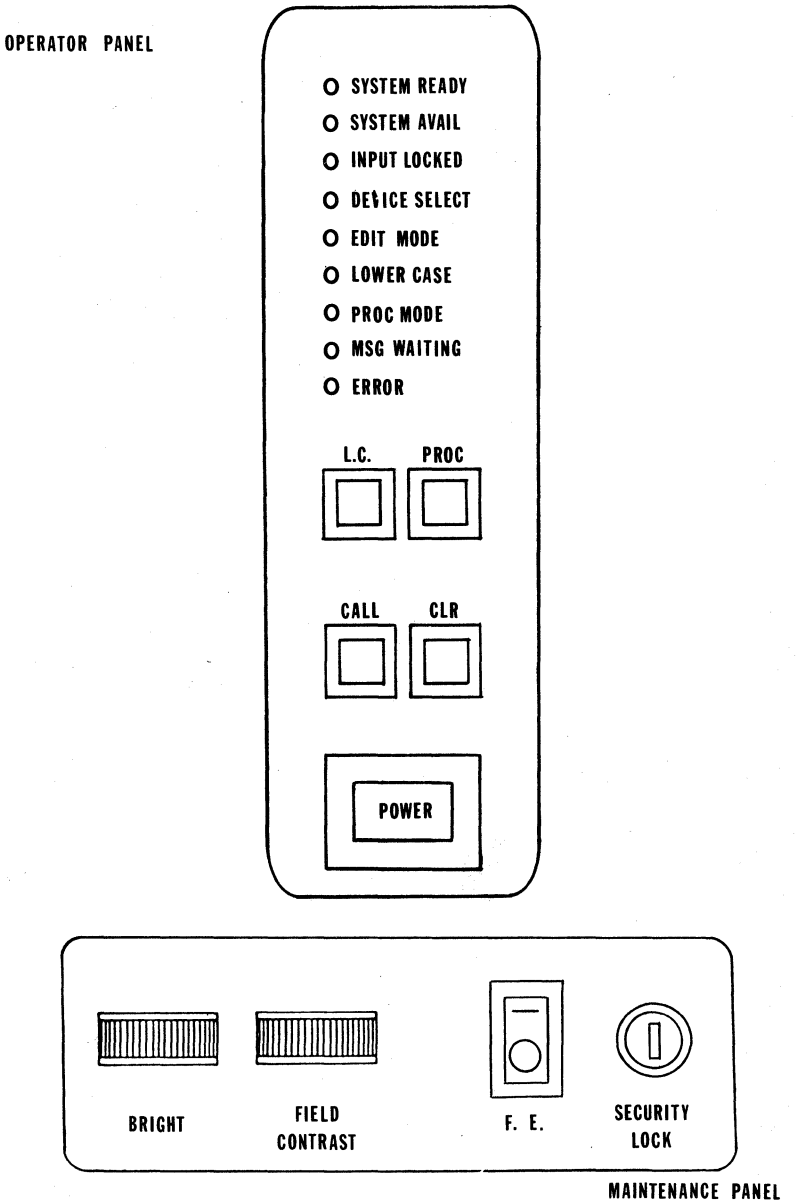


Figure 2.1 OPERATOR AND MAINTENANCE PANELS

A. Alphameric Keys - Operation of these keys will display the appropriate character at the cursor location if the cursor is in an unprotected field. The cursor will then advance to the next unprotected location. If the cursor is in a protected field, no operation will occur.

If Lower Case Display is enabled, the 26 alphabetic keys will generate lower-case characters if the keyboard is unshifted, and upper-case characters when shifted.

If the Numeric Lock option is enabled, and the cursor is in a numeric field only numeric characters (0-9, ., -, and DUP) can be entered. Any other alphameric key will cause the keyboard to lock. In the data entry keyboard, depressing the ALPHA key disables numeric lock and any alphabetic character can be entered without restriction.

When in Insert Mode and a null character is present between the cursor location and the next attribute byte, the alphameric character will be entered at the cursor position, the cursor advances and all characters between the present cursor location and the next null character will shift right one location. The first null character between the cursor and the next character will be deleted.

If the keyboard is input locked, no keyboard entry is allowed. If the keyboard is input locked by other than an I/O operation the Reset Key is active and will reset the input lock condition when depressed.

B. Mode Keys function:

SHIFT	- up shift keyboard and release SHIFT LOCK latch
SHIFT LOCK	- up shift keyboard and latch
SHIFT LOCK lamp	- indicates up shift condition
ALPHA	- down shift keyboard momentarily if latched in NUMERIC mode; otherwise no effect
NUMERIC	- up shift keyboard momentarily and release NUM LOCK latch
NUM LOCK	- up shift and lock; if locked, down shift and unlock
NUM LOCK lamp	- indicates up shift condition

C. Attention Keys:

ENTER	- turn off SYSTEM AVAILABLE light; turn on INPUT LOCKED light, post Input Request
PROGRAM ENTER	- If enabled, Program Enter causes the firmware to accept the operation of the PF or PA key depressed prior to the operation of Program Enter.
CLEAR	- clear entire display to nulls; turn off SYSTEM AVAILABLE light; turn on INPUT LOCKED light; set AID bits
TEST REQUEST PA 1-3 PF 1-12	- turn off SYSTEM AVAILABLE light; turn on INPUT LOCKED light; set AID bits

D. Cursor Movement Keys:

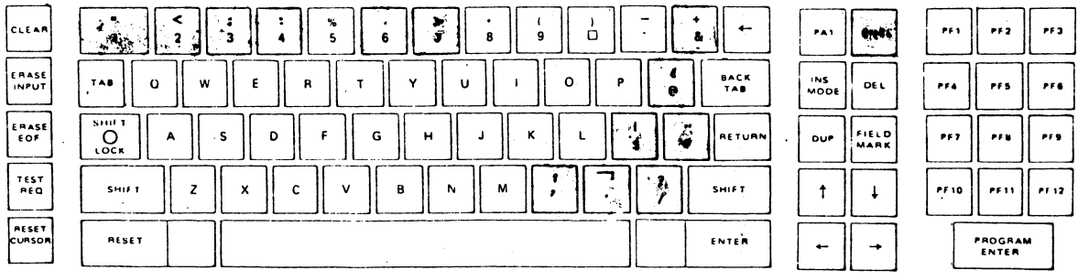
RESET CURSOR	- cursor is positioned to the first unprotected location on the display
UP	- cursor moves up one row; the operation wraps
DOWN	- cursor moves down one row; the operation wraps
LEFT	- cursor backs up one position; the operation wraps
RIGHT	- cursor advances one position; the operation wraps
RETURN	- cursor is positioned to the first location of the next line if the display is unformatted (no attribute bytes). The cursor is positioned to the first character location of the next unprotected field if the display is formatted.
TAB	- cursor is positioned to the first character location of the next unprotected field, or to location 0 if the display is unformatted or has no unprotected locations.
SKIP	- Identical to TAB.

ALPHAMERIC[4]								
U.C. ALPHA	SYM/ PUN	NUMERIC	MODE KEYS	ATTENTION KEYS	CONTROL KEYS	CONTROL REPEAT	NUM LOCK	L.C.[3] ALPHA
A	SP	⊡	SHIFT[2]	ENTER	RESET	NO	⊡	a
B	!	1	ALPHA[1]	PROGRAM ENTER	DUP	NO	1	b
C	"	2	NUMERIC[1]	CLEAR	FIELD MARK	NO	2	c
D	#	3	SHIFT LOCK[2]	TEST REQ	INS MODE	NO	3	d
E	$	4	NUM LOCK[1]	PA 1	DEL	YES	4	e
F	%	5	L.C.[6]	PA 2	ERASE INPUT	NO	5	f
G	&	6		PA 3[1]	ERASE EOT	NO	6	g
H	'	7		PF 1			7	h
I	(	8		PF 2			8	i
J	)	9		PF 3	CURSOR MOVEMENT KEYS		9	j
K	*			PF 4			.	k
L	+			PF 5			-	l
M	,			PF 6			DUP	m
N	-			PF 7[2]				n
O	.			PF 8[2]	RESET CURSOR	NO		o
P	/			PF 9[2]	UP ↑	YES		p
Q	:			PF 10[2]	DOWN ↓	YES		q
R	;			PF 11[2]	LEFT ←	YES[5]		r
S	<			PF 12[2]	RIGHT →	YES[5]		s
T	=				TAB	YES		t
U	>				BTAB	OPTIONAL		u
V	?				RETURN	NO		v
W	@							w
X	¢							x
Y	|							y
Z	¬							z
	_							

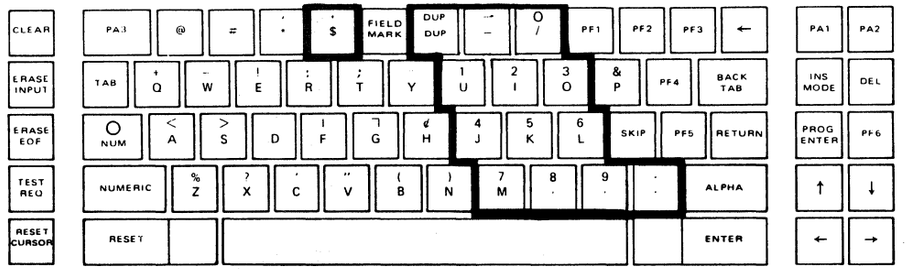
NOTES:

1. Data Entry Keyboard Only.
2. Typewriter Keyboard Only.
3. Lower Case Option Only.
4. Normal repeat rate is 12.5 operations per second maximum.
5. Hi-rate is 25 operations per second maximum.
6. Located on Operator Panel.

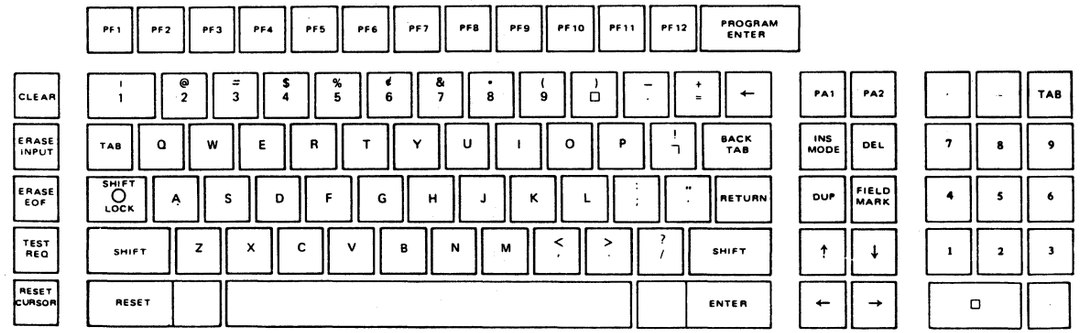
Figure 2.2 KEYBOARD GROUPINGS



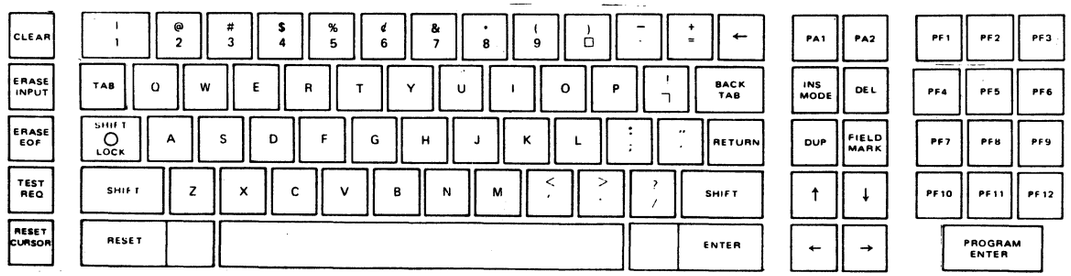
****OPERATOR CONSOLE KEYBOARD**



***DATA ENTRY KEYBOARD**



TYPEWRITER KEYBOARD WITH NUMERIC PAD



TYPEWRITER KEYBOARD

* Numeric Character keys are bold outlined.

** Character combonation of shaded keys are unique to the Operator Console Keyboard.

Figure 2.3 C270 KEYBOARDS

BTAB - cursor is positioned to the first character location of the present unprotected field if located in one; to the first character location of the first preceding unprotected field if one is available; and to location 0 in all other cases.

E. Control Keys:

RESET - blinks cursor if cursor type is underline; resets Enter, Program Enter, Badge Reader Enter, Light Pen Enter, resets AID bits, resets INPUT LOCK and INSERT MODE. Resets key hit stack.

DUP - If the cursor position is protected no operation takes place. If the cursor position is unprotected, an FS (DUP) code is stored (displayed as *); the MDT bit is set if applicable; and a TAB is performed.

FIELD MARK - If the cursor position is protected no operation takes place. If the cursor position is unprotected, an RS (FM) code is stored (displayed as ;); and the cursor advances to the next unprotected location. The MDT bit, if applicable, is set.

INSERT MODE - Enters Insert Mode and turns on Edit Mode light. Further operation is described under Alphameric Keys Operation. Alphameric characters will repeat when in the Insert Mode if the key is held depressed.

DEL - If the cursor position is protected no operation takes place. If the cursor position is unprotected, the character in that position is deleted. The characters between the cursor position and the next attribute byte or end of that row (whichever occurs first) are shifted left one position. A null is shifted into the vacated position and the MDT bit, if applicable, is set. The cursor does not move.

ERASE INPUT - Nulls are placed into all unprotected locations; the MDT bits of all unprotected fields, if applicable, are reset; and the cursor is positioned to the first unprotected character location following an unprotected attribute or location Ø if the screen is unformatted.

ERASE EOF - If the cursor position is protected no operation takes place. If the cursor position is unprotected, all unprotected locations from and including that position to the next attribute byte are replaced with nulls. The MDT bit, if applicable, is set. If the display is unformatted, the erase operation continues to the end of the display.

2.4 FUNCTIONAL THEORY

The terminal is divided into three major functional sections: Input/Output, Keyboard system and Video display. Each is described in detail below. (See Figure 2.4 C270-III General Block Diagram).

2.4.1 Input/Output System

The C270 communications in a bi-directional (half-duplex) manner over coaxial cable (RG-62) with the appropriate controller. The transmission method is half-duplex, serial transmission of 11-bit characters. The 11 bits consists of a start bit, parity bit, and 8 information bits. The communications data stream consists of Data Characters, Attributes, Commands, Status, and Cursor Addressing bytes.

Note: Byte structure shown in Figures 2.5 through 2.8, is Courier coax protocol where bit 1 = LSB and bit 8 = MSB.

1. Data Characters - Data characters, as opposed to attribute bytes, are represented by bit eight equal to zero. Figure 2.5, C270 Internal Data Character Set, illustrates the C270 internal data character set. The C270 devices use a block transmit mode to transfer the device contents to and from the appropriate controller. The device is put into a block mode via a command. Thus, depending on display size, a block transfer consists of 480, 960, or 1920 characters (data and attribute bytes) plus cursor position and status if applicable.

2. Attribute Bytes - A stored attribute byte has bit eight equal to a one. The make-up of the attribute byte is shown in Figure 2.6, Attribute Byte.

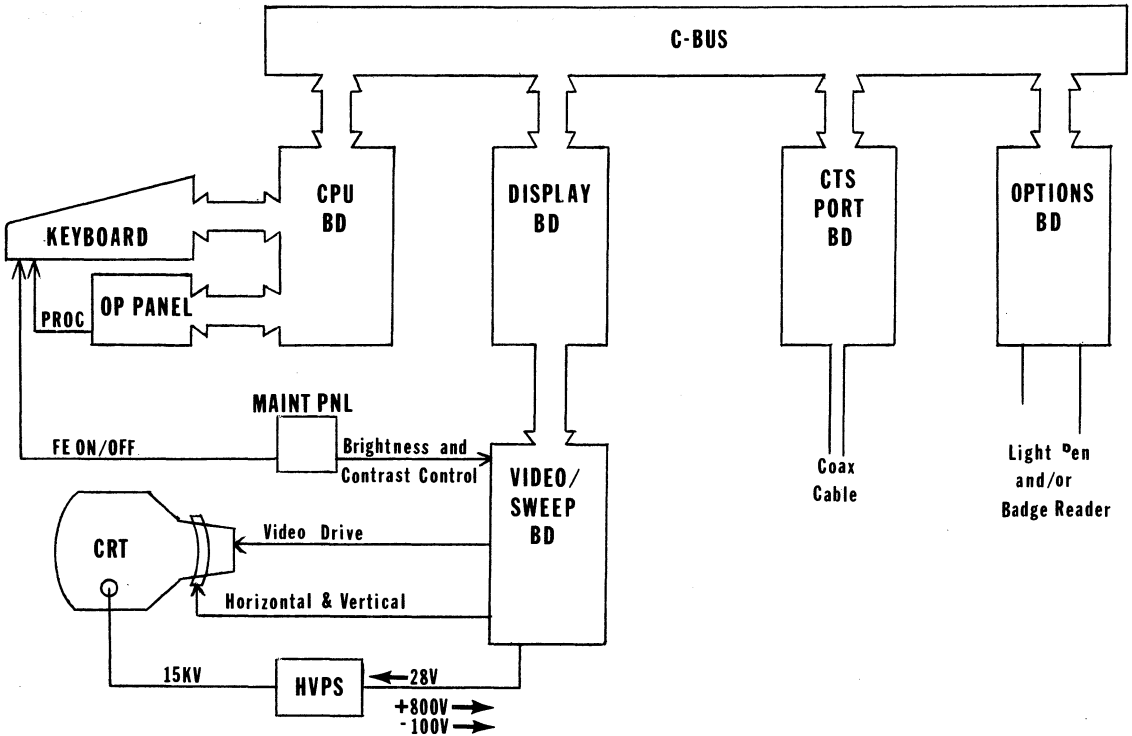


Figure 2.4 C270-III GENERAL BLOCK DIAGRAM

b8 →					0	0	0	0	0	0	0	0
b7 →					0	0	0	0	1	1	1	1
b6 →					0	0	1	1	0	0	1	1
b5 →					0	1	0	1	0	1	0	1
b4	b3	b2	b1	Hex	0	1	2	3	4	5	6	7
0	0	0	0	0			SP	⊡	@	P		p[2]
0	0	0	1	1		Note 1	!	1	A	Q	a[2]	q
0	0	1	0	2			"	2	B	R	b	r
0	0	1	1	3			#	3	C	S	c	s
0	1	0	0	4			$	4	D	T	d	t
0	1	0	1	5			%	5	E	U	e	u
0	1	1	0	6			&	6	F	V	f	v
0	1	1	1	7	BEL		'	7	G	W	g	w
1	0	0	0	8			(	8	H	X	h	x
1	0	0	1	9		EM	)	9	I	Y	i	y
1	0	1	0	A	NL		*	:	J	Z	j	z
1	0	1	1	B	VT		+	;	K	¢	k	
1	1	0	0	C	FF	DUP[3]	,	<	L	■	l	
1	1	0	1	D			-	=	M	¦	m	
1	1	1	0	E	SO	FM[3]	.	>	N	¬	n	
1	1	1	1	F	S1		/	?	O	_	o	

NOTES:

1. Character assignments for blank table entries are undefined.
2. The 26 lower case characters are generated and displayed only if the terminal is equipped with the lower case option; otherwise displayed as upper case.
3. The characters DUP and FM are displayed as the graphics * and ; respectively.

Figure 2.5 C270 INTERNAL DATA CHARACTER SET

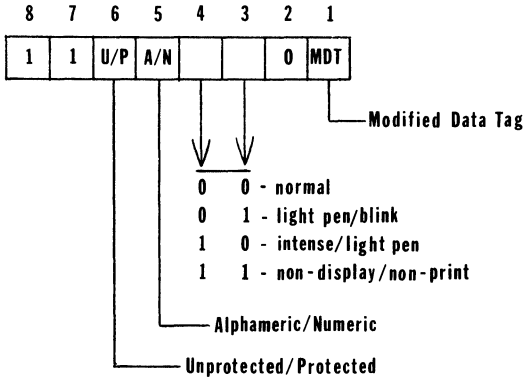
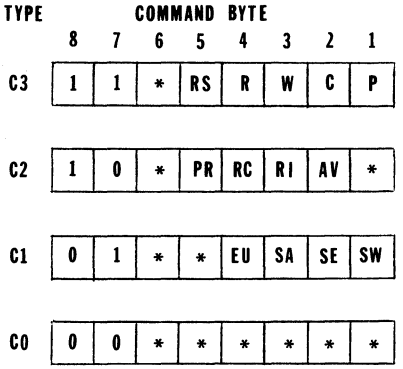


Figure 2.6 ATTRIBUTE BYTE

3. Device Commands - When a device is not performing a block transfer, it is waiting for a command. Commands are single character in length - consisting of a type identification and bit positional command flags. The command set for the C270 terminal is shown in Figure 2.7 Device Commands.



Abbrev.	Operation
RS	Read Short (Status Only)
R	Read (Device Buffer)
W	Write (Device Buffer)
C	Capture Write
P	Poll
PR	Power On Reset
RC	Reset Comlock
RI	Reset Input
AV	Set System Avail Indicator

Abbrev.	Operation
EU	Erase Unprotected
SA	Sound Alarm
SE	Set Error Indicator
SW	Set Message Waiting Indicator
*	Not Used

Figure 2.7 DEVICE COMMANDS

4. Device Status - Two bytes are transmitted from the device to the controller to indicate the status of the device. The two bytes are always transmitted as a pair. The information content is given in Figure 2.8 Device Status.

STATUS

	8	7	6	5	4	3	2	1
Stat 1	B	IO	PE	A1	L	F	XC	CL
Stat 2	0	T2	T1	A5	A4	A3	A2	A1

Abbrev.	Indication
B	Busy
IO	Input Request
PE	Program Enter
AI	Auxillary Input
L	Local Process Modifier
F	F.E. Mode
XC	Transmit Check
CL	Comlock

T2, T1 Type (Special [00], 480 [01], 960 [10], 1920 [11])

A5-A1 Aid code for Enter, PF1-PF12, PA1-PA3, Clear, Test Req, Badge Reader, Light Pen. A5 is MSB.

AID Value (decimal)	Meaning
1 - 12	PF1 - PF12
13	Enter
16 - 18	PA1 - PA3
19	Clear
20	Test request
30	Badge reader
31	Light pen

Figure 2.8 DEVICE STATUS

5. Cursor Addressing - Two bytes are transmitted between the controller and a terminal to indicate the cursor address. The two bytes are always transmitted as a pair in a block read or write. The information content is given in Figure 2.9 Cursor Addressing.

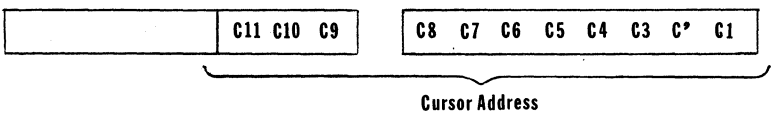


Figure 2.9 CURSOR ADDRESSING

2.4.2 Keyboard System

The keyboard keyswitch scanning is controlled by the 8080 using the PIA as the interface to the keyboard logic board. When a keyswitch is depressed and that keyswitch address is present at the decoder and multiplexer, a positive output is produced on the sense line. (Refer to Figure 2.10 Keyswitch Addressing Technique).

The keyboard address decoder is addressed by the three low-order bits of the keyswitch address. The decoder enables one group at a time of up to eight groups of keyswitches. A maximum of 16 keyswitches may be in one group. The outputs of these keyswitches are input to a 16 to 1 multiplexer. The multiplexer is addressed by the four high-order bits of the keyswitch address. This technique allows the processor to individually address any one of 128 switches and sense whether the keyswitch is depressed or not.

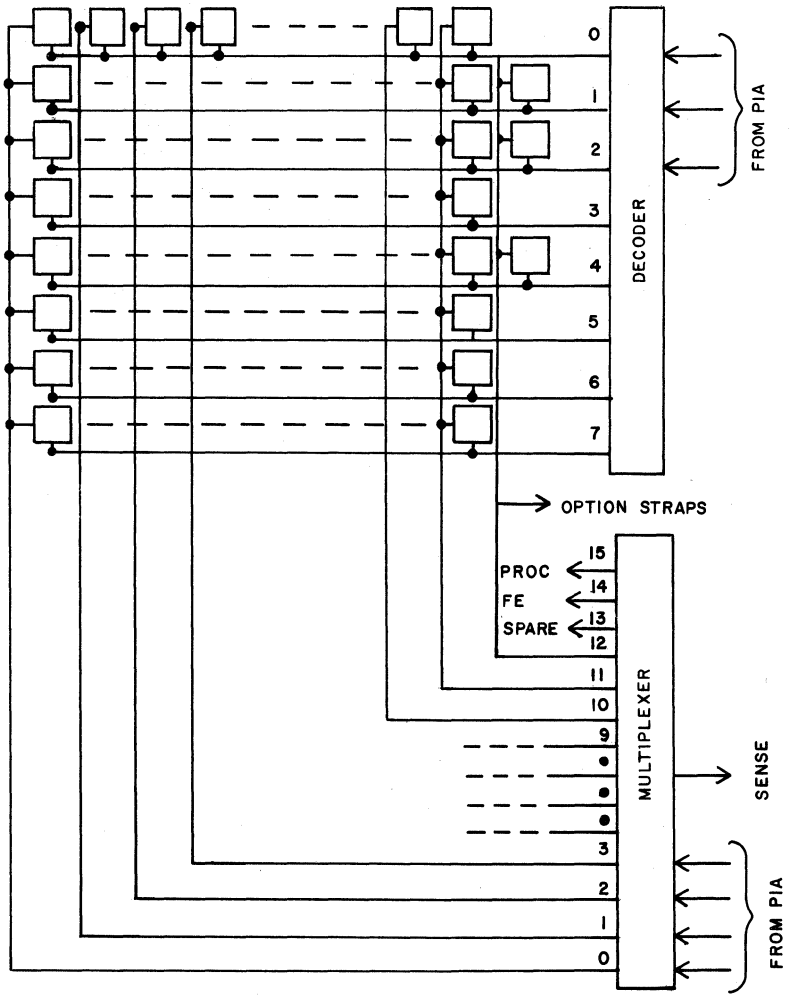


Figure 2.10 KEYSWITCH ADDRESSING TECHNIQUE

Each keyswitch, when operated, is sensed by the software. When the software "accepts" the keyswitch closure, a mechanical "clacker" is sounded providing the operator with aural feedback each time a key is depressed.

The F.E. and PROC switches and straps A, B, C, and D on the keyboard are read by the firmware through the keyboard decoder and multiplexer scheme.

2.4.3 CRT Display

CRT display information originates as a keyboard entry or an I/O input from the controller. Character information is taken from either source and written into the refresh memory. Whenever refresh memory is not being accessed by the CPU the refresh counter continually accesses memory for display information. Characters from memory pass through a translation ROM and then through the character generator ROM. Information from the character generator ROM is converted from parallel to serial form and fed to the video/sweep board as TTL level signals. The video/sweep board amplifies the video signal and feeds it to the CRT to generate the display image.

Horizonatl and vertical drive timing pulses originate on the display board and are fed to the video/sweep board. The video/sweep board generates the proper ramp voltages and feeds them to the yoke for deflection control of the CRT electron beam.

2.5 FUNCTIONAL BOARD DESCRIPTION

The terminal electronics consist of the CPU, Display and CTS Port boards, Keyboard, Operator Panel, Video/Sweep board, High Voltage Power Supply, Low Voltage Power Supply, and an optional Options Interface board. (See Figure 2.11 C270-III Functional Block Diagram.)

2.5.1 CPU Board

The CPU board provides the central control for the C270. The board consists of an 8080A micro-processor and a maximum of 8K bytes of ROM to hold the terminal's basic firmware. 1K of RAM provides the CPU with scratch pad memory. A 6820-1 PIA (Peripheral Interface Adapter) is used to interface the keyboard and operator panel to the CPU. A set of eight DIP switches and 4 straps located on the CPU board provide for the selection of optional features.

2.5.2 Display Board

The Display board provides for storage of the display information in 2K of RAM memory. This memory is accessable for CRT refresh, I/O read and write operations, and keyboard character entries. Also included on this board is cursor control, display timing, character translation, and character set dot information.

2.5.3 CTS Port Board

The CTS Port Board interfaces the terminal to the controller. Coax cable signals are converted from serial to parallel, checked for errors and formatted into data bytes that are transferred to the terminal's C-Bus and on to the display memory.

2.5.4 Keyboard

The keyboard permits the operator to enter new data, edit previous-

ly entered data, and communicate with the host CPU.

2.5.5 Operator Panel

The operator panel contains nine LED indicators and four control switches. The Power On/Off switch is also located on the operator panel.

2.5.6 Maintenance Panel

Located on the Maintenance Panel are the display brightness and contrast controls and the F.E. maintenance switch and indicator.

2.5.7 Video/Sweep Board

The video/sweep board receives video, horizontal drive, and vertical drive signals from the display board and generates all the outputs necessary to drive the CRT display. Display adjustment pots are located on this board.

2.5.8 High Voltage Power Supply

The HVPS provides -100 VDC and +800 VDC to the video/sweep board and 15.0 KV to the CRT for electron beam accelleration. Input power (28 VDC) for the HVPS comes from the LVPS through the V/S board.

2.5.9 Low Voltage Power Supply

The LVPS provides the various voltages required for the operation of the C270. Output voltages provided are: +5 VDC, -9 VDC, -16 VDC, +16 VDC, +28 VDC, and 6.3 VAC. Fuses for the AC input power and each of the output voltages are located on the power supply. A separate ferro-resonant transformer is used by the power supply.

2.5.10 Regulator Board

The regulator board regulates -5 VDC, -12 VDC, and +12 VDC. Input voltages are -9 VDC, -16 VDC, and +16 VDC.

2.5.11 Options Board - Optional

The options board provides the link between the CPU and the Light Pen and/or the Badge Reader.

2.6 FIRMWARE FUNCTIONAL DESCRIPTION

The C270-III CPU is controlled by firmware permanently stored in ROM. This program handles the input and output of commands and data, services operator and host CPU requests on a priority basis, performs the power-on initialization, controls the inter-module exchange of commands and data, and provides the means for overall control of the terminal's activities. (See Figure 2.12 Firmware Block Diagram.)

The firmware is made up of four major sub-routines which include power-on initialization, keyboard service, interrupt handler, and

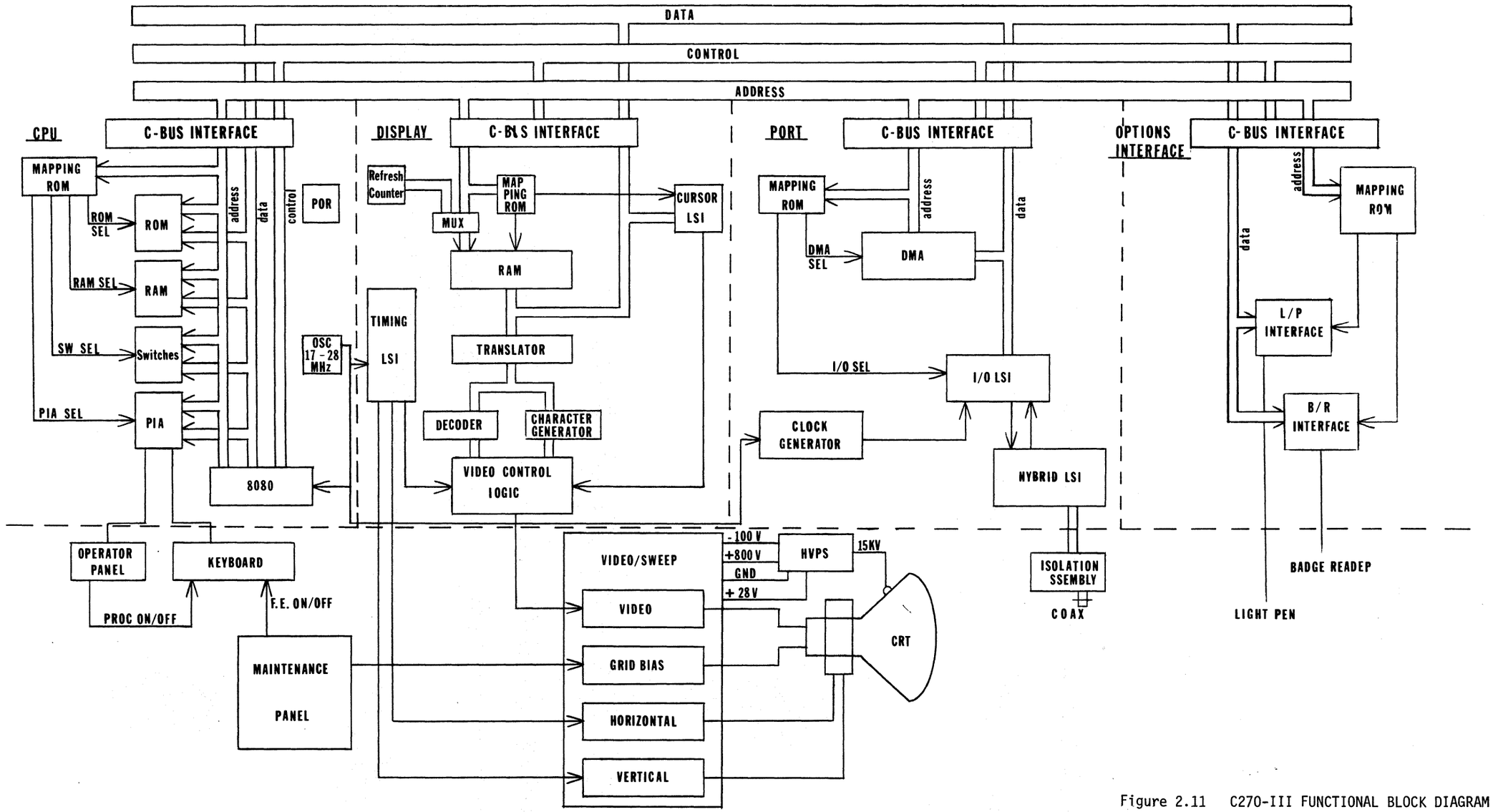


Figure 2.11 C270-III FUNCTIONAL BLOCK DIAGRAM

key services.

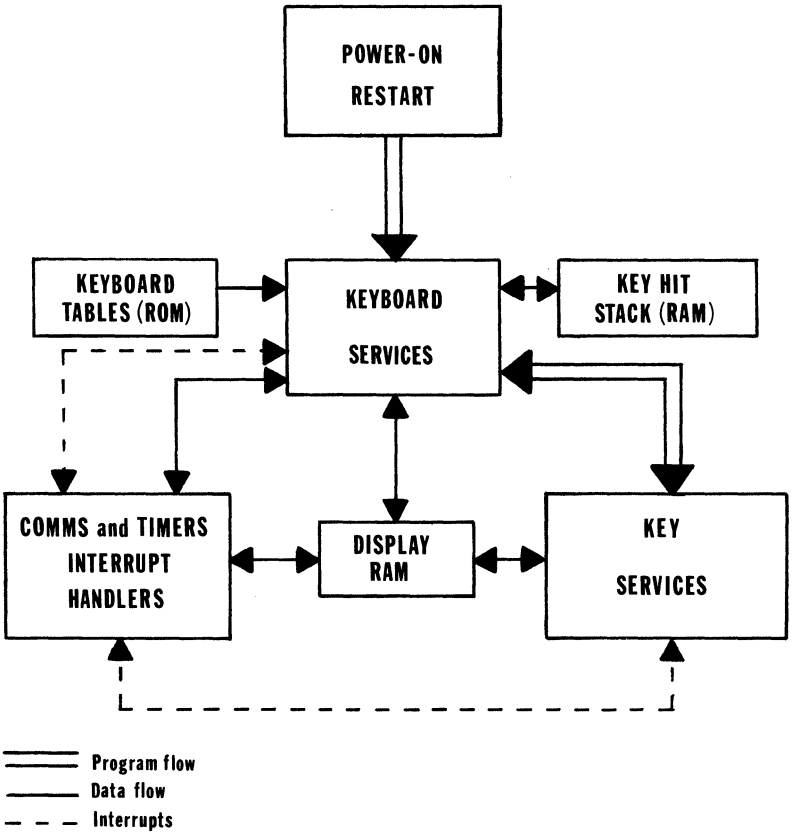


Figure 2.12 FIRMWARE BLOCK DIAGRAM

2.6.1 Power-On Initialization

This routine is entered when power is first applied to the terminal. It performs the various housekeeping functions necessary to initialize the terminal. These functions include: initializing the key hit stack, clearing the program RAM, clearing the display RAM, initializing the PIA, establishing the screen size bytes, storing the end-of-screen flag, initializing the keyboard parameter table, reading the option switches, performing ROM LRC test, and setting all counters and flags to their initialized condition.

2.6.2 Keyboard Services

This routine, KYSVC, is the main background loop for the terminal's control program. The routine tests all keyboard keys, switches, and comms flags to determine if service is required. KYSVC can be interrupted by communications and timer interrupts.

When the terminal is not comm locked or input locked, and a keyboard key is to be serviced, the key's PIA number is used as an index to the keyboard action index table. New key closures, type-ahead key closures, and repeating (held down) keys are all serviced in this manner. The keyboard action index table contains two entries for each key on the keyboard: the first is an index to the action address table, the second is an index to the character code table. Each action address table entry is the address of the corresponds key's service routine. This address is calculated with the appropriate character code for key servicing.

If a new key is closed when the terminal is comm locked, KYSVC will click the clacker and make the appropriate entry in the key hit stack. The key will be serviced when comm lock has been cleared. If a second key closure is detected in the next call to the keyboard scan routine, it will be ignored unless the type-ahead and N-key rollover features are active. If these features are active, the second and all subsequent key closures will cause the routine to sound the clacker and save the key's address in the key hit stack. If the key hit stack should be filled (approximately 70 entries) before comm locked is cleared, subsequent key closures will be ignored. If the Reset key is depressed while one or more unserviced entries reside in the key hit stack, the key hit stack will be cleared.

If the terminal is in an input locked condition, all key closures except the Reset key are ignored. If the Reset key is sensed, the routine will click the clacker and clear the input locked condition.

2.6.3 Key Services

The key services routine is a group of sub-routines that are called to perform the services associated with each key. The sub-routines are structured to service logical groups of keys such as the alphabetic keys, numeric keys, AID keys, and control keys. The sub-routine's address location in the action address table determines if the key is a repeat key.

2.6.4 Comms and Timer Interrupt Handler

This routine handles the interrupts from the I/O chip, the DMA, and the PIA timer. The I/O chip is initialized to present receive interrupts only. When a byte is received from the controller, an interrupt occurs. When interrupted by a controller command byte, the comms handler will respond with two status words and, if appropriate, will send or receive the screen image. If the command byte is non-immediate, the comms flags are set and the command is handled

by the keyboard services routine.

The timer interrupt counts down a timer byte and resets the timer hardware when zero is reached.

INSTALLATION

3.1 GENERAL

Installation of the C270 Terminal should be performed by qualified Courier personnel only. This section contains the following:

1. Equipment Specifications
2. Pre-Installation Data
3. Cable Requirements and Specifications
4. Unpacking and Inspection Procedures
5. Installation Procedures
6. Strapping Guide

3.2 EQUIPMENT SPECIFICATIONS

3.2.1 Power Requirements

Voltage	- 115 VAC ± 10% Single Phase
Frequency	- 59-61 Hz
Circuit Capacity	- 15 Amps
Heat Dissipation	- 785 BTUs
Power	- 234 Watts

3.2.2 Environmental Requirements

Operating Temperature	- 40^{o} to 100^{o}F
Storage Temperature	- 20^{o} to 160^{o}F
Humidity	- 10% to 80% R.H.

3.2.3 Physical Characteristics

Height - 17 inches
Width - 18.5 inches
Depth - 21 inches
Weight - 80 lbs.

3.2.4 U.L. Approval

U.L. Standard 478 for Electronic Data Processing Units and Systems.

3.2.5 CRT Display Characteristics

A modified 525 Line Raster Scan (10 line interlace) is used for displaying characters in a 7 X 8 dot matrix.

Refresh Rate - 57 pages per second minimum

Cathode Ray Tube - 15 inch, 70 degree industrial grade tube. It uses P31 phosphor and has an etched and bonded, non-glare faceplate.

Refresh Memory size - 1920, 960, or 480 bytes of RAM storage.

Display Area - 10" horizontal X 7" vertical for 1920
10" horizontal X 5" vertical for 960
9" horizontal X 6" vertical for 480

3.2.6 I/O Format

Serial data transferred between controller and display in standard Courier 11-bit data word format.

3.2.7 Display Format

24 lines with 80 characters per line
12 lines with 80 characters per line
12 lines with 40 characters per line

3.2.8 Displayable Character Set

Standard ASCII 64 character set.

3.3 PRE-INSTALLATION

Prior to equipment installation, the proper I/O cables (type RG-62 coax) and power must be installed to accommodate the C270. These items are the customer's responsibility.

If terminals are being added to an existing system, schedule the additional C270 installation for a time when the controller may be taken off line. Approximately one-half hour should be scheduled to resolve any problems that may occur on the new C270 Terminal.

Insure that a three-wire grounded power outlet is available for the terminal locations. An 8 foot power cord comes standard with each C270 terminal.

Prior to C270 installation, insure that the controller is strapped properly to accept additional terminal addresses. Terminal addresses are determined by controller strapping and I/O connector. C270 terminals have no address strapping. See controller maintenance manual to determine addresses.

Verify that a 1928 Port Board is installed in the controller instead of a 1910 Port Board. The C270-III will not work with a 1910 Port Board.

3.3.1 Coaxial Cable Requirements

Coaxial Cable (RG-62) is utilized to connect the C270 to the RTC, LTC, or VTLC. Maximum acceptable cable length between the terminal and controller is 2000 feet. Additional cable length can be accommodated by using a coaxial cable line extender.

3.3.2 Power

The C270 Mod III Display terminal must be powered from a 115 VAC three-wire grounded power outlet. The ground must supply a good earth ground. The Hot and Neutral feeds must be connected to the

proper receptacles. (See Figure 3.1 Power Receptacle.) An 8 foot power cord comes standard on each terminal. The cord is designed to plug into the standard three hole wall receptacle. The power circuit should be rated at 15 amperes.

3.4 UNPACKING AND INSPECTION

The C270 Mod III is transported in a special container to eliminate possible damage during shipment. Unpacking from this container is relatively easy and requires only a knife to cut the nylon shipping straps.

3.4.1 Unpacking

1. Open top of container and remove packing material.
2. Remove the keyboard.
3. Remove the terminal.

3.4.2 Inspection

1. Remove the terminal's cover. This is done by loosening the two large screws at the rear of the terminal and sliding the cover back and then up.
2. Inspect all connections. Check all connectors to the logic rack, low voltage power supply, AC switch, high voltage power supply, and tube. Also check all boards for proper seating into the logic rack connectors.
3. Inspect the terminal for any damage.

3.5 INSTALLATION

Installation of the C270 should be accomplished according to the following procedures. Deviation from these procedures may cause damage to the equipment or injury to personnel.

3.5.1 Pre-Operational Check-Out

Various hard to define problems may be caused by improper grounding of equipment. All Courier equipment should be powered from a 115 VAC three-wire grounded power outlet. The ground wire must supply a good earth ground by being hard-wired to building steel. If conduit is used, it should be noted that some joints contain an insulating sleeve and prevent the conduit from returning to ground properly.

The customer must guarantee proper grounding of the power source. In most cases, he may verify this through the building Engineers who support the building. An indication that the outlet may be grounded may be obtained with a voltmeter as follows (refer to Figure 3.1 Power Receptacle):

1. From the safety ground to neutral should measure Ø volts AC.
2. From the safety ground to hot should measure 115 volts AC

± 10%.

3. From hot to neutral should measure 115 volts AC ± 10%.

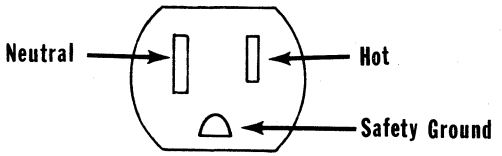


Figure 3.1 POWER RECEPTACLE (FEMALE)

3.5.2 Initial Check-Out

Perform the test listed on Table 3.2 prior to attachment to the controller.

Table 3.1 INITIAL TESTS

ACTION	RESULTS
1. Enable cross hatch test pattern. (Display board, switch B). Disable test pattern after test is completed.	Display screen should be of proper size, proportions, and clarity.
2. Depress CLEAR key.	Screen should clear and INPUT LOCKED light should go off.
3. Depress RESET key.	INPUT LOCKED light should go off.
4. Repeat steps 2 & 3 using TEST REQUEST, ENTER, and all PA and PF keys.	Same as steps 2 & 3, except screen does not clear.
5. Depress PROC switch on operator panel.	PROC mode light should come on.
6. Depress L.C. switch on operator panel.	LOWER CASE light should come on.
7. Depress operator panel CLR switch.	LOWER CASE and PROC lights should go out.
8. Turn F.E. switch on.	F.E. light should come on.
9. Turn F.E. switch off.	F.E. light should go off.
10. Depress INS MODE key.	EDIT MODE light should come on.
11. Depress RESET key.	EDIT MODE light should go off.
12. Test all other keys on keyboard.	Results per 270 Info Display System Operating Manual.

3.5.3 Off-Line Tests

Verify that a 1928 Port board is installed in the RTC, LTC, or VTLC instead of a 1910 Port board. Attach the C270 to the RTC, LTC, or VTLC via coax cable. Perform off-line tests in accordance with the respective controller F.E. Manual. Upon successful completion of these tests, strap the options on the Terminal per customer specifications.

3.5.4 Strapping Guide

The strappable features for C270-III are described below. Table 3.2 provides the strapping information for all straps and switches. Figure 3.2 is a board location chart.

1. Numeric Lock Option - With numeric lock option enabled, the characters (0-9), period (.), minus sign (-), and DUP may be entered by the operator in a field identified by the attribute byte as numeric and unprotected. Operation of any other key which can enter a displayable character lights the INPUT LOCKED indicator and disables all keys except the RESET key. Operation of the RESET key enables the keyboard and the INPUT LOCK light goes out. On a data entry keyboard the numeric lock option is disabled while the ALPHA key is depressed. If numeric lock option is disabled, alphabetic characters may be entered into a numeric field without restriction.

2. Numeric Lock Override - If enabled, alphabetic characters can be entered into an unprotected numeric field when the keyboard is up-shifted. If disabled, only numeric characters 1-9, ., -, and DUP can be entered into an unprotected numeric field.

   NOTE: Numeric Lock Override is applicable only if the Numeric Lock Option is enabled and a typewriter keyboard is being used.

3. Auto Skip - Upon entry of a character into the last character location of an unprotected field, the cursor is repositioned according to the attribute character that describes the next field.

   If in IBM mode, and the attribute character defines the next field as (a) alphameric and either protected or unprotected, or (b) numeric and unprotected, the cursor is positioned on the first character location in that field. If the next field is defined as numeric and protected, the cursor skips that field and is positioned to the first character location of the next unprotected field. If in Courier mode, the cursor skips all protected fields and is positioned on the first character location of the next unprotected field.

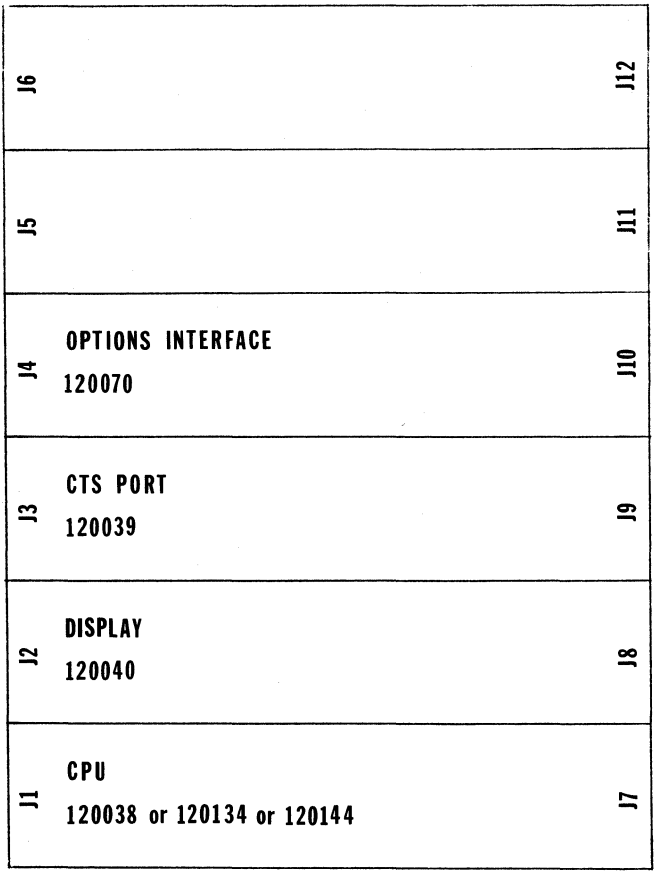


Figure 3.2 C270-III BOARD LOCATION

4. Protected Field Keyboard Lock - When enabled, the keyboard will lock if an attempt is made to enter data in a protected field. Depressing the RESET key will unlock the keyboard. If disabled, the keyboard does not lock if an attempt is made to enter data in a protected field; however, no data is entered, the clacker does not sound, and the cursor will not move.

5. Blinking Cursor - When enabled, the rectangular blinking cursor is displayed. If disabled, the underline type of cursor is displayed.

6. Blink Field - A high-lighting feature, that if enabled blinks the characters in an attribute-defined blinking field. If disabled, the characters will not blink.

7. Lower Case - When enabled, it allows for upper and lower case characters to be entered into the memory from the keyboard. If disabled, only upper case characters can be entered. This option is sometimes referred to as the Lower Case Transmit option. Lower case codes entered will not display lower case characters unless Lower Case Display option is installed.

8. Lower Case Display - If enabled, lower case character codes will display lower case alphabetic characters. If disabled, lower case character codes will display upper case alphabetic characters. This feature can be enabled by installing a strap or turning on the lower case switch on the operator panel. Lower Case ROMs are required to enable this option.

9. Full Reveal - When enabled, reveal mode uniquely identifies attribute and control characters on the display which otherwise would be non-displayable.

10. Variable Field Underline - When enabled, unprotected fields on a formatted screen are high-lighted by being underlined. If disabled, unprotected fields are not underlined.

11. Display Size - (Combination of two straps)

    1920 characters: 24 lines with 80 characters per line
    960 characters: 12 lines with 80 characters per line
    480 characters: 12 lines with 40 characters per line

12. Character Size - This feature is used to reduce character height when using a 960 or 480 character display.

13. Crosshatch - Test pattern used to align the CRT display.

14. Two Key Protram Enter - When enabled, this feature makes

the Program Enter Key the second key of a two key operation. The Program Enter Key must be depressed following the operation of any one of the PF keys (PF1-PF12) or PA keys (PA1, PA2). This feature prevents presenting unintentional requests to the host CPU. If disabled, the program enter key has no function whatsoever.

Table 3.2 C270 MOD III STRAPPING GUIDE

BOARD TYPE	SWITCH NO.	FUNCTION
CPU	Switch S1	OFF enables Numeric-Lock Option
	S2	OFF Courier Auto Skip, ON IBM Auto Skip
	S3	NOT Used
	S4	OFF enables Protected Field Keyboard Lock
	S5	OFF enables Blinking Cursor
	S6	OFF enables Full Reveal with F.E. Switch ON
	S7	NOT Used
	S8	OFF enables Variable Field Underline
	Straps	The following 13 straps (A - $\overline{D}$) are used to configure the CPU Board to accept different type ROMS.

See Note ***	82S181	2708	2KMask	4KMask
A	OUT	OUT	IN	IN
C	IN	OUT	IN	IN
D	OUT	OUT	OUT	IN
E	IN	IN	OUT	OUT
F	OUT	OUT	IN	OUT
G	IN	IN	OUT	OUT
H	OUT	OUT	IN	IN
J	IN	IN	OUT	OUT
K	OUT	OUT	IN	IN
$\overline{0}$	OUT †	OUT	OUT	IN
$\overline{B}$	OUT †	IN	OUT	OUT
$\overline{C}$	OUT †	IN	OUT	OUT
$\overline{D}$	OUT †	IN	OUT	OUT

B	OUT*
I	OUT* †
L	IN*
M	IN*
N	OUT*
P	IN*
R	OUT enables Numeric Lock Override
S	NOT Used
T	OUT enables Program Enter Key
U	IN enables Lower Case Transmit
V	OUT*
W	IN*
X	OUT*

CPU Continued on next page

Table 3.2 C270 MOD III STRAPPING GUIDE (continued)

BOARD TYPE	SWITCH NO.	FUNCTION
CPU	Y	OUT*
	Z	IN*
	A	IN*†
Display	Switch A	NOT Used
	B	ON enables Crosshatch Test Pattern
	C	OFF enables Blink Field Feature
	D	NOT Used
	Strap A	IN enables Lower Case Display
	B	IN for 480 Characters OUT for 1920 or 960 Characters.
	C	IN for small Characters (480 or 960)
	D	IN for 960 or 480 Characters OUT for 1920 Characters.
		Straps E thru N available on 120040-002 Display Board Only.
	E	OUT*
	F	IN for 480 Characters OUT for 1920 or 960 Characters.
	H	OUT*
	J	IN for 960 or 480 Characters OUT for 1920 Characters.
	K	OUT*
	L	OUT*
	M	IN*
	N	OUT*
CTS Port	Strap A	IN*
	B	OUT*
	C	IN*
	D	OUT*
	E	OUT*
	F	OUT*
	G	OUT*
	H	OUT*
	J	OUT*
	K	OUT*
	L	OUT*
	M	OUT*
	N	IN*
	P	OUT*
	R	IN*
Keyboard	Strap A	IN enables Keyboard Enhancement Option
	B,C	B C OUT OUT Typewriter Keyboard OUT IN Data Entry Keyboard IN OUT Typewriter/ Numeric Pad IN IN Operator Console Keyboard
	D	Not used

Table 3.2 C270 MOD III STRAPPING GUIDE (continued)

BOARD TYPE	SWITCH NO.		FUNCTION
Operator Panel	Strap	A	IN*
		B	IN*
Video/Sweep	Strap	A	IN*
		B	IN*
		C	IN*
Option** Interface	Strap	A,C	IN External EIA Clock
		B,D	IN Internal EIA Clock
		E	IN Parity Checked or EIA Data OUT No Parity Check
		F	IN 2 Stop bits transmitted OUT 1 Stop bit transmitted
		G,H	G H IN IN 5 Bit EIA Data Word IN OUT 6 Bit EIA Data Word OUT IN 7 Bit EIA Data Word OUT OUT 8 Bit EIA Data Word
		K	IN ODD Parity OUT EVEN Parity
		L	OUT Optical Character Reader IN Printer Interface

NOTE: 1 = OUT = OFF = OPEN
Ø = IN = ON = CLOSE

* The setting of these straps is not optional. The straps have to be set as specified for the terminal to operate properly.

** The Option Interface Board is used for Light Pen and Badge Reader options only. These strap functions are not used and regardless of their configuration have no effect on terminal operation and are described for information purposes only.

***CPU boards 120038-001 and -002 can use 82S181 or 2K Mask ROMs. CPU boards 120134-001 and -002 use 2708 ROMs only. CPU board 120144-002 uses 4K Mask ROMs only. CPU boards 120038-003 and -004 can use any of the ROM types available.

† These straps are provided on CPU Board #120038-003 & 004 only.

MAINTENANCE

4.1 SECTION OVERVIEW

This section contains information pertaining to diagnostic aids, measurement and adjustment procedures, and removal and replacement of major sub-assemblies. Interconnection and Power Distribution diagrams are also included.

4.2 TROUBLESHOOTING PROCEDURES

The following basic troubleshooting techniques should be utilized when repairing the C270 Display Terminal.

1. Determine whether the problem is in the C270 or elsewhere in the system.
2. Determine whether the problem is solid or intermittent. Intermittent problems will require more testing to insure they have been corrected.
3. Isolate the problem to either the video or logic section.
4. Check the terminal voltages for proper tolerance.
5. If a module has been replaced but does not solve the problem, consider the following based upon the symptoms:
    a. If the symptoms did not change, replace the original module and continue troubleshooting.
    b. If the symptoms change, consider the possibility of a defective spare and replace that module with another spare if possible.

4.3 DIAGNOSTIC AIDS

4.3.1 Crosshatch

This test pattern is used to isolate CRT display problems. Switch B on the display board will display the crosshatch pattern when switched to the "close" position. A proper display of the crosshatch pattern verifies the video/sweep board, HVPS, CRT and yoke as being good.

4.3.2 Screen Fill

The screen fill operation provides a fast and easy way to display the same character in every display position. To fill the screen, the character to be displayed has to be in the first position of the display. Turn F.E. switch ON, depress and hold the left shift key then depress and hold the shift lock key and depress PA2.

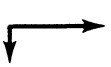
4.3.3 RAM Option Bits

Upon power-up, 8 option switches and 4 straps (S1-S8, and straps R, S, T, and U) located on the CPU board are read by the firmware. This switch and strap setting information is stored in RAM and used by the firmware to configure the terminal with the desired options. After power-up, the program no longer reads these straps and switches and changing their setting will not change the options selected prior to power-up. In order to reconfigure the terminal options controlled by these straps and switches, the terminal has to be powered down, the strap and switch setting changed to the new option configuration, then power the terminal up again causing the firmware to load into RAM the new switch and strap setting information.

The option information stored in RAM can be displayed on the screen as two bytes of ones and zeros. To display the RAM bits, clear the screen and set F.E. switch ON. Depress and hold the left shift key then depress and hold the shift lock key and depress the zero key. Bits 1 through 9 can be toggled, thus modifying the options configuration. This modification is short term because the RAM option bits will revert to the switch and strap setting if the terminal is powered down and back up.

To toggle bits 1 through 9, depress and hold the left shift key then depress and hold the shift lock key, then depress the numeric key corresponding to the bit number. Bit 9 of the RAM option bits can be set to a one by a keyboard operation only and does not have a corresponding strap or switch. Table 4.1 shows the relationship between the RAM bits, the straps and switches, the numeric keys used to toggle the bits, and the options.

Table 4.1 RAM OPTION BITS



BIT DISPLAY POSITION	SWITCH	NUMERIC KEY	BIT STATE	FUNCTION
1	S1	1	1 Enable 0 Disable	Numeric Lock Option
2	S2	2	1 Courier 0 IBM	Auto Skip
3	S3	3	NOT USED	
4	S4	4	1 Enable 0 Disable	Protected Field Keyboard Lock
5	S5	5	1 Enable 0 Disable	Blinking Cursor
6	S6	6	1 Enable 0 Disable	Full Reveal w/F.E. switch

Table 4.1 RAM OPTION BITS (Continued)

BIT DISPLAY POSITION	SWITCH	NUMERIC KEY	BIT STATE	FUNCTION
7	S7	7	NOT USED	
8	S8	8	1 Enable 0 Disable	Variable Field Underline
9		9	1 Enable 0 Disable	Aid Key Repeat
10			NOT USED	
11			NOT USED	
12			NOT USED	
13	STRAPS S		NOT USED	
14	R		1 Enable 0 Disable	Numeric Lock Override
15	T		1 Enable 0 Disable	Two Key Program Enter
16	U		1 Disable 0 Enable	Lower Case Transmit

4.3.4 ROM LRC Test

An LRC check is done on the terminal's program ROMs upon power-up. If a failure occurs, the error light will be lit and the audible alarm will sound if installed.

4.3.5 Full Reveal

Reveal mode is used to identify characters received by the terminal's display buffer that are normally non-displayable. These include the attributes and control characters that format the CRT display. Full reveal can be on unconditionally or be controlled by the F.E. switch.

To invoke unconditional Full Reveal, depress and hold down the left shift key, then depress and hold down shift lock, and depress PA1. To come out of uncontitional Full Reveal, repeat the operation.

To have Full Reveal under control of the F.E. switch, turn power off, set switch S6 on the CPU board off and turn power back on, or set bit 6 of RAM options bits to a 1.

NOTE: The C270 Information Display Reference Manual has a reveal mode identification chart that identifies all 256 character combinations. The chart is on pages 19 - 24 of the manual.

4.3.6 AID Key Repeat

AID keys (PF1 - PF12, PA1 - PA3, Clear, Test Request, and Enter) can be set to repeatedly present their AID code as long as they are held down. This feature can be used to observe the host system's response time to a keyboard request. To enable AID key repeat bit #9 of the RAM option bits has to be set to a 1.

4.4 MEASUREMENT AND ADJUSTMENT PROCEDURES

4.4.1 Voltage Test Points

Table 4.2 provides the test points and tolerances for the terminal's voltages. Figure 4.1 C270-III Power Distribution shows the source and destination points for each voltage.

Table 4.2 VOLTAGE TEST POINTS

VOLTAGE	TEST POINT LOCATION
+ 5 VDC ± .25 VDC	Top of Backpanel.
- 5 VDC ± .25 VDC	Top of Backpanel.
+12 VDC ± .4 VDC	Top of Backpanel.
-12 VDC ± .4 VDC	Top of Backpanel.
+28 VDC ± 2.0 VDC	Top of Backpanel.
6.3 VAC ± 1.0 VAC	Measure across the two brown wires going to the CRT at the two-pin connector, P2.
-100 VDC ± 10 VDC	Sweep Board, lower left corner
+800 VDC ± 25 VDC	Sweep Board, lower left corner
Ground	Top of Backpanel.

4.4.2 Video/Sweep Adjustment Procedure

The following procedure is for adjusting the video/sweep PC board and Yoke assembly to obtain a video display of proper size, proportion, and linearity. The display should be 7" high X 10" wide. Characters should be of a uniform size and clarity at all potitions on the display.

To insure optimum alignment, perform adjustments in the sequence laid out by this procedure.

A 15 minute warm-up period is required by the terminal prior to performing this procedure.

1. Fill the screen with H's.
2. Adjust brightness control on maintenance panel for maximum brightness.
3. Adjust R80 (Brightness Control pot on the video/sweep board) to the point where background raster just disappears.

4. Adjust R103 fully counterclockwise. Power the terminal OFF while looking at the screen to check for screen flash. If screen flash does not occur, the pot is adjusted properly. If screen flash does occur, adjust the pot clockwise in eighth turn increments while checking for screen flash after each adjustment. The pot is properly adjusted when screen flash no longer occurs.

5. Adjust R19 (Vertical Centering) to center the display vertically.

6. Adjust R33 (Vertical Size) for a vertical display size of approximately 7".

7. Adjust R34 (Vertical Linearity) to obtain uniform vertical character size from top to center to bottom of display.

8. Readjust vertical centering (R19) and vertical size (R33) to center the display and obtain a 7" vertical display size.

9. Adjust R39 (Horizontal Size) to obtain a 10" horizontal display size. If a 10" display cannot be obtained, adjust R39 for maximum width.

10. Adjust L1 (Horizontal Linearity Coil) for maximum display width.

11. If the sides of the display fall outside the screen, adjust R39 to bring both sides of the display within the viewing area.

12. Adjust R47 (Horizontal Centering) to center the display horizontally.

13. Adjust R39 to obtain a 10" horizontal display size.

14. If needed, readjust L1 to obtain uniform character widths at each side and center of display and readjust R39 for a 10" display width.

15. Adjust R26 (Transient Response Pot) to make the top dots on the top row of characters equally spaced as compared to the top dots in the center and bottom rows. Data should look uniform throughout the screen.

16. Verify that the top line of characters appear level. If no, loosen and adjust the yoke to obtain a level display.

17. Adjust R46 (Orthogonality Pot) to make the left side of the display.

18. Adjust R77 for uniform focus throughout the display area.

4.5 REMOVAL AND REPLACEMENT PROCEDURES

Disconnect AC power to the terminal prior to removal or replacement of any assembly. Exercise extreme caution in handling the CRT to

prevent breakage. Never handle the CRT by its neck. Figure 4.2 C270-III Interconnection Diagram provides a reference for proper mating of connectors during re-assembly.

4.5.1 Cover

Removal:

Loosen the two captive retaining screws in the lower rear corners of the cover. Move the cursor towards the rear until it is free of the front bezel. Raise the front of the cover and lift it off the unit.

Replacement:

Lower the cover over the unit from the rear. Lower the front of the cover and guide the front lip into the bezel. Secure the cover by tightening the captive retaining screws in the rear of the cover.

4.5.2 Low Voltage Power Supply

Removal:

1. Disconnect J1, J2, and J3 from the Low Voltage Power Supply.
2. Remove the two holding screws on the AC Power receptacle.
3. Remove one holding screw on the LVPS access plate and rotate the access plate up.
4. Disconnect the transformer connector located inside the LVPS.
5. Remove the screws securing the bracket at the rear of the LVPS to the base pin.
6. Remove the two screws securing the LVPS to the transformer mounting clamp.
7. Remove the LVPS from the terminal.
8. Remove the rear mounting bracket from the LVPS and mount it on the replacement LVPS.

Replacement:

1. On the replacement LVPS remove the screw that locks the access plate and rotate the access plate toward the top of the LVPS.
2. Place the LVPS beside the transformer and connect the transformer connector to J5 inside the LVPS.
3. Secure the LVPS with the two holding screws on the rear mounting bracket and the two holding screws on the transformer clamp.
4. Secure the LVPS AC power receptacle to the rear of the terminal base with two holding screws.

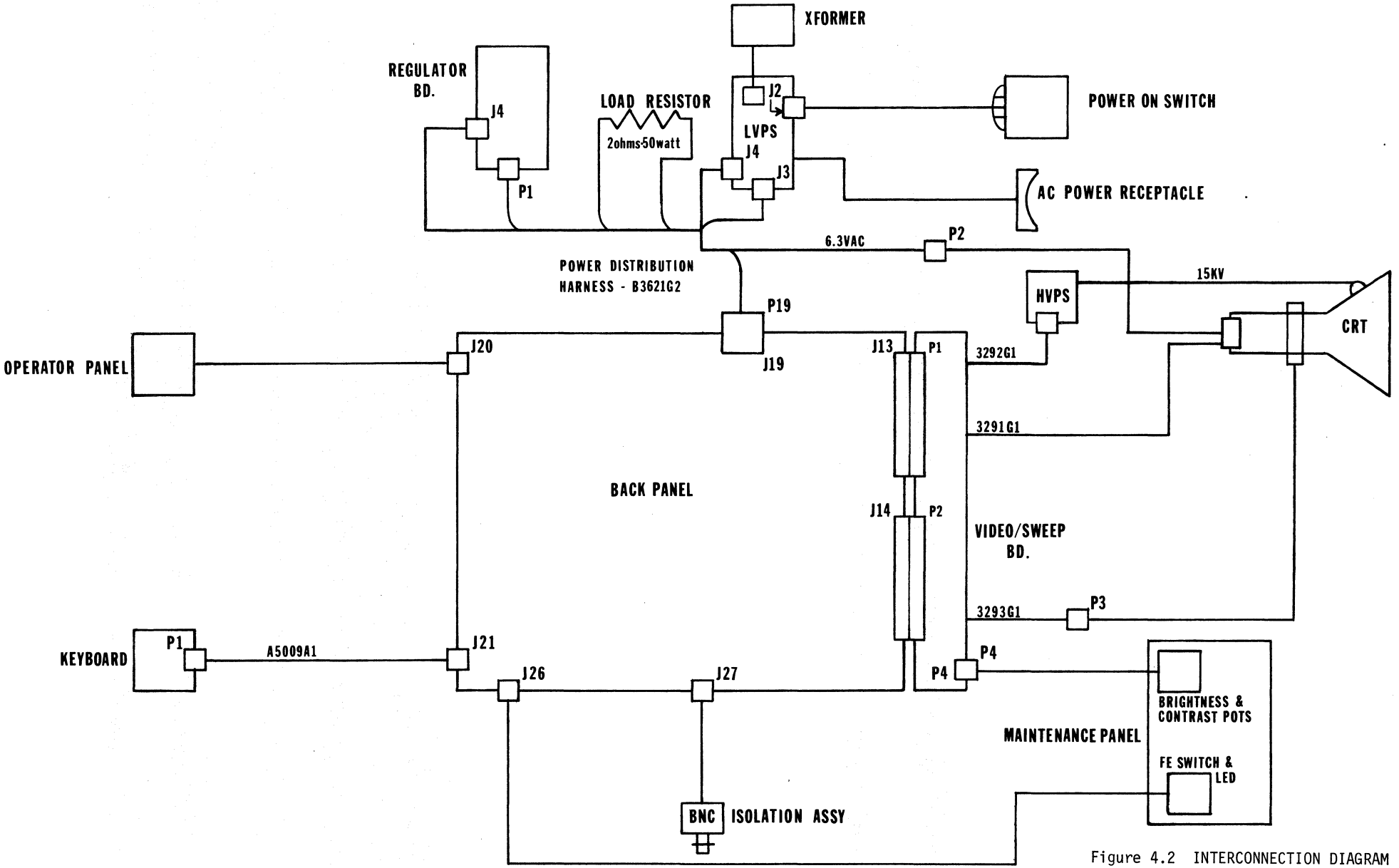


Figure 4.2 INTERCONNECTION DIAGRAM

5. Connect the power harness connectors to J1, J2, and J4 on the LVPS.

6. Secure the LVPS access plate in place.

4.5.3 High Voltage Power Supply

Removal:

1. Disconnect the high voltage lead that goes to the CRT.

2. Disconnect the 4 pin connector at the HVPS.

3. Remove the two nuts secruing the HVPS to its mounting bracket.

NOTE: It is not necessary to remove the mounting bracket.

Replacement:

Reverse the removal procedure.

4.5.4 Video/Sweep Board

Removal:

1. Disconnect CRT base connector.

2. Disconnect the two pin 6.3 V connector.

3. Disconnect yoke 4 pin connector.

4. Disconnect 4 pin connector from HVPS.

5. Disconnect P4 connector at the Video/Sweep board.

6. Remove sweep board shield.

7. Remove two video/sweep board holding screws.

8. Disconnect and remove video/sweep board.

Replacement:

Reverse the removal procedure.

4.5.5 Keyboard

Removal:

1. Disconnect the keyboard cable connector from back panel J21.

2. Remove cable retaining clamp (located inside the base by the opening where the cable enters the terminal).

3. Remove cable from the base.

Replacement:

1. Insert keyboard cable through the opening on the base and connect cable connector to J21 on the back panel.

2. Secure the cable to the terminal base with the cable clamp.

4.5.6 Operator Panel PCB

Removal:

1. Disconnect operator panel cable connector from J20 on the back panel.
2. Remove four operator panel holding screws and remove operator panel PCB.

Replacement:

1. Secure operator panel in place with four holding screws.
2. Connect operator panel cable connector to J21 on the back panel.

4.5.7 Yoke

Removal:

1. Disconnect the four pin yoke cable connector.
2. Disconnect the CRT base connector.
3. Remove yoke metal shield.
4. Loosen yoke clamp and remove yoke from CRT neck.

Replacement:

1. Install replacement yoke on CRT neck. Do not install yoke metal shield yet.
2. Connect 4 pin yoke connector.
3. Connect CRT base connector.
4. Restore power to the terminal and fill screen with characters for yoke alignment.
5. After yoke is aligned, tighten the yoke retaining clamp for a snug but not over-tight fit.
6. Remove AC power to the terminal and install yoke metal shield.
7. Restore AC power.

4.5.8 Isolation Assembly

Removal:

1. Disconnect coaxial cable connector at the rear of the terminal.
2. Disconnect BNC Isolation Assembly cable connector from J27 on the back panel.
3. Remove the two screws holding the BNC Isolation Assembly to the chassis and remove the BNC Isolation Assembly.

Replacement:

Reverse the removal procedure.

4.5.9 CRT

Removal:

1. Disconnect CRT base connector.
2. Disconnect the 4 pin connector on the leads coming out of the rear of the yoke shield.
3. Remove yoke shield and yoke from CRT neck.
4. Disconnedt high voltage lead from the CRT.
5. Carefully place terminal face down so that CRT neck is pointing up.
6. Remove the 4 screws that hold the CRT to the bezel.
7. Remove the CRT from terminal.
8. Remove metal shields and holding straps off the back of the CRT. These shields and straps will be mounted on the replacement CRT.

Replacement:

1. Mount metal shields and straps on the CRT.
2. Place CRT into the terminal insuring High Voltage receptacle on the CRT is towards the LVPS side of the terminal.
3. Secure CRT to front bezel with the 4 CRT holding screws. Insure all grounding strap lugs are also secured by the 4 CRT holding screws.
4. Install yoke on CRT. Do not install yoke metal shield yet.
5. Connect the yoke to sweep/video board with 4 pin connector.
6. Connect the High Voltage lead to the CRT.
7. Connect the CRT base connector to the CRT.
8. Power up the terminal and fill the screen with characters to be used for alignment of the yoke.
9. After the yoke is aligned, tighten the retaining clamp to secure the yoke to the CRT.
10. Remove AC power from the terminal and install yoke metal shield.
11. Install Terminal Cover, restore AC power to the terminal.

4.5.10 Maintenance Panel

Removal:

1. Disconnect F.E. switch cable connector J26 at the back panel.
2. Disconnect brightness control cable connector from P4 on the video/sweep board.
3. Remove the maintenance panel holding screws and remove maintenance panel.

Replacement:

1. Secure replacement maintenance panel in place with two holding screws.
2. Connect F.E. switch cable connector to J27 at the back panel.
3. Route and connect brightness control cable connector to P4 on the video/sweep board.

4.6 PREVENTATIVE MAINTENANCE

There is no scheduled preventative maintenance on the C270-III.

4.7 TOOLS AND TEST EQUIPMENT

There are no special tools or test equipment required to maintain the C270-III other than the standard field engineer's tool kit.

PARTS

5.1 SECTION OVERVIEW

This section contains parts lists and mechanical drawings to aid the F.E. in identifying and ordering replacement assemblies for field repair of the C270-III.

5.2 TABLES

Table 5.1 is a cross reference from part number to marketing number. Table 5.2 is the parts list for the C270. The item number indicates the location of the corresponding part in Figure 5.1 where applicable.

Table 5.1 CROSS REFERENCE

Part No.	Description	Marketing No.
Terminals without keyboards		
112700-001	Upper Case 480 Char Display	2700-01
112700-002	Upper Case 960 Char Display	2700-02
112700-003	Upper Case 1920 Char Display	2700-03
111121-001	Lower/Upper Case 480 Char Display	2700-01 w/1121 option
111121-002	Lower/Upper Case 960 Char Display	2700-02 w/1121 option
111121-003	Lower/Upper Case 1920 Char Display	2700-03 w/1121 option
Keyboards		
111001-001	Typewriter	1001
111002-001	Data Entry	1002
111003-001	Typewriter with Numeric Pad	1003
111004-001	Operator Console	1004
111011-001	Cascade Typewriter	1011
111012-001	Cascade Data Entry	1012
111013-001	Cascade Typewriter with Numeric Pad	1013
111014-001	Cascade Operator Console	1014
Options		
111100-001	Audible Alarm	1100
111101-001	Keyboard Numeric Lock	1101
111102-001	Security Keylock (keyed the same)	1102
111102-002	Security Keylock (keyed different)	1102
111120-001	Badge Reader	1120
111122-001	Light Pen	1122

Table 5.2 PARTS LIST

Description	Part No.	Item No.
Display (without Keyboard)		
1920 Char Upper Case	112700-003	
960 Char Upper Case	112700-002	
480 Char Upper Case	112700-001	
1920 Char Lower/Upper Case	111121-003	
960 Char Lower/Upper Case	111121-002	
480 Char Lower/Upper Case	111121-001	
CPU Board (with ROMs and RAMs)		
Standard	890038-001	
LP/BR Option	890038-002	
CPU PCBA (without ROMs or RAMs)	120038-001	
Program ROM Kit	150083-001	
PGM ROM #1 IC 68	170049-001	
PGM ROM #2 IC 67	170050-001	
PGM ROM #3 IC 53	170051-001	
PGM ROM #4 IC 52	170052-001	
PGM ROM #5 IC 28 (Light Pen/Badge Reader Option only)	170401-001	
Mapping ROM IC 23	170044-001	
RAM IC 25 and IC 26	A3772P1	
Display Board (with ROMs and RAMs)		
480 Char Upper Case	890040-001	
960 Char Upper Case	890040-002	
1920 Char Upper Case	890040-003	
480 Char Lower/Upper Case	890040-004	
960 Char Lower/Upper Case	890040-005	
1920 Char Lower/Upper Case	890040-006	
Display PCBA (without ROMs or RAMs)	120040-001	
Translator ROM IC 21	170047-001	
Decoder ROM IC 20	170048-001	
Mapping ROM IC 11	170045-001	
Char Generator Upper Case IC 19	170053-001	
Char Generator Upper/Lower Case IC 19	170054-001	
RAM 1920 Char IC 22, 23, 24, 25	A3772P2	
RAM 960 or 480 Char IC 23, 25	A3772P2	
CTS Port Board (with ROM)	890039-001	
CTS Port PCBA (without ROM)	120039-001	
Mapping ROM IC 6	170046-001	
Options Interface Board		
Options Interface PCBA	120070-001	
Mapping ROM	170486-001	
Regulator Board	C1814A3	25
Video/Sweep Board	120063-001	15
Cable	A3291A1	
Cable	A3292A1	
Cable	A3292A1	
Operator Panel	890036-001	
Op Panel Basic	150095-001	33

Table 5.2 PARTS LIST (Continued)

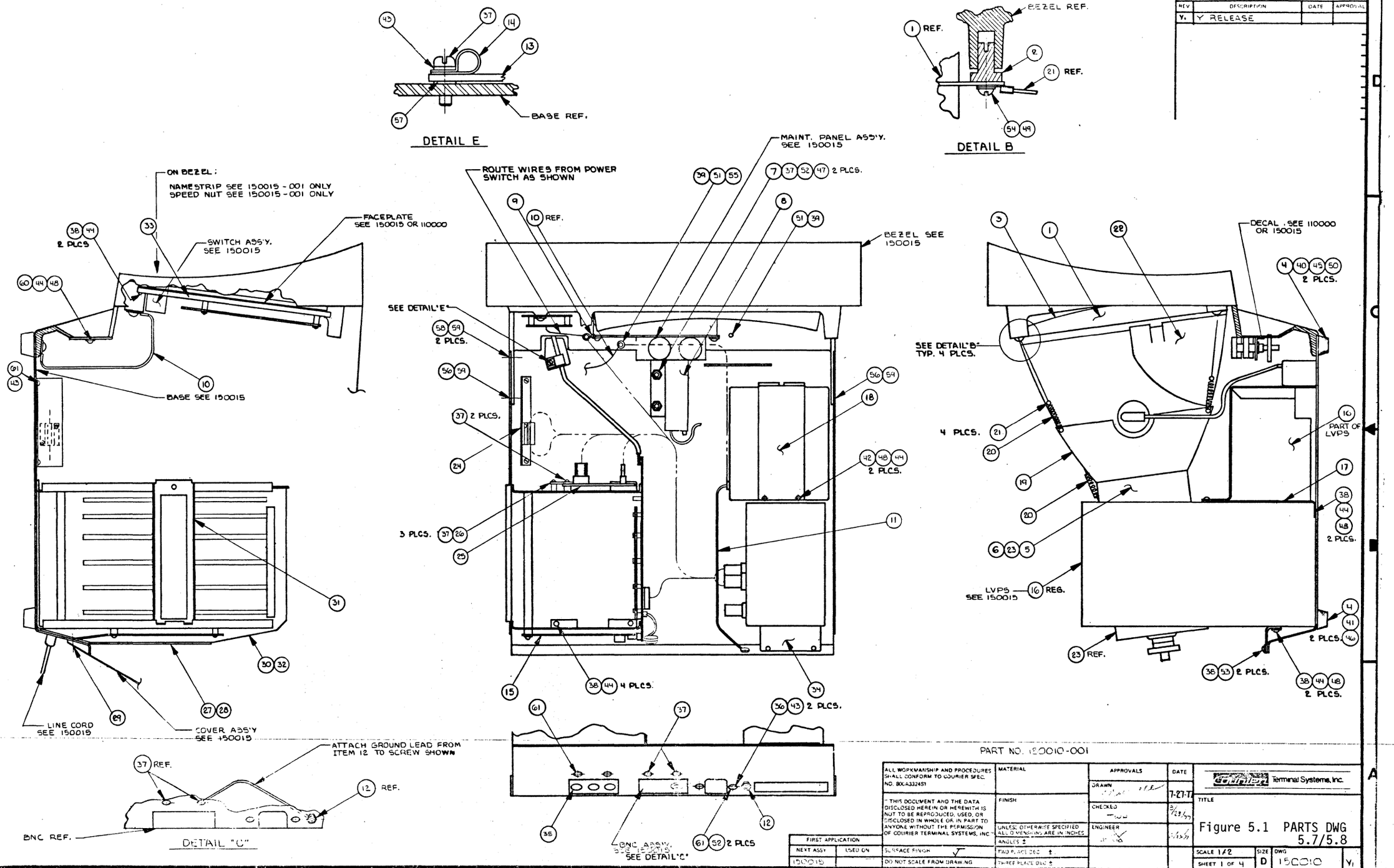
Description	Part No.	Item No.
Op Panel PCBA	120036-001	
Faceplate	1514P1	
On/Off Switch	3050G2	
LVPS	A259065	
LVPS (shoe box)	A2528P1	
Transformer	A2529P1	
LVPS (alternate)	A2590G1	
LVPS (shoe box)	1856P1	
Transformer	1857P1	
LVPS (alternate)	2590G2	
LVPS (shoe box)	1856P2	
Transformer	1857P2	
LVPS (alternate)	2590G3	
LVPS (shoe box)	2227P2-1	
Transformer	2228P1-1	
LVPS (alternate)	2590G4	
LVPS (shoe box)	2227P2-2	
Transformer	2228P2-2	
LVPS (alternate)	2590G6	
LVPS (shoe box)	2227P2-2	
Transformer	2228P2-2	
Cover	A2555G1	
Maintenance Panel	150091-001	
BNC - Isolation Assembly	A2274A2	
HVPS	A2808P1	8
Module Door	150093-001	31
Card Module	150092-001	30
Back Panel	120037-001	
Yoke	A1526A1	5
Cable, Power Harness	B3621G1	24
Cable, Coax	A1745A specify length	
Straps (Jumpers)	A0533P2	
CRT	A1718P1	1
Shield, CRT Neck	A2539A1	6
Cable Clamp (Maint Panel)	A0235P3	9
Ground Strap (CRT)	150094-001	10
Ground Strap (Transformer)	A1344A4	11
Cable Hole Plug	B2001P1	12
Cable Clamp (Keyboard Cable)	A2362P4	14
Shield, Transformer	B1887P1	16
Bracket, Transformer	A2328P1	17
Shield, CRT Top	C1888P1	19
Spring, CRT Shield	A1118P1	20
Strap, CRT Shield	A1872A1	21
Shield, CRT bottom	C1853P1	22
Shield, Video/Sweep	A2284P1	27
Receptacle	A1889P202	29
Bracket, LVPS	A1588P1	34

Table 5.2 PARTS LIST (Continued)

Description	Part No.	Item No.
Light Pen	111122-001	
Badge Reader	111120-001	
Security Lock	111102-001	
Keyboard Numeric Lock	111101-001	
N-Key Rollover Option	110009-001	
Keyboards		
Typewriter	110000-001	
PCB with keytops	150000-001	
PCB with switches only	120041-001	
Keytops Typewriter	C1523P21	
Keytops PF	C1523P23	
Data Entry	111002-001	
PCB with keytops	150000-002	
PCB with switches only	120041-002	
Keytops DE	C1523P22	
Typewriter with Numeric Pad	111003-001	
PCB with keytops	150000-003	
PCB with switches only	120041-003	
Keytops Typewriter	C1523P21	
Keytops PF	C1523P25	
Operator Console	111004-001	
PCB with keytops	150000-004	
PCB with switches only	120041-001	
Keytops Op Console	C1523P26	
Keytops PF	C1523P23	
Typewriter, Cascade	111011-001	
PCB with keytops	150000-006	
PCB with switches only	120041-004	
Keytops Typewriter	C1523P21	
Keytops PF	C1523P23	
Data Entry, Cascade	111012-001	
PCB with keytops	150000-007	
PCB with switches only	120041-001	
Keytops DE	C1523P22	
Typewriter with Numeric Pad, Cascade	111013-001	
PCB with keytops	150000-008	
PCB with switches only	120041-006	
Keytops Typewriter	C1523P21	
Keytops PF	C1523P23	
Keytops Numeric Pad	C1523P25	
Operator Console, Cascade	111014-001	
PCB with keytops	150000-009	
PCB with switches only	120041-004	
Keytops Op Console	C1523P26	
Keytops PF	C1523P23	

Table 5.2 PARTS LIST (Continued)

Description	Part No.	Item No.
Keyboard Common Parts		
Audible Alarm (Optional)	111100-001	
Cable	A5009A1	
Space Bar Assembly	A2813P1	
Switch, Logic Scan	A2479P4	
Lighted Switch Logic Scan	A2479P9	
Dummy Switch	A2479P5	
Clacker	A1875G1	
Switch, Cascade Logic Scan	A2479P10	



REVISIONS			
REV	DESCRIPTION	DATE	APPROVAL
Y1	Y RELEASE		

PART NO. 150010-001

ALL WORKMANSHIP AND PROCEDURES SHALL CONFORM TO COURIER SPEC. NO. 80A332451	MATERIAL	APPROVALS	DATE
THIS DOCUMENT AND THE DATA DISCLOSED HEREIN OR HEREWITH IS NOT TO BE REPRODUCED, USED, OR DISCLOSED IN WHOLE OR IN PART TO ANYONE WITHOUT THE PERMISSION OF COURIER TERMINAL SYSTEMS, INC.	FINISH	DRAWN	7-27-77
	UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES	CHECKED	8/23/77
	ANGLES ±	ENGINEER	8/25/77
	SURFACE FINISH √	TWO PLACE DEC. ±	
	DO NOT SCALE FROM DRAWING	THREE PLACE DEC. ±	

FIRST APPLICATION	
NEXT ASSY	USED ON
150015	

Courier Terminal Systems, Inc.

TITLE

Figure 5.1 PARTS DWG 5.7/5.8

SCALE 1/2	SIZE D	DWG 150010	Y1
SHEET 1 OF 4			

The Courier C277 "Plug Compatible" Display Terminal

APPENDIX-A

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

INTRODUCTION

1.1 SCOPE

The C277 Appendix to the C270-III provides Courier Field Engineers with information to facilitate installation and amintenance of the C277 Display Terminal.

1.2 CONTENT

Much of the information contained in the C270-III Manual applies to the C277 terminal and this supplement will only cover subject matters unique to the C277.

Section 1 - Introduction

Describes the scope and content of this supplement, provides a general product description and references related publications.

Section 2 - Theory of Operation

Provides a general and functional block diagram and describes the coax interface.

Section 3 - Installation

This section provides information for pre-installation planning, installation and initial check-out procedures.

Section 4 - Maintenance

References C270-III manual for voltage measurement and adjustment procedures, removal and replacement procedures, power distribution and interconnection drawings. Describes a basic approach to isolating problems between the terminal and controller.

Section 5 - Parts

This section contains a list of spare parts unique to the C277 and references the C270-III manual parts section for parts common to C277 and C270-III.

1.3 PRODUCT DESCRIPTION

The C277 is a general purpose alpha numeric display terminal for use in clusters via coax cable attachment to an IBM Local Terminal Controller (3272), Remote Terminal Controller (3271), or other controllers that support the IBM 3277 display terminal.

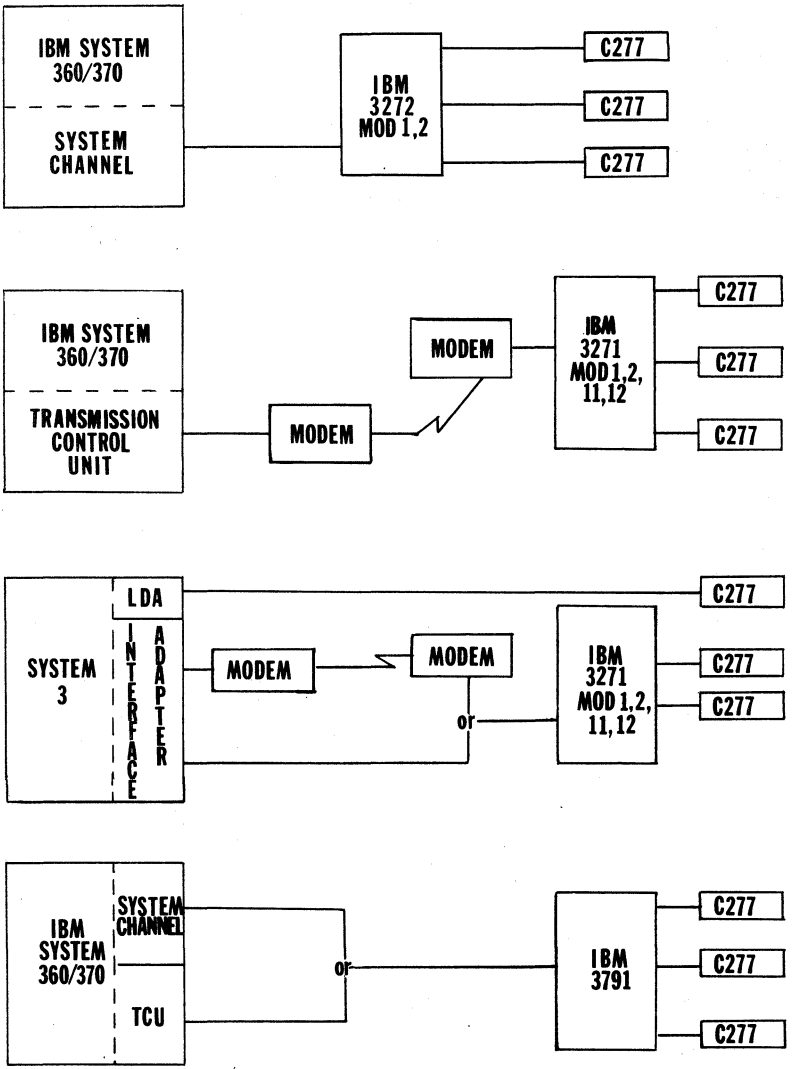


Figure 1.1 SYSTEM CONFIGURATOR

1.4 MARKETING CONFIGURATION

All options applicable to the C270-III are compatible to the C277 with the exception of a 960 character screen. The 960 character screen is excluded to maintain compatibility with the IBM 3277 display terminal.

1.5 REFERENCES

Additional information may be obtained from the publications listed below.

A. Courier Product Description - Courier Publication Number 30-0003-00-00

B. 270 Information Display System Reference Manual - Courier Publication Number 30-0001-00-01

C. Field Engineer's Handbook - Publication Number FED-9999-1-0

D. IBM 3270 Information Display System Component Description IBM Publication Number GA-27-2749

THEORY OF OPERATION

2.1 SECTION OVERVIEW

This section is designed to give the Courier field engineer an understanding of how the C277 display terminal functions by presenting the general and functional theory of operation and associated block diagrams. Descriptions of controls and indicators unique to the C277 are included. Reference is made to the C270-III manual for areas common to the C270 and C277.

2.2 GENERAL THEORY

The C277 functional architecture consists of a three digital board system connected to:

a coax line for Control Unit interface
a keyboard for operator data entry
an operator panel for operator functions control
the video system for information display

Interboard communications is through a standard C-BUS interconnection providing address, data and bus control lines between boards. See Fig. 2.1.

2.3 OPERATOR AND MAINTENANCE CONTROLS

The indicators and controls defined in Section 2.3 of the C270-III manual apply to the C277 with the following exceptions:

FE - This two-position switch and indicator is used to set-up the C277 for maintenance activities.

Proc Mode - This push button switch places the C277 in local data process mode which presently is not used by the C277.

Message Waiting - NOT USED by C277.

Error - This indicator is turned on by the terminal's firmware ROM LRC test to indicate a failure. Reset by the CLR push button.

2.4 FUNCTIONAL THEORY

The functional description in Section 2.4 of the C270-III manual applies to the C277 with the exception of the Input/Out System. The coax Input/Out System for the C277 is described below.

2.4.1 Coax I/O System

The C277 communicates in a bi-directional (half-duplex) manner

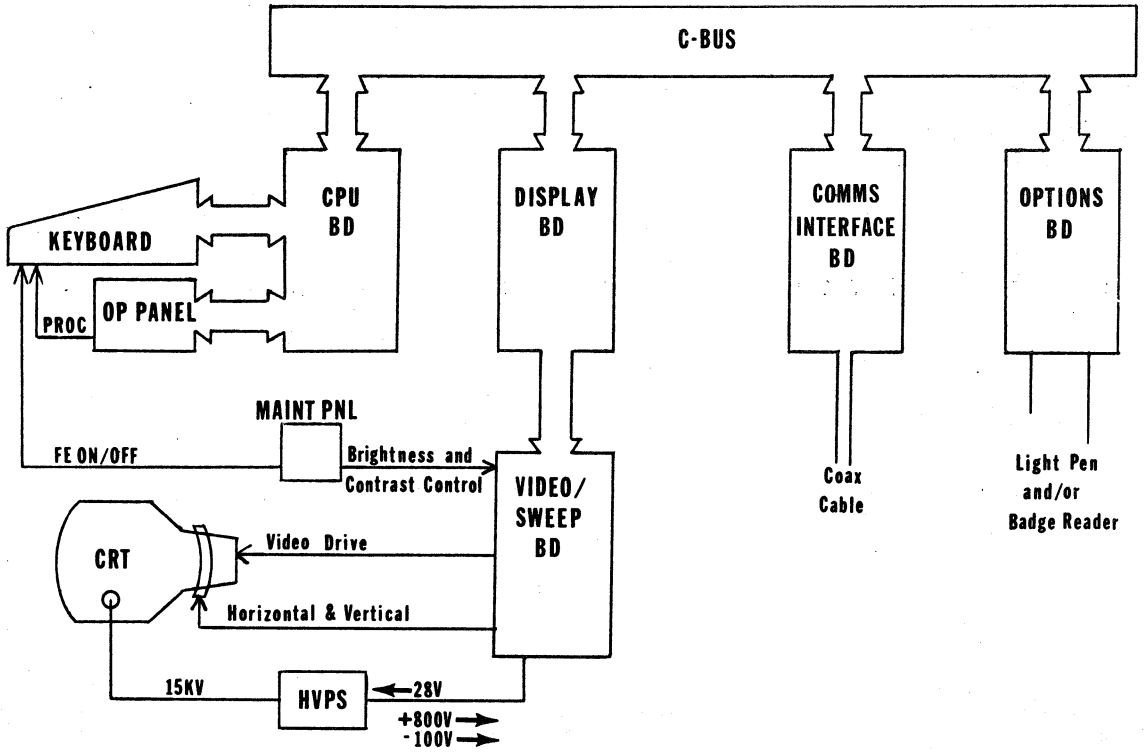


Figure 2.1 C277-III GENERAL BLOCK DIAGRAM

over coaxial cable (RG-62) with the appropriate IBM controller. The transmission method is half-duplex, serial transmission of 13-bit words. The communications data stream consists of Data, Control, and Status words. The bit definition for each word is described below.

Data Word:

Character Format

1	Ø	Csr	Ø	1	2	3	4	5	6	7	P	Ø
				DATA BITS								
1	2	3	4	5	6	7	8	9	10	11	12	13

Attribute Format

1	Ø	Csr	1		U/P	A/N	D/S	LP BL	Ø	MDT	P	Ø
1	2	3	4	5	6	7	8	9	10	11	12	13

Bit

1 - Always a 1 indicates first bit of an incoming word.

2 - Always Ø for data word.

3 - Cursor position. If a bit is a 1, cursor will be positioned on character identified by the particular data word.

4 - Ø = data character, 1 - attribute character.

5 - 11 - Character Data Bits. When defined as an attribute by bit 4:

Bit 5 = Space
Bit 6 = 0 = Unprotected Field
1 = Protected Field
Bit 7 = 0 = Alphanumeric Field
1 = Numeric Field
Bits 8 & 9 00 = Display Non Detect
01 = Normal

Bit 8 & 9 00 = Display/Non-detectable
01 = Display/Detectable/Blink
10 = Intense/Detectable
11 = Non-display/non-print/non-detectable

Bit 10 - NOT USED
Bit 11 1 = Modified Data Tag for Previous Field
Bit 12 - Parity bit, assigned by transmitting Unit to maintain odd parity.
Bit 13 - Always Ø when transmitted from Control Unit.
1 - when transmitted from a 1920 Character Terminal
Ø - when transmitted from a 480 Character Terminal

Control words 1 & 2 are transmitted from control unit to the terminal.

Control Word #1

1	1	Ø	POLL	READ	WRITE	SYS AVAIL	UNLK KEYBD	ERASE UNPRO	Reset Xmit Chk	Ack	P	Ø
1	2	3	4	5	6	7	8	9	10	11	12	13

Control Word #2

1	1	1	POLL	SPARE	FORMAT		START PRINT	SOUND ALARM	Reset Xmit Chk	SPARE	P	Ø
1	2	3	4	5	6	7	8	9	10	11	12	13

Bit

1 - Always a 1 indicates first bit of an incoming word.
2 - Always 1 for Control word.
3 - Ø = Control Word #1.
1 = Control Word #2.
4 - Poll, a 1 causes terminal to respond with status word and trigger System Ready Indicator.
5 - CW# 1 - Read - Causes transfer of Device Buffer to Control Unit Buffer.
4&5 - Read Poll - Both bits set to a 1 - Causes Terminal to respond with status word and set Device Select and Input Lock Latches and Reset System Available Latch.
6 - CW# 1 - Write - Signals terminal that Control Unit Buffer is to be transferred to the terminal.
7 - CW# 1 - System Available - Sent to the terminal on an ending poll initiated by an I/O Command. Lights System Available Indicator.
6&7 - CW# 2 - Specifies printer line length.
8 - CW# 1 - Unlock keyboard - Sent to terminal after a Write if specified by WCC. Unlocks keyboard and clears aid bits.
CW# 2 - Starts Printer

9 - CW#1 - Erase all unprotected - Sent to terminal as a result of CPU initiated EAU command.
CW#2 - Sounds Audible Alarm.
10 - Reset XMIT CHECK - Sent to terminal to reset Xmit Check Flag.
11 - CW#1 - ACK - Positive Acknowledgement from the control unit to a terminal status word with bit 6 (info. pending) set.
CW#2 - Spare
12 - Parity - Assigned by transmitting unit for odd parity.
13 - Always Ø on Control Words.

Terminal Status Word

1	Ø	DEV BUSY	DEV CHECK	XMIT CHECK	INFO PENDING	AID CODE	P	Ø/2
1	2	3	4	5	6	7 8 9 10 11	12	13

Bit
1 - Always a 1.
2 - Always a Ø for display status word.
3 - Busy - Indicates that the terminal is executing a keyboard, Light Pen, Badge Reader, or EAU operation.
4 - Device Check - Indicates that the terminal detected a Parity error or Cursor Check in its buffer during a read operation.
5 - Transmit Check - Indicates that the terminal detected a Parity error, Cursor Check, or data overflow in data received from control unit.
6 - Info Pending - Indicates that an AID has been generated by the display station operator.
7-11 - Contain the AID code.
12 - Parity - Assigned by Transmitting unit to maintain odd parity.
13 - Ø when transmitted from a 480 character device.
1 when transmitted from a 1920 character device.

2.5 FUNCTIONAL BOARD DESCRIPTION

Section 2.5 of the C270-III manual provides a functional description of each major module in the C277. It should be noted that the C277 comms interface board performs the same function as the CTS port board does on the C270-III. (See Fig. 2.2)

2.6 FIRMWARE FUNCTIONAL DESCRIPTION

The firmware description in Section 2.6 of the C270-III applies to the C277 with the exception of the Timer interrupt handler routine which is described below for C277 application.

2.6.1 Timer Interrupt Handler

This routine handles the interrupts from the PIA timer. The timer interrupt counts down a timer byte and resets the timer hardware when zero is reached.

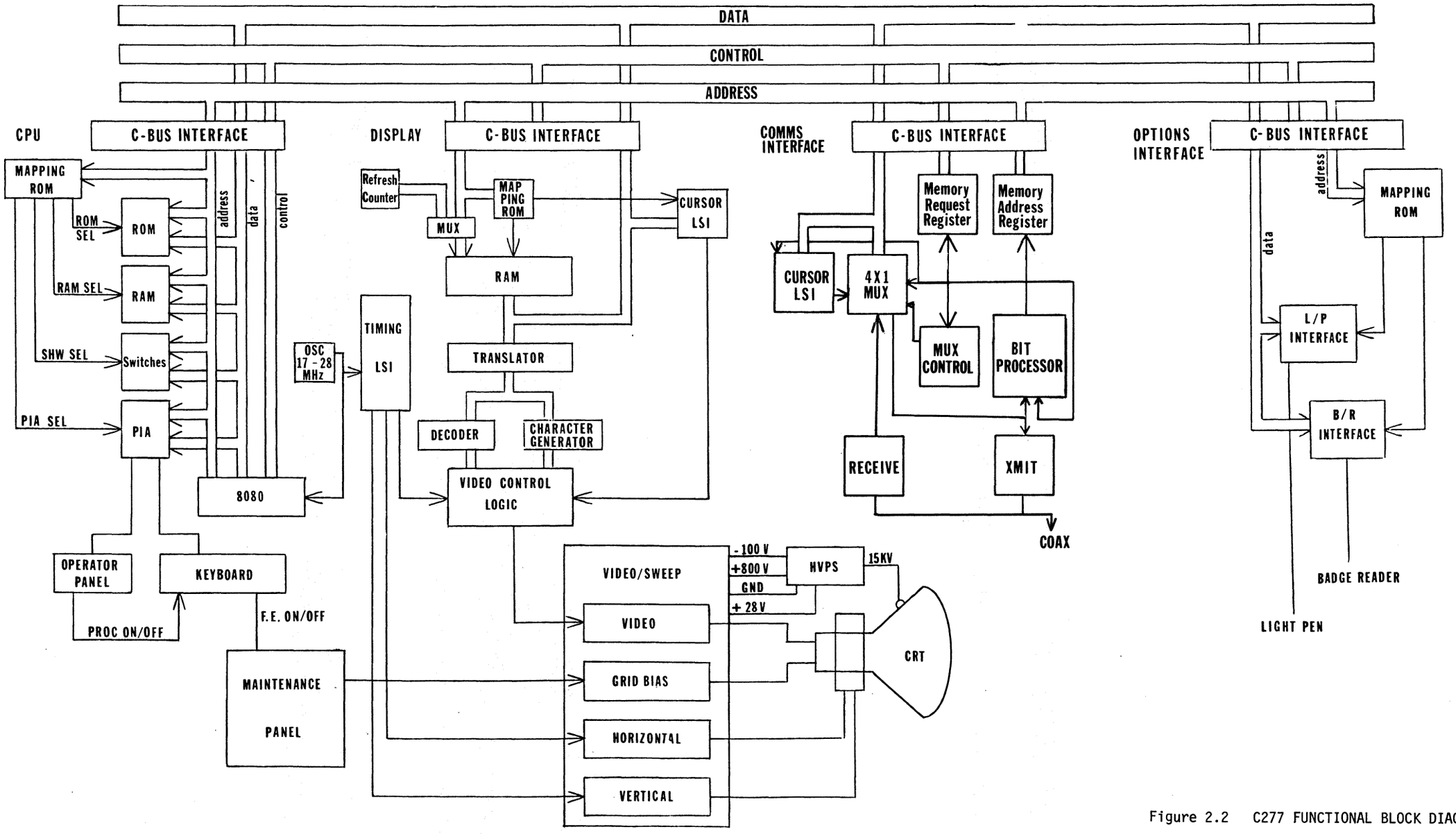


Figure 2.2 C277 FUNCTIONAL BLOCK DIAGRAM

INSTALLATION

3.1 GENERAL

Installation of C277 Terminal should be performed by qualified Courier personnel only. The installation section of the C270-III manual should be referenced for the following information:

1. Equipment Specifications
2. Cable Requirement and Specifications
3. Unpacking and Inspection Procedures
4. Pre-Installation Data
5. Installation Procedures

3.2 EQUIPMENT SPECIFICATIONS

The equipment specifications in the installation section of the C270 Mod III apply to the C277 with the following exception:

3.2.1 I/O Format

Serial data transfered between controller and display is in IBM's 13-bit data word format.

3.2.2 Display Format

24 lines with 80 characters per line
12 lines with 40 characters per line

3.3 PRE-INSTALLATION

Prior to C277 installation, verify with the customer that the IBM controller is strapped properly to accept additional terminal addresses and the necessary device adapter boards and coax connectors are installed in the controller.

3.4 INSTALLATION

Installation of the C277 should be accomplished according to the procedure called out in section 3.5 of the C270-III manual.

3.4.1 Initial Check Out

Perform the test listed on Table 3.1 of the C270-III manual prior to attachment to the IBM controller.

3.4.2 Strapping Guide

The strappable features for the C277 are described in Section 3.5.4. of the C270-III manual. Table 3.1 in this supplement provides the strapping information for all straps and switches. Figure 3.1 is a board location chart for the C277.

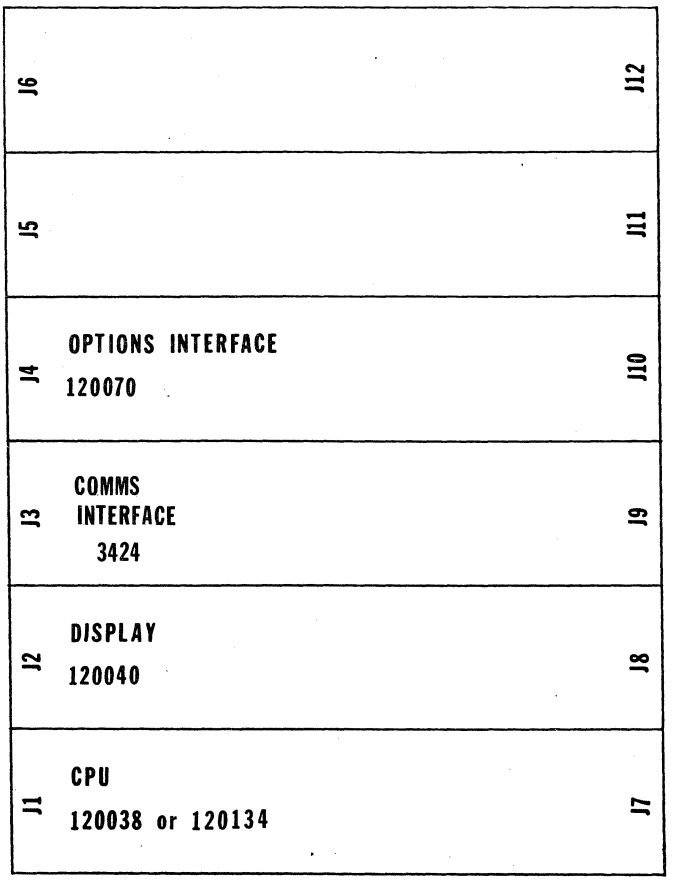


Figure 3.1 C277 BOARD LOCATION

Table 3.2 C277 STRAPPING GUIDE

BOARD TYPE	SWITCH NO.	FUNCTION
CPU	Switch S1	OFF enables Numeric-Lock Option
	S2	OFF Courier Auto Skip, ON IBM Auto Skip
	S3	NOT Used
	S4	OFF enables Protected Field Keyboard Lock
	S5	OFF enables Blinking Cursor
	S6	OFF enables Full Reveal with F.E. Switch ON
	S7	NOT Used
	S8	OFF enables Variable Field Underline
	Straps	The following 13 straps (A-$\overline{D}$) are used to configure the CPU Board to accept different type ROMs.
		82S181 2708
	See Note *** A	OUT OUT
	C	IN OUT
	D	OUT OUT
	E	IN IN
	F	OUT OUT
	G	IN IN
	H	OUT OUT
	J	IN IN
	K	† OUT OUT
	$\overline{O}$	† OUT OUT
	$\overline{B}$	† OUT IN
	$\overline{C}$	† OUT IN
	$\overline{D}$	† OUT IN
	B	OUT*
	I	OUT* †
	L	IN*
	M	IN*
	N	OUT*
	P	IN*
	R	OUT enables Numeric Lock Option
	S	NOT Used
	T	OUT enables Program Enter Key
	U	IN enables Lower Case Transmit
	V	OUT*
	W	IN*
	X	OUT*
	Y	OUT*
	$\overline{Z}$	IN*
	$\overline{A}$	IN* †

Table 3.2 C277 STRAPPING GUIDE

BOARD TYPE	SWITCH NO.	FUNCTION
Display	Switch A	NOT Used
	B	ON enables Crosshatch Test Pattern
	C	OFF enables Blink Field Feature
	D	NOT Used
	Strap A	IN enables Lower Case Display
	B	IN for 480 Characters; OUT for 1920 Characters
	C	IN for small Characters (480)
	D	IN for 480 Characters; OUT for 1920 Characters Straps E thru N available on 120040-002 Display Board only.
	E	OUT*
	F	IN for 480 Characters; OUT for 1920 Characters
	H	OUT*
	J	IN for 480 Characters; OUT for 1920 Characters
	K	OUT*
	L	OUT*
	M	IN*
	N	OUT*
COMMS Interface 3424	Strap A	OUT for 1920; IN for 480
Keyboard	Strap A	IN enables Keyboard Enhancement Option
	B,C	B C OUT OUT Typewriter Keyboard OUT IN Data Entry Keyboard IN OUT Typewriter with Numeric PAD IN IN Operator Console Keyboard
	D	NOT Used
Operator Panel	Strap A	OUT*
	B	IN*
Video/Sweep	Strap A	IN*
	B	IN*
	C	IN*

Table 3.2 C277 STRAPPING GUIDE (continued)

BOARD TYPE	SWITCH NO.	FUNCTION
Option ** Interface	Strap A,C	IN External EIA Clock
	B,D	IN External EIA Clock
	E	IN Parity Checked or EIA Data OUT No Parity Check
	F	IN 2 Stop bits transmitted OUT 1 Stop bit transmitted
	G,H	G H IN IN 5 Bit EIA Data Word IN OUT 6 Bit EIA Data Word OUT IN 7 Bit EIA Data Word OUT OUT 8 Bit EIA Data Word
	K	IN ODD Parity OUT EVEN Parity
	L	OUT Optical Character Reader IN Printer Interface

NOTE: 1 = OUT = OFF = OPEN
Ø = IN = ON = CLOSE

* The setting of these straps is not optional. The straps have to be set as specified for the terminal to operate properly.

** The Option Interface Board is used for Light Pen and Badge Reader options only. These strap functions are not used and regardless of their configuration have no effect on terminal operation and are described for information purposes only.

*** CPU Boards 120038-001 and -002 can use 82S181 ROMs only. CPU Boards 120134-001 and -002 can use 2708 ROMs only. CPU Boards 120038-003 and -004 can use any of the ROM types available.

† These straps are provided on CPU Board #120038-003 & 004 only.

MAINTENANCE

4.1 SECTION OVERVIEW

Reference is made to Section 4 of the C270-III manual for the following maintenance information:

- General Troubleshooting Procedure
- Diagnostic Aids
- Voltage Test Points
- Video/Sweep Adjustments
- Removal and Replacement Procedures

4.2 TROUBLESHOOTING PROCEDURES

In addition to the maintenance procedures called out in the C270-III manual the following procedures can be used in isolating I/O problems between the C277 and the IBM controller and coax cable.

If an I/O problem persists after replacing the Comms Interface board and BNC assembly on a C277, swap coax cables between the faulty terminal and a near by trouble-free terminal. If the original faulty terminal still exhibits the problem after the cable swap, the trouble is in the terminal. If the problem goes to the second terminal and the original terminal works fine, the trouble is in the coax cable or controller.

If the problem goes away altogether after the cable swap it could indicate an intermittent coax cable connection.

When an I/O problem shows up in more than one terminal in a cluster there is a good likelyhood that the controller is at fault.

PARTS

5.1 SECTION OVERVIEW

The C277 is based on the hardware of the C270-III and many of the spare parts are common between the two terminals. Hardware differences between the two terminals include the Coax interface board, BNC coax assembly, the program ROMs on the CPU board, and the Translator ROM on the display board. Table 5.2 calls out the unique parts for the C277. If a spare part number for the C277 cannot be found in Table 5.2 , use the C270-III spare parts list to acquire the number.

Table 5.1 is a cross reference between part numbers and marketing numbers.

Table 5.1 CROSS REFERENCE

Part No.	Description	Marketing No.
112770-003	Upper Case 1920 Char Display	2770-03
112770-001	Upper Case 480 Char Display	2770-01
111119-003	Upper/Lower Case 1920 Char Display	2770-03 w/1119 option
111119-001	Upper/Lower Case 480 Char Display	2770-01 w/1119 option

Table 5.2 PARTS LIST

Description	Part No.
Display (without Keyboard)	112770-003
1920 Char Upper Case	112770-001
480 Char Upper Case	111119-003
1920 Char Upper/Lower Case	111119-001
480 Char Upper/Lower Case	
CPU Board (with ROMs and RAMs)	
Standard	
LP/BR Option	
CPU Board (without ROMs and RAMs) standard	120038-003
LP/BR option	120038-004
Program ROM Kit	150265-001
PGM ROM #1 IC 68	170688-001
PGM ROM #2 IC 67	170689-001
PGM ROM #3 IC 53	170690-001
PGM ROM #4 IC 52	170691-001
PGM ROM #5 IC 28 (Light Pen/Badge Reader option only)	170402-001
CPU Bd. Mapping ROM IC 23 (standard)	170044-001
CPU Bd. Mapping ROM IC 23 (LP/BR option)	170090-001
Display PCBA (without ROMs and RAMs)	120040-001
Translator ROM IC 21	170047-001
Decoder ROM IC 20	170706-001
Mapping ROM IC 11	170045-001
Char Generator Upper/Case IC 19	170407-001
Char Generator Upper/Lower Case IC 19	170267-001
RAM 1920 Char IC 22 23 24 25	A3772P1
RAM 480 Char IC 23 25	A3772P1
Display PCBA (withour ROMs and RAMs)	120040-002
Decoder ROM IC 20	170601-001
Mapping ROM IC 11	170045-001
Char Generator Upper/Case IC 19	170407-001
Char Generator Upper/Lower Case IC 19	170267-001
RAM 1920 Char IC 22 23 24 25	A3772P1
RAM 480 Char IC 23 25	A3772P1
Comm Interface Bd. (with ROMs)	3424A1
Comm Interface Bd ROM A IC 69	170648-001
Comm Interface Bd ROM B IC 55	170749-001
Options Interface Bd. (with ROM)	
Option Interface Bd. (without ROM)	120070-001
Option Interface Bd. Mapping IC 10 ROM	170486-001
BNC Coax Assembly	150022-001

The Courier C270-III DATA ANALYSIS– APL FEATURE

APPENDIX-B

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DATA ANALYSIS-APL FEATURE

1.1 INTRODUCTION

The APL feature equips the ITT Courier 270 Information Display System with an expanded character set and the facility to interact with host-system-resident APL programs. The system components requiring modification to incorporate the APL feature include the associated controller, Remote Terminal Controller (RTC), Local Terminal Controller (LTC), or Virtual Terminal Line Controller (VTLC), the printer, and the display terminal.

Both APL and non-APL equipped display terminals and printers can be attached to an APL equipped controller. The basic characteristics and capabilities of non-APL display terminals and printers are not affected when attached to the APL equipped controller.* (See Figure B1.1)

1.2 CHARACTER SETS

The APL feature expands the displayable and printable character repertoire of the C270 from 91 to 209 characters. Most, but not all of these additional 118 characters, can be entered from the keyboard. All characters can be displayed.

The following character sub sets make up the APL character set. (See Table B1.1).

C270 alphanumeric characters	91
TN characters	35
Special characters	3
APL unique characters	80
Total C270 APL characters	209
Control characters	4
Unassigned codes	11
Attributes	32
	256

1.2.1 C270 Alphanumeric Characters

The C270 alphanumeric character set is defined as 91 characters:

Upper case alphabetics	26
Lower case alphabetics	26
Numerals	10
Symbols	27
Blank and space (00 and 20 Hex)	2
	91

* Exceptions: Bell (07), VT (0B), SO (0E), SI (0F) are not supported with APL equipped controllers.

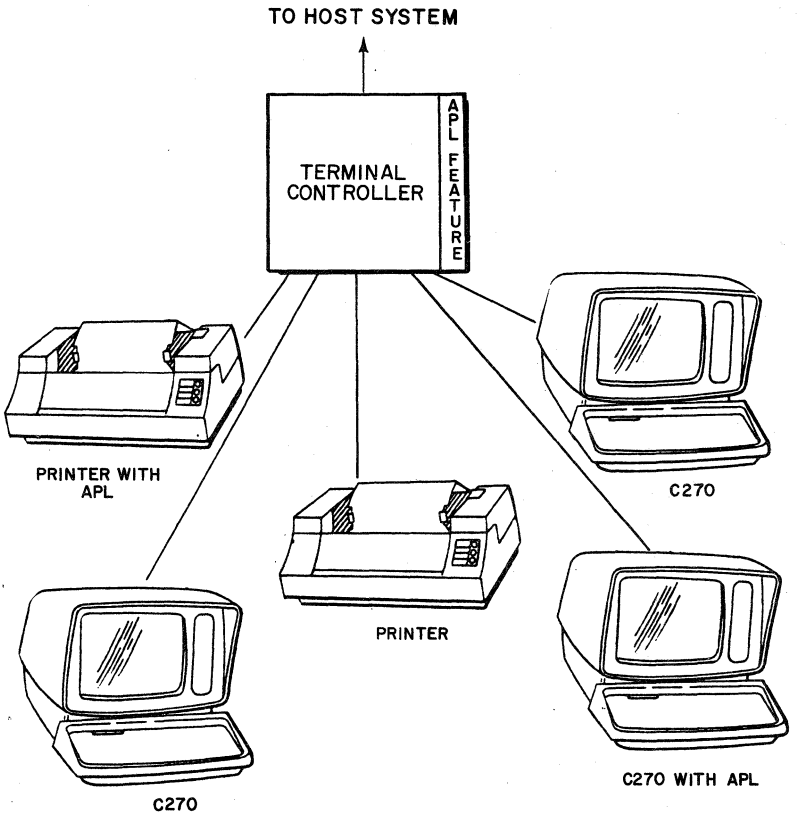


Figure B1.1 APL System Configuration

TN Characters	Special Characters (No IBM Equivalent)	APL Characters	Control Characters	Unassigned	Attribute	C270-III Standard Character Set		C270 Exceptions
8A Sub 1	11 SBA	01 Cap	0A NL	7C	C0	00 Blank	50 Upper Case P	5C Stile
8C Super Minus	EE SF	02 Cup	19 EM	80	C1	20 Space	51 Upper Case Q	
8D Super Open Paren	0C FF	03 Base	1C Dup	8B	C4	21 Exclamation	52 Upper Case R	
8E Super Plus		04 Open Bracket	1E FM	9C	C5	22 Quote	53 Upper Case S	
8F Cross		05 Not Less		EF	C8	23 Pound	54 Upper Case T	
90 Open Brace		06 Null		F2	C9	24 Dollar	55 Upper Case U	
9A Sub 2		07 Del		F6	CC	25 Percent	56 Upper Case V	
9B Lozenge		08 Epsilon		F7	CD	26 Ampersand	57 Upper Case W	
9D Super Close Paren		09 Right		FA	D0	27 Apostrophe	58 Upper Case X	
9E Plus/Minus		0B Delta		FE	D1	28 Open Paren	59 Upper Case Y	
9F Solid Square		0D Top		FF	D4	29 Close Paren	5A Upper Case Z	
A0 Close Brace		0E Close Bracket			D5	2A Asterisk	5B Cent	
A1 Degree		0F Circle			D8	2B Plus	5D Vertical	
AA Sub 3		10 Alpha			D9	2C Comma	5E Logical NOT	
AB Bottom Left		12 Iota			DC	2D Bar	5F Underbar	
AC Top Left		13 Rhe			DD	2E Period	61 Lower Case a	
AD Left Joint		14 Omega			E0	2F Slash	62 Lower Case b	
AE Right Joint		15 Not Equal			E1	30 Zero	63 Lower Case c	
AF Solid Circle		16 Multiply			E4	31 One	64 Lower Case d	
B0 Super 0		17 Slope			E5	32 Two	65 Lower Case e	
B1 Super 1		18 Divide			E8	33 Three	66 Lower Case f	
B2 Super 2		1A Left			E9	34 Four	67 Lower Case g	
B3 Super 3		1B Downstile			EC	35 Five	68 Lower Case h	
B4 Super 4		1D Close Shoe			ED	36 Six	69 Lower Case i	
B5 Super 5		1F Overbar			F0	37 Seven	6A Lower Case j	
B6 Super 6		60 Quad			F1	38 Eight	6B Lower Case k	
B7 Super 7		7B Open Shoe			F4	39 Nine	6C Lower Case l	
B8 Super 8		7D Up			F5	3A Colon	6D Lower Case m	
B9 Super 9		7E Not Greater			F8	3B Semicolon	6E Lower Case n	
BA Sub n		7F Up Stile			F9	3C Less Than	6F Lower Case o	
BB Bottom Right		81 Upper Case A			FC	3D Equal	70 Lower Case p	
BC Top Right		82 Upper Case B			FD	3E Greater Than	71 Lower Case q	
BD Top Joint		83 Upper Case C				3F Quary	72 Lower Case r	
BE Bottom Joint		84 Upper Case D				40 At	73 Lower Case s	
BF Ext Bar		85 Upper Case E				41 Upper Case A	74 Lower Case t	
		86 Upper Case F				42 Upper Case B	75 Lower Case u	
		87 Upper Case G				43 Upper Case C	76 Lower Case v	
		88 Upper Case H				44 Upper Case D	77 Lower Case w	
		89 Upper Case I				45 Upper Case E	78 Lower Case x	
		91 Upper Case J				46 Upper Case F	79 Lower Case y	
		92 Upper Case K				47 Upper Case G	7A Lower Case z	
		93 Upper Case L				48 Upper Case H		
		94 Upper Case M				49 Upper Case I		
		95 Upper Case N				4A Upper Case J		
		96 Upper Case O				4B Upper Case K		
		97 Upper Case P				4C Upper Case L		
		98 Upper Case Q				4D Upper Case M		
		99 Upper Case R				4E Upper Case N		
		A2 Upper Case S				4F Upper Case O		
		A3 Upper Case T						
		A4 Upper Case U						
		A5 Upper Case V						
		A6 Upper Case W						
		A7 Upper Case X						
		A8 Upper Case Y						
		A9 Upper Case Z						
		C2 Down						
		C3 Dieresis						
		C6 Del Tilde						
		C7 Log						
		CA NAND						
		CB NOR						
		CE Circle Stile						
		CF Circle Slope						
		D2 I-Beam						
		D3 Quote Dot						
		D6 Del Stile						
		D7 Delta Stile						
		DA Quote Quad						
		DB Cap Null						
		DE Slash Bar						
		DF Slope Bar						
		E2 Circle Bar						
		E3 Domino						
		E6 Top Null						
		E7 Base Null						
		EA AND						
		EB OR						
		F3 Delta Bar						
		FB Tilde						

Table B1.1 APL ENHANCED ASCII CHARACTER SETS

One change is made to the C270 character set: the solid square (5C hex) is redefined and displayed as a stile (|). (See Figure B1.3)

1.2.2 TN Characters

The TN character set consists of 35 special characters including superscripts, subscripts, and graphic (chart making) symbols. These characters can be printed and displayed but cannot be directly entered through the C270-III APL keyboard.

1.2.3 Special Characters

Three special characters (11, EE, OC Hex) are included in the APL character set. These three special characters have no equivalent in the IBM APL displayable character set.

1.2.4 Control Characters

Four control characters NL (OA), EM (19), DUP (IC), and FM (1E) from the alphanumeric character set are retained unchanged in the APL character set.

1.2.5 Unassigned

Eleven of the 256 possible Hex codes are unassigned.

1.2.6 Attributes

Thirty-two Hex codes are assigned as attributes.

1.3 ATTRIBUTE DEFINITION

In the NON-APL 270 system, a clear distinction is made between attributes and data characters received by the terminal via the coax. Attributes have the MSD bit 7 set to a "1" and data characters have the MSD bit set to a "0". This yields 128 distinct data character codes. This in not enough for the expanded APL character set which has 209 data characters. This means that some APL data character codes will have the MSD bit set to a "1". Because of this, attributes used in an APL terminal need further definition, whereby, bits 7 and 6 must be set to a "1" and bit 1 must be set to a "0". Any other configuration of these three bits designates a data character to an APL terminal. (See Figure B1.2).

7	6	5	4	3	2	1	0
1	1	U/P	A/N	D/S	LP/BL	0	MDT

Figure B1.2 APL ATTRIBUTE BYTE

When transmitted between the controller and the host CPU, any character sent or received by the terminal with the MSD bit set to

		MSD = 0								MSD = 1							
		COURIER APL ENHANCED ASCII															
		00				01				10				11			
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
	HEX LSD	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0	NUL	∝	SP	0	@	P	□	p		{	}	0	ATTRIBUTE CODES			
0001	1	∩	SBA	!	1	A	Q	a	q	A	J	°	1				
0010	2	∪	⍀	"	2	B	R	b	r	B	K	S	2	↓	I	⊖	
0011	3	⊥	⍴	#	3	C	S	c	s	C	L	T	3	··	!	⍞	△
0100	4	[	⍵	$	4	D	T	d	t	D	M	U	4	ATTRIBUTE CODES			
0101	5	≥	≠	%	5	E	U	e	u	E	N	V	5				
0110	6	0	X	&	6	F	V	f	v	F	O	W	6	⍨	⍫	⍥	
0111	7	∇	\	'	7	G	W	g	w	G	P	X	7	⍟	⍋	⍜	
1000	8	∈	÷	(	8	H	X	h	x	H	Q	Y	8	ATTRIBUTE CODES			
1001	9	→	EM	)	9	I	Y	i	y	I	R	Z	9				
1010	A	NL	←	*	:	J	Z	j	z	⍳	⍲	⍷	∩	⍒	⍓	∧	
1011	B	△	L	+	;	K	¢	k	⊂		⌑	L	⌡	⍨	⍲	∨	~
1100	C	FF	DUP	,	<	L	|	l		—		⌐	¬	ATTRIBUTE CODES			
1101	D	⊤	⊃	−	=	M	|	m	↑	(	)	⊢	⊤				
1110	E	]	FM	.	>	N	¬	n	≤	+	±	⊣	⊥	⌽	⌿	SF	
1111	F	○	¯	/	?	O	_	o	⌈	⍭	■	●	—	⍉	⍀		

Figure B1.3 INTERNAL DATA CODES

a "1" will be preceded by a '1D' Hex code. These characters are shown in Figure B1.4.

NOTE: When running capture on the APL controller, Figure B1.4 should be referred to in order to identify characters preceded by a '1D' as data or attribute characters.

1.4 KEYBOARD OPERATIONS

Upon power-up, the keyboard will be in a NON-APL mode and will enter and display the standard alphanumeric character set, both upper and lower case. Momentarily depressing the APL ON/OFF key shifts the keyboard to the APL mode and the characters shown in Figure B1.5 under the APL ON columns will be entered and displayed. The keyboard shifts into a fifth mode when the APL ALT key is held depressed and the keyboard is in the APL mode. The characters in Figure B1.5 under the APL ALT column will be entered and displayed in this mode. The APL ALT key shifts the keyboard into this fifth mode only when the keyboard is already in the APL mode, otherwise, it will perform a back tab function.

The Delta Bar character '$\underline{\triangle}$' is not shown on the keyboard keytops (Figure B1.6), but is displayed when in the APL ALT mode and the "return" key is depressed.

All other NON-character keys perform identical functions in all modes on the APL keyboard as on the standard C270 keyboard.

1.5 INDICATORS AND CONTROLS

The APL equipped terminal has one unique indicator on the operator panel labeled APL (Figure B1.7). This LED is on when the keyboard is in the APL mode and is turned ON and OFF by momentarily depressing the APL ON/OFF key. There is no Lower Case display control or indicator since the APL Terminal will always be strapped for lower case transmit and lower case display.

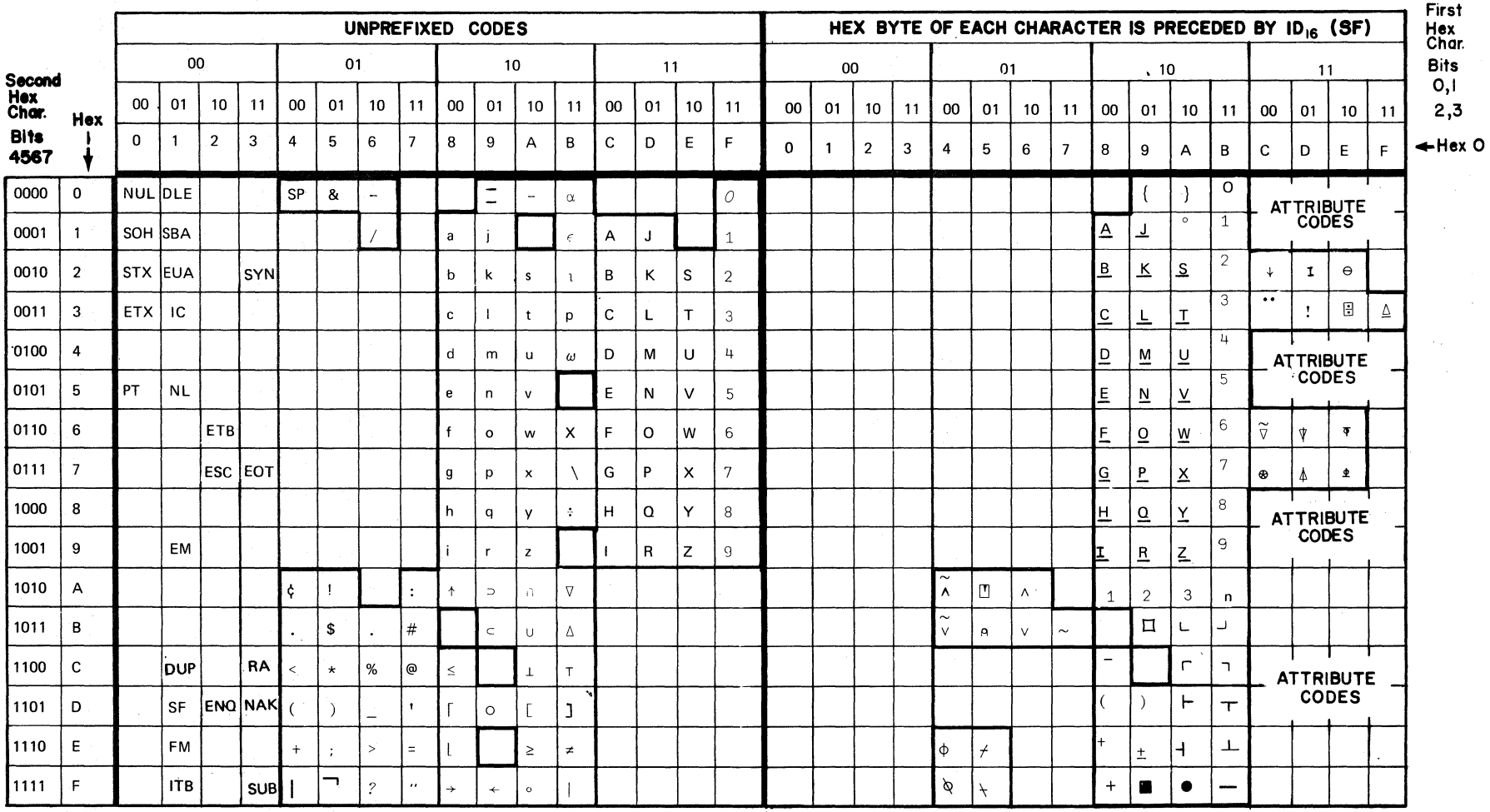
1.6 HARDWARE MODIFICATION FOR APL IMPLEMENTATION

Display Terminal: The APL feature can only be incorporated on C270 Mod III terminals. The following modifications equip a C270 III with the APL feature:

1. An APL Operator Panel
2. APL firmware ROMs on the CPU Board
3. APL Character generator ROMs on the Display Board
4. APL keytops on the keyboard

Printer: The printer has to be an APL enhanced printer and controller.

Controllers: An RTC must have a 'modified for APL' Edit Board (1909) and APL translation ROMs on the EIA Board (1924).



NOTE: Codes B5, B9, and 9E or Codes 15, 19, and 1E may be used in Program To Terminal Messages for characters 5, 9, and ±

Figure B1.4 I/O Interface Codes

APL OFF		APL ON			APL ON with APL ALT	
Lowercase Shift	Uppercase Shift	Lowercase Shift	Uppercase Shift			
a	A	A	α	(alpha)	A	
b	B	B	⊥	(base)	B	
c	C	C	∩	(cap)	C	
d	D	D	⌊	(downstile)	D	
e	E	E	∈	(epsilon)	E	
f	F	F	_	(underbar)	F	
g	G	G	∇	(del)	G	
h	H	H	Δ	(delta)	H	
i	I	I	⍳	(iota)	I	
j	J	J	∘	(null)	J	
k	K	K	'	(quote)	K	
l	L	L	⎕	(quad)	L	
m	M	M	∣	(stile)	M	
n	N	N	⊤	(top)	N	
o	O	O	○	(circle)	O	
p	P	P	⋆	(star)	P	
q	Q	Q	?	(query)	Q	
r	R	R	⍴	(rho)	R	
s	S	S	⌈	(upstile)	S	
t	T	T	~	(tilde)	T	
u	U	U	↓	(down)	U	
v	V	V	∪	(cup)	V	
w	W	W	⍵	(omega)	W	
x	X	X	⊃	(close shoe)	X	
y	Y	Y	↑	(up)	Y	
z	Z	Z	⊂	(open shoe)	Z	
1	!	1	¨	(dieresis)	I	(I beam)
2	@	2	¯	(overbar)	⍫	(del tilde)
3	#	3	<	(less)	⍒	(del stile)
4	$	4	≤	(not greater)	⍋	(delta stile)
5	%	5	=	(equal)	⌽	(circle stile)
6	¢	6	≥	(not less)	⍉	(circle slope)
7	&	7	>	(greater)	⊖	(circle bar)
8	* (asterisk)	8	≠	(not equal)	⍟	(log)
9	(	9	∨	(or)	⍱	(nor)
0	)	0	∧	(and)	⍲	(nand)
-	_	+	−	(bar)	!	(quote dot)
=	+	X	÷	(divide)	⌸	(domino)
¬	!	←	→	(right)	⍞	(quote quad)
;	:	[	(	(open paren)	⍬	(base null)
'	"	]	)	(close paren)	⍫	(top null)
,	<	,	;	(semi colon)	⍬	(cap null)
.	>	.	:	(colon)	⍀	(slope bar)
/	?	/	\	(slope)	⌿	(slash bar)

Figure B1.5 APL Key Board Characters

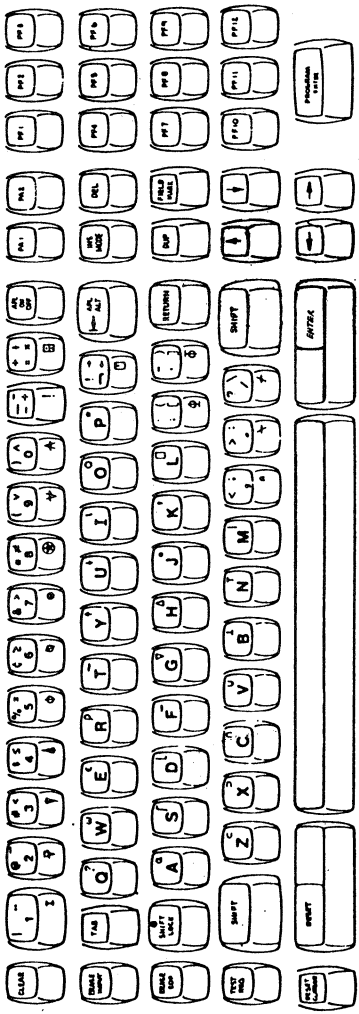


Figure B1.6 APL Key Board

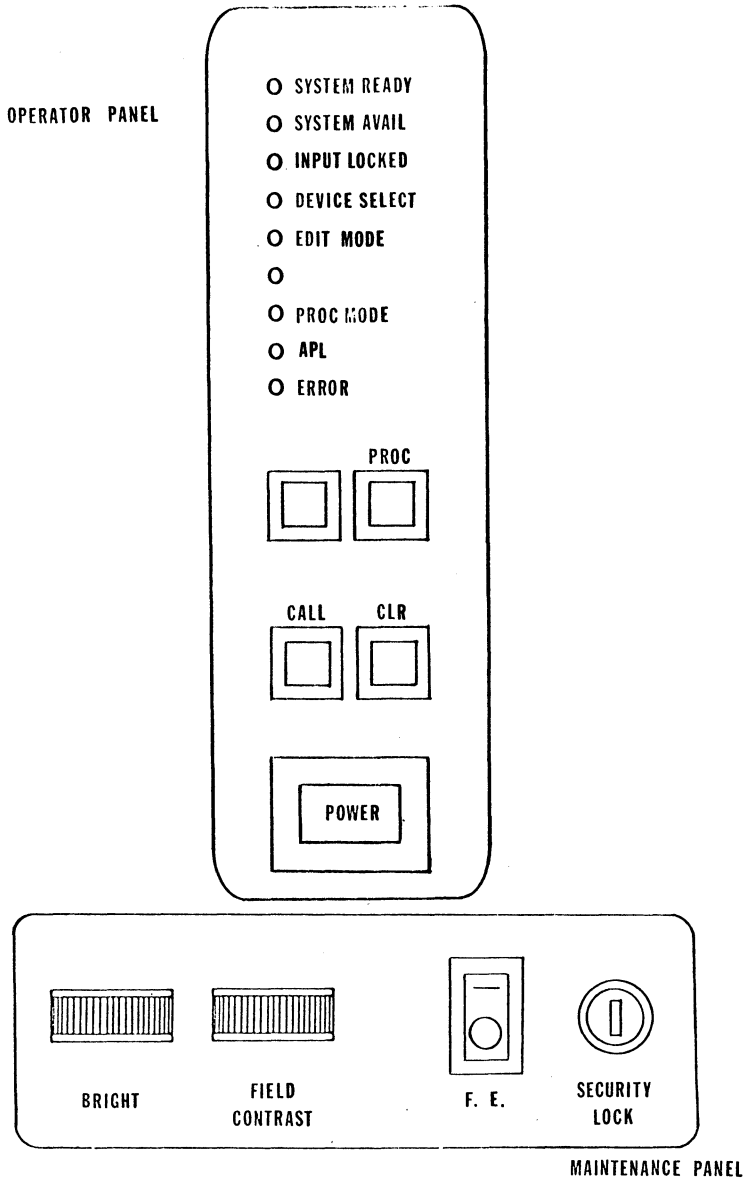


Figure B1.7 APL Operator Panels

An LTC must have a 'modified for APL' Edit Board (1909) and APL translation ROM on the CIF Edit Board (1917).

The VTLC requires a software change incorporated into the floppy disk.

1.7 STRAPPING

Strapping Guide for the APL terminals is in Table B1.2. The APL terminal requires the following options to be set as follows:

Lower Case Transmit	Enabled
Lower Case Display	Enabled
Blinking Cursor	Enabled
Variable Field Underline	Disabled

Table B1.2 APL TERMINAL STRAPPING GUIDE

BOARD TYPE			FUNCTION
CPU 120038	Switch	S1	OFF Enables Numeric Lock Option
		S2	OFF for Courier Auto Skip, ON for IBM Auto Skip
		S3	NOT USED
		S4	OFF Enables Protected Field Keyboard Lock
		S5	OFF* Enables Blinking Cursor
		S6	OFF Enables Full Reveal with F.E. Switch ON
		S7	NOT USED
		S8	ON * Disables Variable Field Underline
	Strap	A	OUT*
		B	OUT*
		C	OUT for 2708 ROMs
		D	OUT*
		E	IN *
		F	OUT*
		G	IN *
		H	OUT*
		I	OUT*
		J	IN *
		K	OUT*
		L	IN *
		M	IN *
		N	OUT*
		O	OUT*
		P	IN *
		R	OUT Enables Numeric Lock Override
		S	NOT USED
		T	OUT Enables Program Enter
		U	IN * Enables Lower Case Transmit
		V	OUT*
		W	IN *
		X	OUT*
		Y	OUT*
		Z	IN *
Display 120040	Switch	A	NOT USED
		B	ON Enables Crosshatch Test Pattern
		C	OFF Enables Blink Field Feature
		D	NOT USED
	Strap	A	IN * for Lower Case Display
		B	IN for 480 Chars. OUT for 1920 Chars.
		C	IN for Small Characters (480 Chars.)
		D	IN for 480 Chars. OUT for 1920 Chars.
CTS PORT 120039	Strap	A	IN *
		B	OUT*
		C	IN *
		D	OUT*
		E	OUT*

(continued on next page)

Table B1.2 APL TERMINAL STRAPPING GUIDE (continued)

BOARD TYPE			FUNCTION
CTS PORT 120039 (continued)	Strap	F	OUT*
		G	OUT*
		H	OUT*
		J	OUT*
		K	OUT*
		L	OUT*
		M	OUT*
		N	IN *
		P	OUT*
		R	IN *
Operator Panel	Strap	A	IN *
		B	IN *
Video/ Sweep 120063	Strap	A	IN *
		B	IN *
		C	IN *
Option** Interface 120070	Strap	A,C	IN External EIA Clock
		B,D	IN Internal EIA Clock
		E	IN Parity Checked on EIA Data OUT No Parity Check
		F	IN 2 stop bits transmitted OUT 1 stop bit transmitted
		G,H	G H IN IN 5 bit EIA Data Word IN OUT 6 bit EIA Data Word OUT IN 7 bit EIA Data Word OUT OUT 8 bit EIA Data Word
		K	IN ODD Parity OUT Even Parity
		L	OUT Optical Character Reader IN Printer Interface

** The Option Interface Board is used only for Light Pen and Badge Reader options. These strap functions are not used and regardless of their configuration have no effect on terminal operation and are described for information purposes only.

Provided on CPU Board #120038-003 & 004 only.

* The setting of these straps in not optional. The straps have to be set as specified for the terminal to operate properly.

NOTE: 1 = OUT = OFF = OPEN
Ø = IN = ON = CLOSE

1.8 SPARE PARTS

Table B1.3 is a cross reference between the APL terminal part numbers and Marketing numbers. Table B1.4 is a list of spare parts unique to APL equipped C270-III Terminals. The parts section of the C270-III manual should be referenced for additional spare parts information.

Table B1.3 CROSS REFERENCE

Part Number	Description	Marketing No.
112700-005	APL Display 1920 Characters	1127-05
112700-004	APL Display 480 Characters	1127-04
110015-001	APL Keyboard, softouch	1008
110015-002	APL Keyboard, cascade	TBA

Table B1.4 APL PARTS LIST

DESCRIPTION	PART NUMBER	
Display (without keyboard)		
1920 Char.	112700-005	
480 Char.	112700-004	
CPU Board (with ROMs and RAMs)		
APL Standard	TBA	
APL with LP/BR option	TBA	
CPU PCBA (without ROMs and RAMs)	120038-001	120038-004
PGM ROM #1 IC 68	170184-001	170726-001
PGM ROM #2 IC 67	170185-001	170727-001
PGM ROM #3 IC 53	170186-001	170728-001
PGM ROM #4 IC 52	170187-001	170793-001
PGM ROM #5 IC 28 (LP/BR option only)	170461-001	
Mapping ROM IC 23	170044-001	
RAM IC 25 and IC 26	A3772P1	
Display Board (with ROMs and RAMs)		
1920 Char.	TBA	
480 Char.	TBA	
Display PCBA (without ROMs or RAMs)	120076-001	
Translator ROM	170047-001	
Decoder ROM IC 20	170194-001	170732-001
Mapping ROM IC 11	170045-001	
Char Generator #1 IC 19	170192-001	170792-001
Char Generator #2 IC 33	170193-001	
RAM 1920 Char. IC 22, 23, 24, 25	A3772P2	
RAM 480 Char. IC 23, 25	A377282	
Operator Panel (with ON/OFF switch and face plate)	TBA	
OP Panel Basic (without ON/OFF switch or face plate)	150095-001	
OP Panel PCBA	120036-001	
Face Plate	170138-001	
ON/OFF switch	1592P6	
APL Keyboard		
PCB with keytops	150000-005	
PCB with switches only	120041-001	
Keytops APL (complete keyboard set)	170112-001	
APL Keyboard, Cascade	110015-002	
PCB with keytops	150000-010	
PCB with switches only	120041-004	
Keytops, APL (complete keyboard set)	170112-001	

NOTE: Shaded areas for reference only.
DO NOT ORDER FOR APL.