CD CONTROL DATA
CORPORATION

CONTROL DATA®
SYSTEM 17

INSTALLATION MANUAL

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PREFACE

This installation manual covers the installation of the basic SYSTEM 17 central processor unit and all of the peripheral equipments designed to operate with it.

The purpose of this manual is to enable Control Data Corporation customer engineers and other technically oriented personnel to install SYSTEM 17 equipments. The information contained within eliminates the need to refer to several sources to install the system. Information on unpacking equipment, power and signal cabling, jumper and card position assignments, and equipment and system checkout is included in each specific equipment section.

To use this manual effectively, one must first determine which equipments are to be set up as a system. A system document will not necessarily be available; therefore, it is recommended that the customer engineer (C.E.) and the customer representative make up their own system block diagram to use as a reference for installing the system. Special attention should be given to the sequence in which different equipments should be installed. In those cases where a conflict of sequence exists, a special note will be included.

The first section of this manual will familiarize the user with the general layout of the SYSTEM 17 and with the central processor unit (CPU) itself. This section includes card placement diagrams, backplane connecting information, standard equipment and interrupt number assignments, and required system documentation.

The installation of the specific equipments is discussed in individual sections (Sections 2 through 14). Each section deals with the unpacking, inspection, assembly, and powering up of the equipments. These sections are set up to cover the installation of each equipment as though each were an individual installation. As additional standard equipments become available, they will be included, each in an inclusive section. Information on actual rack installation of equipment is included but may not be needed, since this type of installation will have been completed at the originating division.

Information is also included that will help the customer engineer set up and run available diagnostics. Where applicable, special routines and important equipment test points are included.

It is assumed that the C.E. involved with these installations will be familiar with the operation of the appropriate test equipment required and with usage of test media such as SMM17 and SCMM (SYSTEM 17 RTMS under MSOS control).

The documents listed below pertain to the overall system. Each specific equipment section has its own required document list.

Title	Publication No.
Mini Computer Systems Preliminary Site Preparation Manual, Section I	60437000
Mini Computer Systems Preliminary Site Preparation Manual, Section II	60437100
1700 System Computer Codes	60163500
1700 Maintenance Monitor (SMM-17) Reference Manual, Volumes I, II, III	60182000
1700 Small Computer Maintenance Monitor Reference Manual	39520200
1784 Computer Reference Manual	89633400
1700 Computer System MSOS Version 4 Reference Manual	60361500
EL101-A Computer Interface Unit/ EL102 Computer Interface Expander Customer Engineering Manual	88980100
1784 Computer Input/Output Specification Manual	89673100
SYSTEM 17 AB107/AB108 Computer Execution Timing Charts	89723800
SYSTEM 17 Key to Logic Manual	89723700
Digital Computer System Grounding — Engineering Standard	CDC-STD 1.30.023

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Figure

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Table

Table

The information in this section applies to all SYSTEM 17 configurations. It is to be used as a reference and will give the user some insight as to how an installation can be set up most efficiently.

1.1 SYSTEM CONCEPT

The intent of the SYSTEM 17 is to provide a series of equipments that can be shipped directly to the customer, installed, and checked out with a minimum of effort.

To accomplish this, equipment controllers have been designed to involve as few cards as possible. These cards are inserted directly into the central processor unit (CPU) or expansion enclosure A/Q and/or DSA slot positions. This places that particular device controller directly onto the internal A/Q-DSA bus. Equipment numbers are selected via jumpers on the respective interface card. Interrupts are selected via backplane jumpers on the CPU and expansion enclosure. In most cases, only a single cable is required to connect the CPU and controller to the peripheral device. Nearly all peripherals have been designed to operate on single phase 50 Hz or 60 Hz primary power.

To provide system flexibility, unwired card slots are available in the expansion enclosure to accommodate special CDC-designed or customer-designed equipments. Equipment add-ons and configuration changes have been simplified due to the overall SYSTEM 17 concept and due to the manner in which specific equipments are dealt with in this manual.

1.2 SYSTEM 17 EQUIPMENTS AND LAYOUT

The block diagram shown in Figure 1-1 is useful in visualizing the components of SYSTEM 17. This diagram will help in choosing the most efficient layout for a specific system. Keep in mind that this is to be used as a reference only. The combination of equipments shown in Figure 1-1 is illegal, since the number of DSA and A/Q devices shown in this figure exceeds the number allowed on a given system.

A typical physical layout of SYSTEM 17 equipments is shown in Figure 1-2. Equipment names, product numbers, and equipment numbers are listed in Table 1-1.
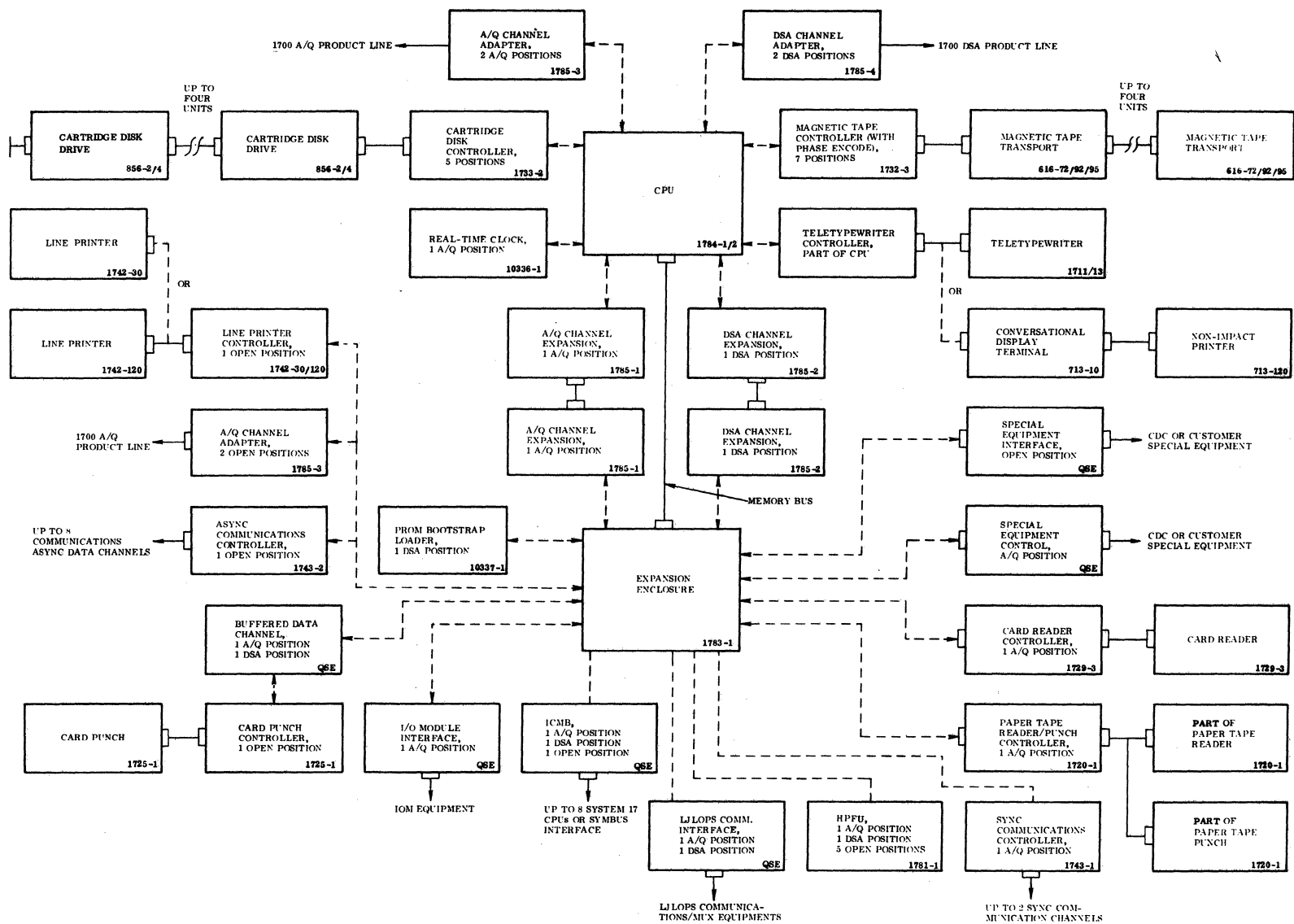
Figure 1-1. SYSTEM 17 Comprehensive Block Diagram
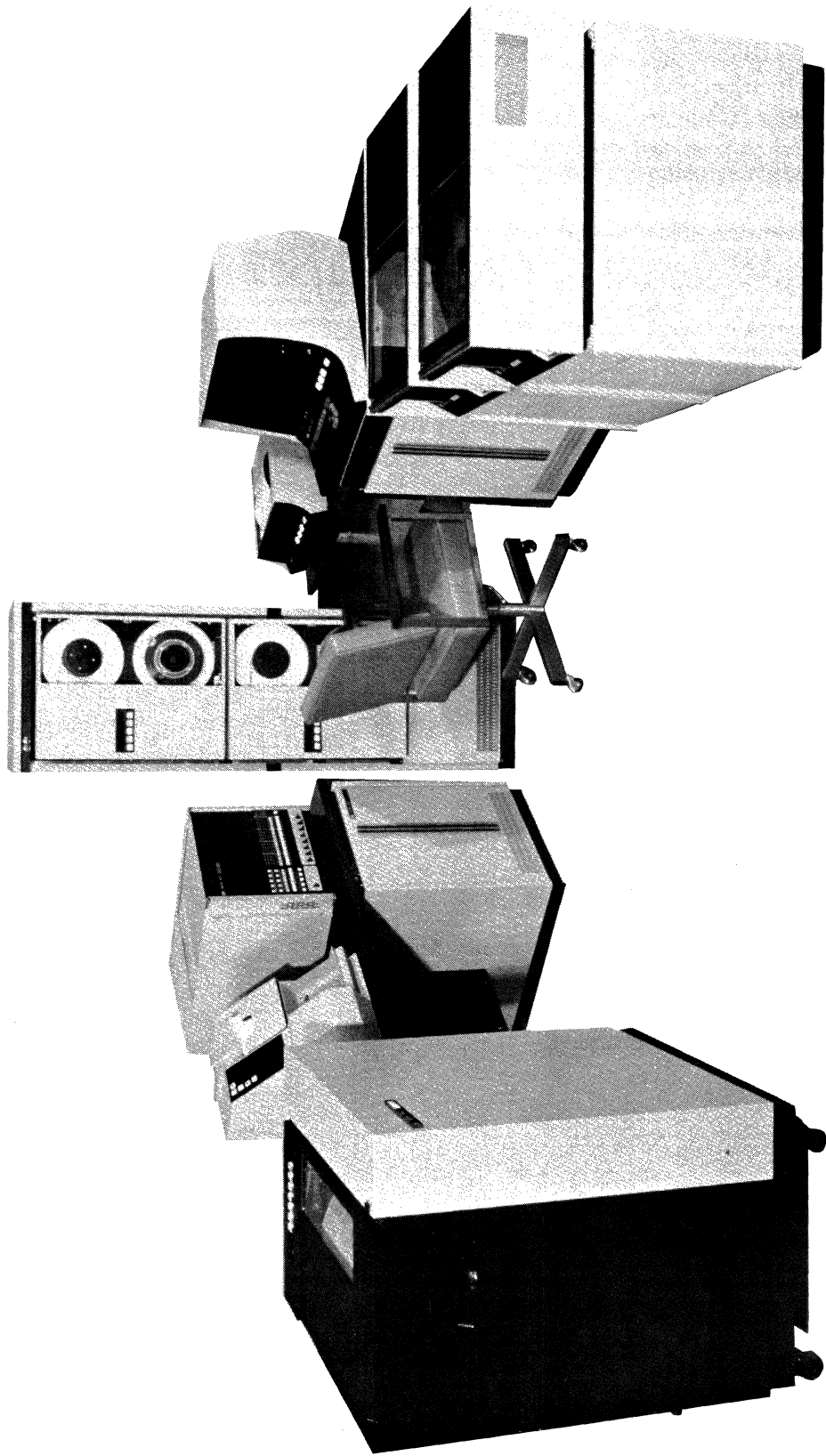
Figure 1-2. SYSTEM 17 Physical Configuration

Table 1-1. SYSTEM 17 Equipment Names, Product Numbers, and Equipment Numbers

EQUIPMENT NAME	PRODUCT NO.	EQUIPMENT NO.
A/Q Channel Adapter	1785-3	DC220-B/C
A/Q Channel Expansion	1785-1	AT310-A
Async Communications Control 1 x 8	1743-2	DJ815-A
Below-Table Enclosure	10299-18	XA120-A
Bootstrap Loader, Programmable Read-Only Memory	10337-1	BU162-A
Cabinet	1787-1	GH423-B
Card Punch	1725-1	CH101-A/B
Card Punch Controller	1725-1	FE203-A
Card Reader Controller	1729-3	FE119-A
Card Reader, 300 cards/minute	1729-3	CB101-A/B
Cartridge Disk Controller	1733-2	FA716-A
Cartridge Disk Drive, 100 tracks/inch	856-2	BR603-A/B
Cartridge Disk Drive, 200 tracks/inch	856-4	BR701-A/B
Central Processor Unit, 900 nsec	1784-1	AB107-A
Central Processor Unit, 600 nsec	1784-2	AB108-A
Conversational Display Terminal	713-10	CC535-A/B
Desk Console	1787-6	XA101-A
DSA Channel Adapter	1785-4	DC221-B/C
DSA Channel Expansion	1785-2	AT310-A
Equipment Cabinet	1787-4	XA123-B
Equipment Table	1787-5	XA115-A
Expansion Enclosure	1783-1	BT148-A

Table 1-1. SYSTEM 17 Equipment Names, Product Numbers, and Equipment Numbers (Continued)

EQUIPMENT NAME	PRODUCT NO.	EQUIPMENT NO.
Hardware Floating Point Unit	1781-1	BT221-A
Line Printer Controller for 300 lines/minute line printer	1742-30	FF524-A
Line Printer Controller for 1200 lines/minute line printer	1742-120	FF524-A
Line Printer, 300 lines/minute	1742-30	CL408-A/B/C/D
Line Printer, 1200 lines/minute	1742-120	CL409-A/B
Magnetic Tape Controller	1732-3	FA446-A
Magnetic Tape Transport, 9-track, 50 inches/ second, dual mode, ANSI	616-95	BW305-A
Magnetic Tape Transport, 9-track, 25 inches/ second, dual mode, ANSI	616-92	BW303-A
Magnetic Tape Transport, 7-track, 25 inches/ second, NRZI, ANSI	616-72	BW101-A
Memory Expansion Control	1786-1	BU120-A
Memory Hold Battery	10297-1	GD611-A
Memory Module, 900 nsec	1782-1	BA201-B
Memory Module, 600 nsec	1782-2	BA201-A
Mini Cabinet	1787-2	GH424-B
Non-Impact Printer Station	713-120	CN503-A/B
Paper Tape Punch	1720-1	FACIT 4070.0004/ 0005
Paper Tape Reader	1720-1	FACIT 4021/22
Paper Tape Reader/Punch Controller	1720-1	AF108-A
Pedestal Cabinet	1787-3	XA121-A
Phase Encoding Option	10300-2	FV618-A

Table 1-1. SYSTEM 17 Equipment Names, Product Numbers, and Equipment Numbers (Continued)

EQUIPMENT NAME	PRODUCT NO.	EQUIPMENT NO.
Power Conversion Transformer	10299-22	XA118-A
Power Distribution Assembly		XA114-A
Power Stacker		GJ105-C/D
Power Supply Assembly, ±12 vdc	10343-1	GD123-A
Real-Time Clock	10336-1	AT229-A
Sync Communications Control, 1 x 2	1743-1	FJ606-A
Table-Top Enclosure	10299-17	XA102-A
Teletypewriter, 33 ASR	1713-4	CK512-A/B
Teletypewriter, 33 KSR	1711-4	CK511-A/B
Teletypewriter, 35 ASR	1713-5	CK514-A/B
Teletypewriter, 35 KSR	1711-5	CK513-A/B
Type Array Cartridge	595-4	CL833-A
Universal Translater Assembly		BW805
220 vac 50 Hz Distribution Panel (Option)	10299-21	GD614-A

1.3 CPU AND EXPANSION ENCLOSURE CARD ASSIGNMENT

Figure 1-3 shows the card assignment of the CPU. Card positions 8 through 36 are prewired and can be used only for their designated function. Four A/Q and three DSA card positions are available for use with one-card controllers that utilize an A/Q position or two-card devices that require one A/Q and one DSA card position.

Each card used in the CPU and the expansion enclosure has two connectors that connect to the backplane. The upper connector is designated P1 and the lower is designated P2. The P1 connector carries signals that interface with the respective CPU A/Q or DSA bus. The P2 connector carries signals that interface with the external equipment or peripheral.

Figure 1-3 also shows the card assignment of the expansion enclosure. Card positions 27 through 36 are prewired positions that are utilized if a memory expansion control and additional increments of memory are required. Up to 32K of memory (eight increments of 4096) can be added.

Card positions 1 through 26 have been assigned to A/Q, DSA, or open positions. The A/Q and DSA positions are an extension of the A/Q and DSA buses of the CPU and may be used with the addition

CENTRAL PROCESSOR UNIT

Slot	Label
36–29	EIGHT MEMORY MODULES
28	MEMORY ADDRESS
27	MEMORY CONTROL
26	CENTRAL PROCESSOR UNIT — ALU
25	CENTRAL PROCESSOR UNIT — ALU
24	CENTRAL PROCESSOR UNIT — DECODER
23	CENTRAL PROCESSOR UNIT — TIMING
22	CENTRAL PROCESSOR UNIT — I/O INTERFACE
21	CENTRAL PROCESSOR UNIT — CONSOLE INTERFACE
20	CENTRAL PROCESSOR UNIT — TELETYPEWRITER CONTROLLER
19	CARTRIDGE DISK CONTROLLER — A/Q
18	CARTRIDGE DISK CONTROLLER — SHIFTER
17	CARTRIDGE DISK CONTROLLER — SECTOR COUNT
16	CARTRIDGE DISK CONTROLLER — DSA
15	CARTRIDGE DISK CONTROLLER — DISK DAISY CHAIN
14	NRZI MAGNETIC TAPE CONTROLLER — UPPER DATA
13	NRZI MAGNETIC TAPE CONTROLLER — LOWER DATA
12	NRZI MAGNETIC TAPE CONTROLLER — Q CHANNEL
11	NRZI MAGNETIC TAPE CONTROLLER — TAPE INTERFACE
10	PHASE ENCODING FORMATTER — P.E. DATA
9	PHASE ENCODING FORMATTER — P.E. DATA
8	PHASE ENCODING FORMATTER — P.E. CONTROL
7, 6	A/Q BUS (2)
5, 4, 3	DSA BUS (3)
2, 1	A/Q BUS (2)

EXPANSION ENCLOSURE

Slot	Label
36–29	EIGHT MEMORY MODULES
28	MEMORY ADDRESS
27	MEMORY CONTROL
26, 25	RESTRICTED
24, 23	OPEN
22	DSA BUS
21, 20	A/Q BUS
19, 18, 17, 16, 15	OPEN
14	DSA BUS
13, 12, 11	A/Q BUS
10, 9, 8, 7, 6	OPEN
5, 4	DSA BUS
3, 2	A/Q BUS
2	DSA BUS
1	A/Q BUS

NOTE: THE MEMORY CONTROL BOARD AND THE MEMORY ADDRESS BOARD TOGETHER FORM THE MEMORY EXPANSION CONTROLLER.

Figure 1-3. CPU and Expansion Enclosure Card Placement

of an A/Q-DSA channel expansion. The open slots can be used in conjunction with the A/Q and DSA card positions to house special equipments and/or interfaces.

1.3.1 BACKPLANE CONNECTING INFORMATION

The backplane of the CPU and the expansion enclosure consists of a combination of PC board and wire-wrap connections. The pins that provide connection to the card position have been pressed through the PC board and serve as the wire-wrap pins on the backplane. Therefore, the pins on the backplane are oriented into groups representing the P1 and P2 connectors of each respective card slot. The upper group of pins is referred to as the P1 portion of the card positions and the lower group of pins is referred to as P2 (see Figure 1-4). Each card position will be referred to as the J1, J2, J3, etc., position. The two rows of 31 pins each for each J position are designated as column A or B. A particular pin location as viewed from the backplane would then carry a designation such as J07 P1 A23. This would refer to card position 7, the upper group of pins, column A, and pin number 23.
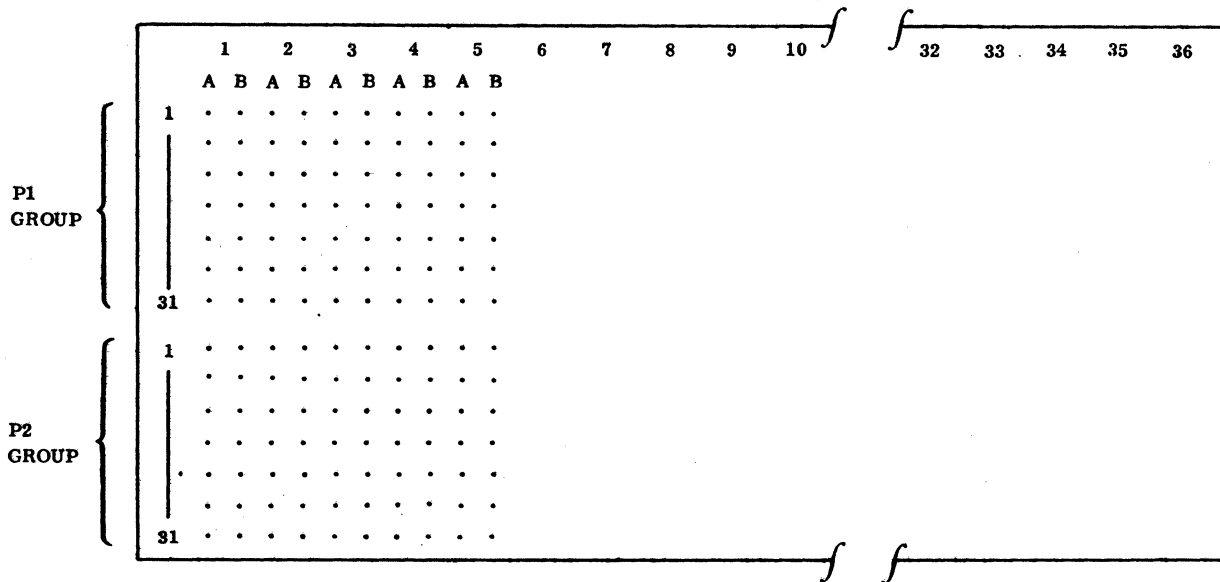
Figure 1-4. CPU Backplane View

1.3.1.1 I/O CONNECTOR PANEL

The CPU and expansion enclosure have an I/O connector panel assembly on the rear of the CPU. The panel has provisions for mounting twelve 66-pin Continental connectors, which will be referred to as J3 through J15. When internal cable assemblies are installed, the Berg connector mounts on P2 of the backplane, and the 66-pin Continental connector end mounts on the I/O connector panel assembly.

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1.3.1.2   BACKPLANE CONNECTOR AND PIN ASSIGNMENTS

When the CPU is shipped from manufacturing, the following equipment cables and interrupts are installed:

- The console interface cable assembly goes to J20 P1.

- The teletypewriter/conversational display terminal internal cable assembly goes from J20 P2 to I/O connector J14.

- Manual interrupt/teletypewriter interrupt No. 1 goes from J20 P2 A12 to J25 P1 B10.

With the exception of teletypewriter/conversational display terminal manual interrupt No. 1, all other interrupts will have to be connected as each equipment is installed. Table 1-2 shows the interrupt input pin assignment for each interrupt.

Table 1-2.   CPU Backplane Interrupt Assignment

INTERRUPT NUMBER	CPU INPUT PIN
0	Internal
1	J25 P1 B10
2	J25 P1 A07
3	J25 P1 B07
4	J25 P1 A05
5	J25 P1 A06
6	J25 P1 B06
7	J25 P1 B05
8	J25 P1 A10
9	J26 P1 B10
10	J26 P1 A07
11	J26 P1 B07
12	J26 P1 A05
13	J26 P1 A06
14	J26 P1 B06
15	J26 P1 B05

The CPU and expansion enclosure utilize a common A/Q-DSA backplane bus. Table 1-3 shows the pin assignment of the internal A/Q bus, and Table 1-4 shows the pin assignment of the DSA bus.

Table 1-3. A/Q Bus Backplane Pin Assignment

P1 CONNECTOR				P2 CONNECTOR			
A COLUMN		B COLUMN		A COLUMN		B COLUMN	
$\overline{A5}$	1	$\overline{A1}$			1		
$\overline{A6}$	2	$\overline{A2}$			2		
$\overline{A0}$	3	$\overline{A7}$		GND	3		
$\overline{A12}$	4	$\overline{A8}$			4		
$\overline{A11}$	5	$\overline{A9}$			5		
$\overline{A3}$	6	$\overline{A10}$			6		
$\overline{A4}$	7	$\overline{\text{CHARACTER INPUT}}$			7		
*	8				8		
$\overline{\text{TIMING PULSE}}$	9	$\overline{A13}$			9		
*	10	$\overline{A14}$			10		
$\overline{A15}$	11	GND			11		
Q0	12	Q1			12		
Q2	13	Q3			13		
Q4	14	Q5			14		
Q6	15	Q7			15		
Q8	16	Q9			16		
Q10	17	Q11			17		
Q12	18	Q13			18		
Q14	19	Q15			19		
$\overline{W=0}$	20	*			20		
$\overline{\text{READ}}$	21	$\overline{\text{WRITE}}$			21	GND	
$\overline{\text{REPLY}}$	22	$\overline{\text{REJECT}}$			22		
$\overline{\text{PROGRAM PROTECT}}$	23	$\overline{\text{MC}}$			23		
*	24	*			24		
*	25				25		

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Table 1-3. A/Q Bus Backplane Pin Assignment (Continued)

P1 CONNECTOR				P2 CONNECTOR			
A COLUMN		B COLUMN		A COLUMN		B COLUMN	
*	26	*			26		
	27	*			27		
*	28	*			28		
GND	29				29		
*	30				30		
	31			Vcc	31		

NOTE: 1. Q0 through Q15 are active high; all other signals are active low.
2. Vcc = +5V.
3. GND = Logic ground.
4. * = Connections between A/Q and DSA card positions to carry status/command signals. See Table 1-5.

Table 1-4. DSA Bus Backplane Pin Assignment

P1 CONNECTOR				P2 CONNECTOR			
A COLUMN		B COLUMN		A COLUMN		B COLUMN	
DA5	1	DA1			1		
DA6	2	DA2			2		
DA0	3	DA7		GND	3		
DA12	4	DA8			4		
DA11	5	DA9			5		
DA3	6	DA10			6		
DA4	7	*			7		
*	8				8		
$\overline{\text{MC}}$	9	DA13			9		
*	10	DA14			10		
DA15	11	GND			11		
*	12	$\overline{\text{PRIORITY}}$			12		
$\overline{\text{RESUME}}$	13	*			13		
*	14	$\overline{\text{PROTECT}}$			14		

Table 1-4. DSA Bus Backplane Pin Assignment (Continued)

P1 CONNECTOR				P2 CONNECTOR			
A COLUMN		B COLUMN		A COLUMN			B COLUMN
$\overline{\text{REQUEST}}$	15	SCAN RTRN IN			15		
*	16	SCAN RTRN OUT			16		
$\overline{\text{P.E.}}$	17	$\overline{\text{P.F.}}$			17		
$\overline{\text{PAR. BIT}}$	18	$\overline{\text{AUTOLOAD}}$			18		
SCAN FWD IN	19	$\overline{\text{SCAN FWD OUT}}$			19		
$\overline{\text{PROTECT BIT}}$	20	*			20		
*	21	$\overline{\text{W.E.}}$			21		GND
*	22	*			22		
AD8	23	AD0			23		
AD9	24	AD1			24		
AD10	25	AD2			25		
AD11	26	AD3			26		
AD12	27	AD4			27		
AD13	28	AD5			28		
GND	29	*			29		
AD14	30	AD6			30		
AD15	31	AD7		Vcc	31		

NOTES: 1. AD0 through AD15 and DA0 through DA15 signals from the computer are active high.
2. Vcc = +5v.
3. GND = Logic ground.
4. * = Connections between A/Q and DSA card positions to carry status/command signals. See Table 1-5.

1.4 STANDARD EQUIPMENT AND INTERRUPT NUMBER ASSIGNMENTS

The selections shown in Table 1-6 are the standard interrupt and equipment number assignments. They provide economic and convenient use of existing MSOS packages and eliminate needless confusion when maintenance is performed on various systems. These numbers can be reassigned to meet customer requirements.

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Table 1-5. A/Q and DSA Bus Interconnections

DSA BUS	A/Q BUS	DSA BUS	A/Q BUS
P1 A8	P1 A8	P1 A22	P1 A30
P1 A10	P1 A10	P1 B7	P1 B20
P1 A12	P1 A24	P1 B13	P1 B24
P1 A14	P1 A25	P1 B20	P1 B26
P1 A16	P1 A26	P1 B22	P1 B27
P1 A21	P1 A28	P1 B29	P1 B28

NOTES: These connections exist between:

A/Q J1 ←→ DSA J3

A/Q J2 ←→ DSA J4

A/Q J3 ←→ DSA J5

Table 1-6. Standard Equipment and Interrupt Number Assignments

INTERRUPT NO.	EQUIPMENT NO.	EQUIPMENT
0		
1	1	1711/1713 Teletypewriter or 713-10/120 Conversational Display Terminal/Non-Impact Printer or 1720-1 Paper Tape Station
3	3	1733-2 Cartridge Disk Controller; 856-2/4 Cartridge Disk Drive
4	4	1742-30/120 Line Printer or 1742-300/1200 Line Printer
5	5	1725-1 Card Punch
7	7	1732-3 Magnetic Tape Controller; 616-72/ 92/95 Magnetic Tape Transports
B	B	1729-3 Card Reader
	C	Not assigned
	D	Not assigned
	E	Not assigned
–	F	1781-1 Hardware Floating Point Unit

1.5 REQUIRED TEST EQUIPMENT

A minimum of test equipment is required to perform the actual installation. In most cases, a standard Simpson or Tripplet VOM will be sufficient. If voltage margins are to be run and more accurate measurements of voltages are required, then a DVM with at least ±0.02% accuracy should be used. If problems occur during installation or checkout of the system, it will be necessary to use an oscilloscope. A Tektronix Model 465 or 475 or equivalent will be satisfactory.

1.6 DSA SCANNER CONFIGURATION

The DSA bus of the CPU and the expansion enclosure does not include all of the DSA scanner wiring necessary to complete the routing of the Scan Forward and Scan Return signals through the various DSA devices that may be installed in the DSA positions.

The prewired cartridge disk controller (CDD) and the magnetic tape (MTT) controller positions have the scanner signal wiring installed. It is possible to run the CDD and the MTT as first and last without installing scanner jumpers on the backplane.

The unassigned DSA positions of the CPU and the expansion enclosure must have external backplane jumpers installed to complete the scanner loop that will enable proper operation of the devices on the DSA bus.

Figure 1-5 shows a typical DSA scanner configuration. In spite of the obvious conflict of having two "last" devices, this configuration will work satisfactorily. To avoid this scanner position conflict, the DSA channel adapter should be installed so that it occupies the last position on the DSA bus with respect to other devices on the CPU or expansion enclosure DSA bus. To accomplish this with the configuration shown, swap buffered data channel (BDC) No. 3 with the DSA channel adapter. BDC No. 3 will then be set to the "mid" position. The scanner positions of the devices connected to the CPU will not change. This should not be confused with assigning the DSA channel adapter to the "last" position on the scanner, since this device does not occupy a position on the scanner, but merely passes the scanner signals to the external devices.

1.7 DIAGNOSTIC TESTING

This section contains a summary of information on how to load and use the 1700 System Maintenance Monitor (SMM17) and the Small Computer Maintenance Monitor (SCMM) for testing SYSTEM 17 products. For more details on the use of these test media, refer to their respective manuals.

1.7.1 SMM17 GENERAL OPERATING INSTRUCTIONS

Enter the bootstrap associated with the loading device. Ensure that the bootstrap is compatible with the existing version of SMM. The bootstrap may be loaded at any legal address above $0FE0.

Ensure that the CPU SELECTIVE SKIP and SELECTIVE STOP switches are set. Execute the bootstrap to load SMM. If SMM resides on a disk, depress the console AUTOLOAD button to load SMM. Depress MASTER CLEAR and GO.

Quick Look will be loaded into memory and will go into execution. Upon completion of Quick Look, the CPU will stop at the first parameter stop.

1.7.1.1 FIRST PARAMETER STOP

Contents of A register = 0021; Stop parameter, two stops. Do not change.

1700 STANDARD PRODUCT
DSA DEVICES

```
LAST          MID          MID
```

SCANNER LINES CARRIED
THROUGH 1700 DSA CABLES

SCAN FORWARD

LAST   MID   MID   MID   FIRST

P1   P1   P1   P1   P1   P1   P1   P1   P1   P2   P2   P1   P1
B19   A19   B19   A19   B19   B19   B19   B19   A19   A26   B25   A4   B6

¢
HARD-   BUFFERED   DSA   DSA   BUFFERED   MAG-   CART-
WARE   DATA   CHANNEL   CHANNEL   DATA   NETIC   RIDGE
FLOATING   CHANNEL   ADAPTER   EXPANDER   CHANNEL   TAPE   DISK
POINT   NO. 2   3SWT   NO. 1   CON-   CON-
UNIT   QSE   P1   QSE   TROLLER   TROLLER
                             B16   P1

P1   P1   P1   P1   P1   P1   P1   P1   P2   P2   P1   P1
B16   B15   B16   B15   A19   A19   B16   B15   B28   A27   B1   B2

                                                                          J12   J16

SCAN RETURN

EXPANSION ENCLOSURE   CENTRAL PROCESSOR UNIT

NOTES: 1. HEAVY SOLID LINES – JUMPER WIRE ALREADY HARDWIRED ON THE CPU BACKPLANE.
        2. DOTTED LINES – OPTIONAL JUMPER WIRE IN PLACE OF THE JUMPER WIRE SHOWN WITH THE SOLID LINES. ONE OR THE OTHER CONFIGURATION COULD BE USED.
        3. DSA DEVICES OPERATING ON THE DSA CHANNEL ADAPTER OCCUPY ONLY MIDDLE OR LAST POSITIONS ON THE SCANNER.

0154

Figure 1-5. DSA Scanner Configuration

Contents of Q register = 02xx; Stop/Jump parameter. Alter as desired. (See the following bit assignments.)

    Stop/Jump Bit assignments:

        Bit 0   = Stop to enter parameter   (Stop Type 1)

        Bit 1   = Stop at end of section   (Stop Type 2)

        Bit 2   = Stop at end of test   (Stop Type 4)

        Bit 3   = Stop on error   (Stop Type 8)

        Bit 4   = Repeat condition

        Bit 5   = Repeat section

        Bit 6   = Repeat test

        Bit 7   = Not used

        Bit 8   = Omit typeout

        Bit 9   = Display memory return address

        Bit 10   = Re-enter test parameter

        Bits 11-15 = Test jumps described in individual test write-ups

Depress GO to get to the next parameter stop.

1.7.1.2   SECOND PARAMETER STOP

Contents of A register = SMM parameter. (See bit assignment below.)

Contents of Q register = Equipment number of the loading device (preset — may be changed if selecting an alternate load device)

    SMM bit assignments:

        Bit 0   =   List SMM library contents. See SELECTIVE SKIP to get revision date.

        Bit 1   =   Repeat Quick Look. Quick Look will execute until this bit is cleared.

                             NOTE

            Bits 0 and 1 can only be selected after the initial
            loading and execution of Quick Look.

        Bits 2-3 =   Specify CPU type and speed.

                00 = 1704/1714 CPU

                10 = 1774 CPU

                01 = 1784-1 CPU

                11 = 1784-1 CPU

Bit 4 = Load tests at even 100_{16}s (ignored for tests No. 2 and 12).

Bit 5 = Teletypewriter output in non-interrupt mode.

NOTE

This bit should always be set when testing other devices.

Bit 6 = Select teletypewriter-I/O mode. Bit 6 is selected at the end of Quick Look only, but may be deselected at any time. When selected, it will allow SMM parameters to be entered from the TTY/CDT only.

Bit 7 = 1 Build test list

= 0 Execute prestored test list.

Bit 8 = Select MBS package. Bit 8 is selected at the end of Quick Look only, but may be deselected at any time.

Bit 9 = Ignore edited program modifications while loading.

Bits 10-11 = Not used

Bits 12-14 = Specify type of equipment used to load SMM.

001 = 1712, 1713, 1721, 1720-1, or 1777 Paper Tape Subsystems

010 = 1726, 1728, 1729-2, or 1729-3 Card Reader Subsystems

011 = 1731-601, 1732-608/609, or 1732-3-616-72/92/95 Magnetic Tape Subsystems

100 = 1738-854/854, or 1733-854/854 Cartridge Disk Subsystems

101 = 1733-2-856-2/4 or 1739 Cartridge Disk Subsystems

Bit 15 = Stop for program modification.

Alternate load devices may be selected at this time by re-specifying the equipment type (bits 12, 13, and 14) of the SMM parameter and by selecting the corresponding equipment number in the Q register.

Deselect the SELECTIVE SKIP switch to allow the monitor to load without another stop.

If the SELECTIVE SKIP switch is left selected, another stop will occur that will allow the operator to select the mask (M) register and to deselect undesired interrupt levels in the M register. The bits may not be reselected for interrupt use by equipment tests unless SMM is reloaded.

When the GO button is depressed, the monitor will be loaded into the CPU and the SMM heading will be typed out. BUILD TEST LIST will be typed out if A bit 7 of the second SMM parameter stop was selected. (This bit is normally preset.)

1.7.1.3 TEST SELECTION

Tests may be selected by means of teletypewriter-I/O entry or operator/console entry. An example of operator/console entry follows.

    A register = Key in test number (tt) and number of runs (ff); i.e., Test 12, four times is keyed in as $1204.

    Q register = Equipment address and status 1 bit set of the device to be tested. Check with the specific equipment section for exceptions. Internal tests (memory, command, and random protect tests) do not require anything in the Q register at this stop.

Depress GO to enable termination of BUILD TEST LIST or to add to the test list.

To terminate BUILD TEST LIST, enter 0000 into the A register and depress GO. If a single test is selected, the test will load, its heading will be typed out, and it will stop at the first test stop. The test ID and the contents of the A register at the first test stop will specify how many stops exist for the particular test. When reviewing these stops, the operator may change test sections to be run, reselect interrupt assignments, or change other parameters peculiar to the device being tested. After each stop, the GO button must be depressed.

Continue the review and GO sequence until all stops have been reviewed. The test should start execution when GO is depressed after the last stop. Upon completion, an end of test statement will be typed out. BUILD TEST LIST will be typed out after the last pass of the test is completed.

1.7.1.4 TEST MULTIPLEXING

To multiplex tests, enter the first test number and equipment number, and then depress GO. Then enter additional test numbers in the A register and the respective equipment address in the Q register at the same stop. Depress GO and repeat this sequence until all required tests are loaded. Enter A with zeros and depress GO. All of the selected tests will start loading.

As each test loads, it will type out its heading. If bit 0 of the Stop/Jump parameter is set, each test will wait to have its test stops altered or accepted.

When the required number of stops has been viewed and accepted, the next test will load. The sequence will continue until all tests have been loaded and their parameters accepted. The tests will then execute in a hand-shake type operation.

As each test completes, it will type out an end of test statement and continue with the other tests. When all tests have been completed, SMM will type out BUILD TEST LIST.

88996000 B

1.7.1.5 TEST STRINGING

To string tests, do not terminate the test list after the first test has been selected; instead, set A = 0001, depress GO, and load the next test. Continue this sequence until all required tests are loaded, then terminate BUILD TEST LIST.

The tests will be loaded and the test parameter checked as was done for multiplex testing. However, when the tests go into execution, the first test will be run first. Upon completion of the first test, the test loaded second will start execution and will run to completion. The third test will then go into execution, etc., until all tests have run their required number of passes.

1.7.1.6 TEST LOADING AT A SPECIFIC LOCATION

Loading a test at a specific location is accomplished by loading FF00 into the A register instead of the test number and loading the memory address where the test is to be run into the Q register. Depress GO and on the next stop, enter the test number and equipment number as usual. Depress GO to load the test. Complete this sequence until all required tests are loaded.

1.7.1.7 CHANGING STJP PARAMETER

To change the Stop/Jump (STJP) parameter, either do a manual interrupt, if using teletype I/O, or set the SELECTIVE SKIP switch. This will stop the CPU with the STJP displayed in Q. The STJP may be changed at this time. To change the STJP associated with a particular test, set the P register to the initial address of the test and depress GO. This may be done any time the CPU is in a stop condition. Change the contents of the Q register as desired and depress GO to continue. The revised STJP parameter will be typed out and the test(s) will resume.

Most tests can be restarted at their initial address if the STJP repeat test bit (bit 6) is set, or if the test frequency counter has not been zeroed out. To do this, set the SELECTIVE SKIP switch, set the MASTER CLEAR switch, set the P register to the test initial address, and depress GO. The test heading will type out, and the test parameters may be viewed and changed if required.

1.7.1.8 TELETYPE INPUT/OUTPUT

Teletype input/output for entering SMM parameters can be selected by setting bit 6 of the A register during the second SMM parameter stop. This I/O option can only be selected upon completion of the initial Quick Look execution; however, it may be deselected at any time.

Use of the teletype I/O may be accomplished by following the following instructions:

1.   Typeouts from the CPU are always in hexadecimal followed by a question mark, a bell sound, a line feed, and a carriage return (? bell LF (CR)).

2. Typeouts are synonymous for the A and Q registers; i.e., contents of A/contents of Q ? bell LF (CR) . For example:

$1231/$0201   ?

Where: $1231 is normally displayed in the A register during the first test stop of Memory Test 12, and

$0201 is the STJP parameter displayed in the Q register of the same stop.

3. Each register entry is independent of the other.

4. There are three modes of entry:

Hexadecimal entry must be prefixed by $.

Decimal numbers have no prefix.

Bit positions are prefixed by B, N, N, N, N. Example: B, 0, 3, 1, 2 = $000F.

5. After a typeout, the teletypewriter always points at the A register. To get to the Q register, type a slash (/). The teletypewriter output may be accepted as is or new values of A or Q may be entered.

6. A (CR) accepts this entry and initiates the next parameter typeout or test execution.

7. A rubout voids this entry and resets the software pointer to A.

8. A manual interrupt simulates the SELECTIVE SKIP switch, in that it causes an SMM parameter stop.

Teletypewriter to panel entry correlations are as follows:

1. /   = Depress Q register selection

2. Rubout = Register clear; reset A to the A register contents.

3. (CR)   = Run

4. MI   = SELECTIVE SKIP

1.7.2 SCMM GENERAL OPERATING INSTRUCTIONS

To perform SCMM testing of the SYSTEM 17, SCMM must be incorporated in the system MSOS disk. Each device to be tested must have a logical unit assignment, which is determined when the MSOS system is built.

1.7.2.1   DETERMINATION OF MSOS LOGICAL UNITS

The MSOS logical unit assignment of each device is required to run all SCMM tests. A listing of these unit assignments may be obtained from MSOS by performing the following operations. The logical unit table will be printed on the system list device.

To begin, load the disk with an MSOS disk pack, apply power to the disk, depress AUTOLOAD, MASTER CLEAR, and GO. Then proceed as follows:

OPERATOR ENTRY   COMMENTS
    SYSTEM REPLY

    MSOS 4.1 – PSR LEVEL 86 09/18/74
    SET PROGRAM PROTECT

Set PROGRAM PROTECT switch

    CUSTOMER SYSTEM NAME   Up to 30 characters

    32K MODE   This depends on what the system was
                                                built for; i.e., 32K or 65K.

    CHECKING FILES – OK
    ENTER DATE/TIME MMDDYYHHMM

1025741355

    DATE: 25 OCT 74 TIME: 1355:00

Depress MANUAL INTERRUPT

    MI

*BATCH (CR)

    L, 10 FAILED 06
    ACTION

CU (CR)

    J

*JOB (CR)

    J

*LULIST (CR)

The list device will then print out the logical unit assignments. In some cases, one device may have two logical unit assignments. If it does, use the larger logical unit for diagnostic purposes.

17.2.2 TEST LOADING

To load SCMM it is first necessary to load MSOS from the disk. To start, depress AUTOLOAD, MASTER CLEAR, and GO. Then proceed as follows:

OPERATOR ENTRY	COMMENTS
SYSTEM REPLY	

<table>
<tr><td>   MSOS 4.1 – PSR LEVEL 86 09/18/74
    SET PROGRAM PROTECT</td><td></td></tr>
<tr><td>Set PROGRAM PROTECT switch</td><td></td></tr>
<tr><td>   CUSTOMER SYSTEM NAME</td><td>Up to 30 characters</td></tr>
<tr><td>   32K</td><td></td></tr>
<tr><td>   CHECKING FILES – OK
    ENTER DATE/TIME MMDDYYHHMM</td><td></td></tr>
<tr><td>1124741445</td><td>Enter month, day, year, hour, and minute, or type a character at least ten times.</td></tr>
<tr><td>   DATE: 24 NOV 74 TIME: 1445:00</td><td></td></tr>
<tr><td>Depress MI</td><td></td></tr>
<tr><td>   MI</td><td></td></tr>
<tr><td>SCMM Ⓒ𝖱</td><td></td></tr>
<tr><td>   SCMM IN</td><td></td></tr>
<tr><td>   11/24/74 1445</td><td></td></tr>
<tr><td>   CONTROL, TEST ID</td><td></td></tr>
</table>

At this point, an SCMM test could be loaded by typing the proper control indicator and test ID.

17.2.3 CONTROL STATEMENTS

The monitor recognizes eight control statements:

LST (CR)   – Provides a list on the standard list devices of all the routines in the SCMM library with their mnemonic names, disk sector address, and length and core address (if presently executing)

SRT, xxx (CR)   – Schedules execution of test xxx if it is in the library and not presently executing

STP, xxx (CR)   – Terminates execution of test xxx if it is in execution

PRM, xxx (CR)   – Halts execution of test xxx and returns to the test's parameter input sequence

XIT (CR)   – Terminates all tests in execution, outputs the message SCMM OUT, and releases all of the allocatable core used by SCMM

NPT, xxx (CR)   – Sets a flag to suppress error printout by test xxx if it is in execution

PRT, xxx (CR)   – Clears a flag to allow error printout for test xxx if it is in execution

CLR (CR)   – Terminates operator/monitor communication without terminating the tests that are in execution

1.7.2.4   TEST MNEMONICS

Tests that are currently available with SCMM have the following mnemonics:

TTY – Test for 1711/13 Teletypewriter and 713-10/120 Conversational Display Terminal and Non-Impact Printer

CRD – Test for 1729-3 Card Reader

PRT – Test for 1742-30/120 Line Printer

CD1 – Test for 1733-2-856-2/4 Cartridge Disk Subsystem, Disk Unit 0

CD2 – Test for the second 1733-2-856 Cartridge Disk, or a second test on 856 Cartridge Disk Unit 0 but on different sectors than CD1.

MTT – Test for 1732-3-616-72/92/95 Magnetic Tape Subsystem

HFP – Test for 1781-1 Hardware Floating Point Unit

The tests specified by these mnemonics are described in the SCMM Reference Manual. Each test may have several sections that may be run on a particular device. For some tests, additional information is required to test a particular device.

The SCMM Reference Manual also gives a detailed explanation of common and unique errors that may occur while running SCMM tests.

1.7.2.5   EXAMPLE

The following example shows how to load and execute a single SCMM test. First load the MSOS monitor and SCMM. Then proceed as follows:

OPERATOR ENTRY   COMMENTS
     SCMM REPLY

Press MANUAL INTERRUPT

    MI

SCMM (CR)

    SCMM IN
    CONTROL TEST ID

SRT, CD2 (CR)   Select sector to be tested from legal scratch area on
                                    the disk.

    BEGIN CARTRIDGE DISK TEST[†]
    LU, TEST, BEG SEC, END SEC,
    RUNS

14, 7000, 8000, 2 (CR)

    END CARTRIDGE DISK TEST
    xxxx TESTS, yyyy ERRORS   xxxx = Number of runs completed

                              yyyy = Number of errors detected

                              TESTS = 007E

                              Error printouts will occur on the line printer.

For information on intermediate typeouts, i.e., errors and comments, refer to the SCMM and MSOS reference manuals.

1.7.2.6   TEST MULTIPLEXING

The operator/monitor interface is illustrated in the following example. Suppose that the magnetic tape, line printer, and disk tests are to run simultaneously.

OPERATOR ENTRY   COMMENTS
     SCMM REPLY

Press MANUAL INTERRUPT

    MI   Manual interrupt processor is in core.

[†]Select sector to be tested from the legal scratch area on the disk

OPERATOR ENTRY	COMMENTS

SCMM REPLY

SCMM

  Request SCMM Executive

 SCMM IN
 12/01/73 0925
 CONTROL, TEST ID

  SCMM Executive in and requests control
  information.

SRT, MTT

  Request magnetic tape test.

 BEGIN MAG TAPE TEST
 SECTIONS, NO. OF RECDS, RUNS

  Test is in operation and requests operational
  parameters.

1E, 100, 2

  Operator requests all sections, 100 records per
  write/read, and two passes.

 DLU, DENSITY

  Test requests additional information.

6,556
7,800
FFFF

  Operator requests diagnostic logical unit 6 at
  556 bpi and 7 at 800 bpi. FFFF terminates the
  logical unit list. A total of eight logical units may
  be specified. The test begins exercising the
  device(s) at this point.

Press MANUAL INTERRUPT

 MI

  Manual interrupt processor is in core.

SCMM

  Request SCMM Executive.

 SCMM IN
 12/01/73 0910
 CONTROL, TEST ID

  SCMM Executive is in and requests control
  information.

SRT, PRT

  Request line printer test.

 BEGIN LINE PRINTER TEST
 DLU, SECTIONS, RUNS

  Test is in operation and requests operational
  parameters.

14, 3E, 2

  Operator requests sections 1 through 5 and two
  passes on DLU 14. The test begins exercising the
  device at this point.

Press MANUAL INTERRUPT

 MI

  Manual interrupt processor is in core.

SCMM

  Request SCMM Executive.

 SCMM IN
 12/01/73 0950
 CONTROL, TEST ID

  SCMM Executive in and requests control
  information.

SRT, CD1

  Request cartridge disk test.

 BEGIN CDD 1 TEST
 BEWARE OF SCRATCH CONFLICT,
 $C1=xxxx
 LU, SECTIONS, BEG SEC, END SEC, RUNS

  Test is in operation and requests operational
  parameters.

OPERATOR ENTRY
    SCMM REPLY

30,2,6000,8000,2

    END PRINTER TEST

COMMENTS

Operator requests MSOS logical unit 30, section 1, beginning sector of 6000, ending sector of 8000, and two passes.

Test has completed the requested test sections and number of passes. It has also released allocatable core.

To terminate the magnetic tape test, use the following procedure:

OPERATOR ENTRY
    SCMM Reply

Press MANUAL INTERRUPT

    MI

SCMM

    SCMM IN
    12/01/73 0955
    CONTROL, TEST ID

STP, MTT

    END MAG TAPE TEST, 0002 RUNS
    TAPE UNIT 00, 0000 ERRORS
    TAPE UNIT 01, 0000 ERRORS

COMMENTS

Manual interrupt processor is in core.

Request SCMM Executive.

SCMM Executive in and requests control information.

Stop magnetic tape test.

Test has completed requested test sections and number of passes, logged the number of errors encountered, and released allocatable core.

To terminate all tests, use the following procedure:

OPERATOR ENTRY
    SCMM REPLY

Press MANUAL INTERRUPT

    MI

SCMM

    SCMM IN
    12/01/73 1010
    CONTROL, TEST ID

XIT

    END CDD 1 TEST, xxxx RUNS, yyyy
    ERRORS

    SCMM OUT
    12/01/73 1015

COMMENTS

Manual interrupt processor is in core.

Request SCMM Executive.

SCMM Executive in and requests control information.

Test has completed requested test sections and number of passes. It has also released allocatable core.

SCMM Executive has determined that there are no other tests in execution so it terminates and releases core.

1.8 GROUNDING

All CDC system cabinets, as well as customer-provided switch boxes, air conditioners, and other electrical devices or appliances in the computer/processing room must be ultimately connected to earth. Usually the protective ground at the building power service entrance is a satisfactory connection point. On most systems ground wire in a power cable or a metallic electrical conduit will be sufficient to provide an equipment-to-earth conductor. However some systems require more sophisticated ground systems (EMC ground).

SYSTEM 17 equipments were primarily intended to rely upon the green wire power cord ground for safety purposes and for system EMC grounding. This is not sufficient in all cases as some systems require additional EMC grounding such as shielded cable ground, grid ground, raised floor grid ground, or star ground (see Table 1-7).

If shielded data cables are to be used to interconnect SYSTEM 17 equipments other grounding techniques need not be used (see Figure 1-6).

If shielded cable ground is not available, the raised floor grid ground technique may be used. The metal floor support braces may be used for the grid ground providing its joints are well bonded and it is connected to a satisfactory earth electrode (see Figure 1-7).

The braided wire grid system may be used where a raised floor grid or shielded cable ground is not available. It consists of a grid composed of braided flat cable that is located under a raised floor and is tied to an earth electrode (see Figure 1-8).

A modified star ground must be utilized if a raised floor and/or shielded cable ground are not available (see Figure 1-9).

Refer to the CDC Standard for Digital Computer System Grounding for details when implementing these ground systems.

Table 1-7. Computer Systems and System EMC Grounds[†]

SYSTEM EMC GROUND	COMPUTER SYSTEM				
	GENERAL COMMERCIAL OFFICE (NONDEDICATED)	GENERAL COMMERCIAL OFFICE (DEDICATED)	EDP DATA CENTER (GENERAL)	EDP DATA CENTER (SPECIAL)	INDUSTRIAL PROCESS CONTROL
Raised-Floor Grid	No	No	Recommended	Recommended	Acceptable
Wire-Mesh Grid[††]	No	No	Acceptable	Acceptable	Acceptable
Shield	Yes	Yes	Acceptable	No	Recommended
Solid-Metal Plane	No	No	Acceptable	Acceptable	Acceptable
Braided-Strap Grid	No	No	Acceptable	Acceptable	No
Military and Red/ Black[†††]					

[†]When a system uses solely an optically-coupled transmission scheme, the only ground for the system need be the safety ground to each device in the system. The logic chassis in each device will have to be tied at one point to the frame ground of that device.

[††]Requires raised floor also.

[†††]For these special site installations, contact the EMC office, Arden Hills.

NOTE

TERMINAL BLOCKS SHOWN ARE CDC NO. 53714400. TERMINAL NO. I IS THE FRAME GROUND. TERMINAL NO. 2 IS THE LOGIC GROUND.

CPU

LOGIC GROUND

POWER DISTRIBUTION PANEL

GRN OR GRN/YEL WIRE

2453481

OPTIONAL SAFETY GROUND TO POWER DISTRIBUTION PANEL

#2 OR LARGER, CU OR AL

EARTH ELECTRODE

CABLE SHIELDS TERMINATE IN CONNECTORS. CONNECTORS ARE COMMON TO CONNECTOR PANEL AND CONNECTOR PANEL SHOULD BE COMMON WITH FRAME GROUND

CONNECTOR PANEL

LOGIC GROUND

CONNECTOR PANEL

SHIELDED LOGIC CABLES

LOGIC GROUND

GRN OR GRN/YEL WIRE

2453481I OR EQUIV.

GRN OR GRN/YEL WIRE

PERIPH.

Figure 1-6. Shield EMC Ground System

1/4-20 TAP-TITE, 3/8 LG. (18862636)

LUG (13487201)

1/4 EXT. TH. LOCK WASHER (10126404)

SURFACE SHALL BE BURNISHED TO REMOVE ANY PAINT, CORROSION, OIL, AND OTHER INSULATING SURFACES PRIOR TO ATTACHMENT OF THE STRAP

DETAIL B

COMPUTER EQUIPMENT, . TYP.

⚠1 FOR A PROPER CONNECTION SEE DETAIL B

⚠2 WHEN THE FOLLOWING 2 CONDIONS ARE MET,

1) EQUIPMENT HAS AN ISOLATED LOGIC GROUND

2) EQUIPMENT IS INSTALLED ON A MILITARY SITE WITH A SYSTEM EMC GROUND WHICH IS ISOLATED FROM THE SYSTEM SAFETY GROUND

THEN THE JUMPER BETWEEN 1 & 2 OF THE WHITE TERMINAL BLOCK SHALL BE REMOVED AND A SECOND BONDING STRAP SHALL BE CONNECTED FROM THE BOTTOM HALF OF #1 TERMINAL TO THE SYSTEM SAFETY GROUND.

⚠3 BE DETAIL A

⚠4 WARNING - DO NOT POWER ON EQUIPMENT WITH JUMPER REMOVED WITHOUT A POSITIVE CONNECTION BETWEEN LOGIC CHASSIS AND SYSTEM EMC GROUND.

GRID-TO-EARTH 2 CONDUCTOR (6 AWG OR LARGER CU OR AL WIRE)

LOGIC CHASSIS

JUMPER

WHITE TERM BLOCK (53714400) OR EQUIV.

TERM1.FRAME
TERM2.LOGIC

BONDING STRAP (2453481I OR EQUIV)

BOLT TO GRID

1/4-20 BOLT, NUT, & EXT. TOOTH LOCK WASHER.

LOGIC GROUND-TO-GRID BONDING STRAP (SEE DETAIL A)

60 CM (24 IN) TYP

75 CM (30 IN) MAX.

RAISED FLOOR PANEL, TYP.

CIRCULAR CLAMP (92157003) OR EQUIV.

LUG (13487201 OR EQUIV.) SEE DETAIL B

SUPPORT PEDESTALS, TYP.

RAISED FLOOR GRID, TYP.

DETAIL A (3 VARIATIONS ON CONNECTING BONDED STRAPS TO FALSE FLOOR GRIDS)

Figure 1-7. Raised Floor Grid System EMC Ground

Figure 1-8. Wire Mesh Grid System EMC Ground

NOTES: 1. LOGIC GROUND BONDING STRAP (24534811) CLAMPED TO MAIN GROUND WIRE VIA BURNDY TYPE KSU, PENN UNION SWT OR EQUIVALENT

2. TERMINAL BLOCKS SHOWN ARE CDC NO. 53714400. TERMINAL NO. 1 IS THE FRAME GROUND AND TERMINAL NO. 2 IS THE LOGIC GROUND.

Figure 1-9. Modified Star Ground System

The central processor unit (CPU) is a 16-bit processor with 600 or 900 nsec cycle time, that is program compatible with existing 1700 equipment. The CPU comes with 4K of memory and has prewired locations for up to 32K of memory. The unit has prewired slots for an internal cartridge disk controller and an internal magnetic tape controller. The unit also has four prewired A/Q slots and three prewired DSA slots that may be used with standard controllers or special equipment interfaces. Extra memory, A/Q, and DSA accommodations may be acquired through the addition of other equipments. The CPU also includes a programmer's console, power supply, a teletypewriter/conversational display terminal (TTY/CDT) controller, and a TTY/CDT I/O port. The CPU may be housed in a variety of CDC enclosures, it may be used as-is as a free standing table-top device, or it may be housed in customer furnished cabinetry. A memory hold battery option is available that will preserve the memory contents of the CPU in case of power failure.

See Figure 2-1 for a block diagram of basic CPU equipments and functions.

The basic CPU does not include an enclosure; therefore, several optional enclosures have been provided. The customer may want to provide his own enclosure. The enclosure options are:

- Cabinet
- Mini cabinet
- Equipment table
- Desk console
- Table-top enclosure
- Equipment cabinet
- Pedestal cabinet

2.1 APPLICABLE DOCUMENTS

The following lists include the documents associated with the basic CPU and its associated housings. The documents with asterisks (*) are required for installation and maintenance of the CPU and its enclosures.

Documents relating to the basic CPU are as follows:

Title	Publication No.
1784 Computer Customer Engineering Manual (*)	89633300
1784 Computer Reference Manual (*)	89633400
1784 Computer Input/Output Specification Manual	89673100
Key to Logic Manual (*)	89723700
SYSTEM 17 AB107/AB108 Computer Execution Charts (*)	89723800

Figure 2-1. Block Diagram of the Basic CPU

Title	Publication No.
Mini Computer Systems Preliminary Site Preparation Manual, Section 1	60437000
Mini Computer Systems Preliminary Site Preparation Manual, Section 2	60437100

Optional cabinet enclosure documents include the following:

Title	Publication No.
Mini Computer Systems Preliminary Site Preparation Manual, Section 2	60437100
Installation Instruction, 1787-5, 1787-6, 10299-17, 1787-3	96761600
Installation Instruction, 1787-4	96711000

2.2 REQUIRED PARTS

The following hardware is required for the basic central processor unit (CPU) and memory hold battery:

	Product No.	Equipment No.
Memory module, 900 nsec[†]	1782-1	BA201-B
Memory module, 600 nsec[†]	1782-2	BA201-A
Central processor unit, 900 nsec	1784-1	AB107-A
Central processor unit, 600 nsec	1784-2	AB108-A
Memory address		
Memory control		
Timing board		
Arithmetic and logical unit (ALU) board (two required)		
Decoder board		
I/O interface board		
Console interface board		
Teletypewriter controller board		
Teletypewriter/conversational display terminal internal cable assembly	89684200	

[†]Only one memory increment supplied with the basic CPU

	Product No.	Equipment No.
Teletypewriter external cable assembly	89642300	
Power cord		
Memory hold battery (optional)	10297-1	GD611-A
Conversational display terminal external cable assembly	89668300	
Shorting jumper	89684100	

To configure a cabinet to accept installation of a CPU, the following items are required:

	Product No.
Cabinet	1787-1
Door assembly, rear (includes hinges and latch)	
Panel assembly, side (two required; includes screw latch assembly)	
Power distribution panel (includes mounting hardware)	
Front door assembly, bottom (includes hinges, latch, shelf)	
Front door assembly, top (includes hinges, latch)	
Strut assembly, horizontal (two required; includes unistrut nuts and bolts)	
Mounting rail assembly, vertical (two required; includes unistrut nuts and bolts)	
Screws and washers for mounting CPU (No. 10-32, 3/4 in.)	
Shelf assembly (optional)	10299-23
Blank panels (optional, two each. 1-3/4 in. Includes required mounting screws. For top mounted expansion enclosure only)	

The following items are required to configure a mini cabinet to accept installation of a CPU:

	Product No.
Mini cabinet	1787-2
Door assembly, rear (includes hinge and latch hardware)	
Door assembly, front (includes hinge, latch, and shelf hardware)	
Panel assembly, side (two required; includes screw latch assembly)	
Power distribution panel (includes mounting hardware)	
Mounting rail assembly, vertical (two required; includes mounting hardware)	
Screws and washers for mounting CPU (No. 10-32, 3/4 in.)	
Shelf assembly option	10299-23

The required parts and assembly instructions for the desk and table-top enclosures are included in the installation instructions for these enclosures. Following is a list of these enclosures:

	Product No.
Equipment table	1787-5
Pedestal cabinet	1787-3
Desk console	1787-6
Equipment cabinet	1787-4
Table top enclosure	10299-17
Below-table enclosure	10299-18

Miscellaneous required material is as follows:

Card extender	89791700
Card extractor	89670300

SMM diagnostic source (SMM17 on tape, disk pack, cards, or magnetic tape)

SCMM diagnostic source (MSOS disk pack)

2.3 INSTALLATION

Before installing the CPU, determine the type of enclosure that has been provided. Refer to Section 2.2 for a list of required parts, then proceed to the following paragraphs and select the applicable installation procedure. Since other equipments (such as expansion enclosures and 1500 series equipment) may be installed in the CPU enclosure, make sure that the installation instructions do not conflict with each other.

2.3.1 IN CABINET

1. UNPACKING AND CHECKOUT. Uncrate and unpack the cabinet and associated equipment. Ensure that all hardware parts listed in Section 2.2 are available. Record any damage or deficiencies. If there is a parts shortage, determine whether it will impede the assembly of the rack. Place a priority order with the responsible division for missing parts. If enough hardware parts are available, proceed with the installation.

2. ASSEMBLY. To assemble the cabinet, remove the side panel assemblies. Open and remove the front and/or back doors if installed. Install two unistruts and two vertical mounting rails as shown in Figure 2-2. To mount the struts and rails, use the provided uninuts and bolts. The smaller uninuts are inserted spring first into the vertical slots, located to the front and rear of the inside of each side of the cabinet, and then turned 90 degrees to the right. Insert the remaining uninuts in their respective positions and install the unistruts. Install the larger uninuts in the unistrut, position them, and install on the vertical rail. Refer to Figure 2-2 for the proper dimensions.
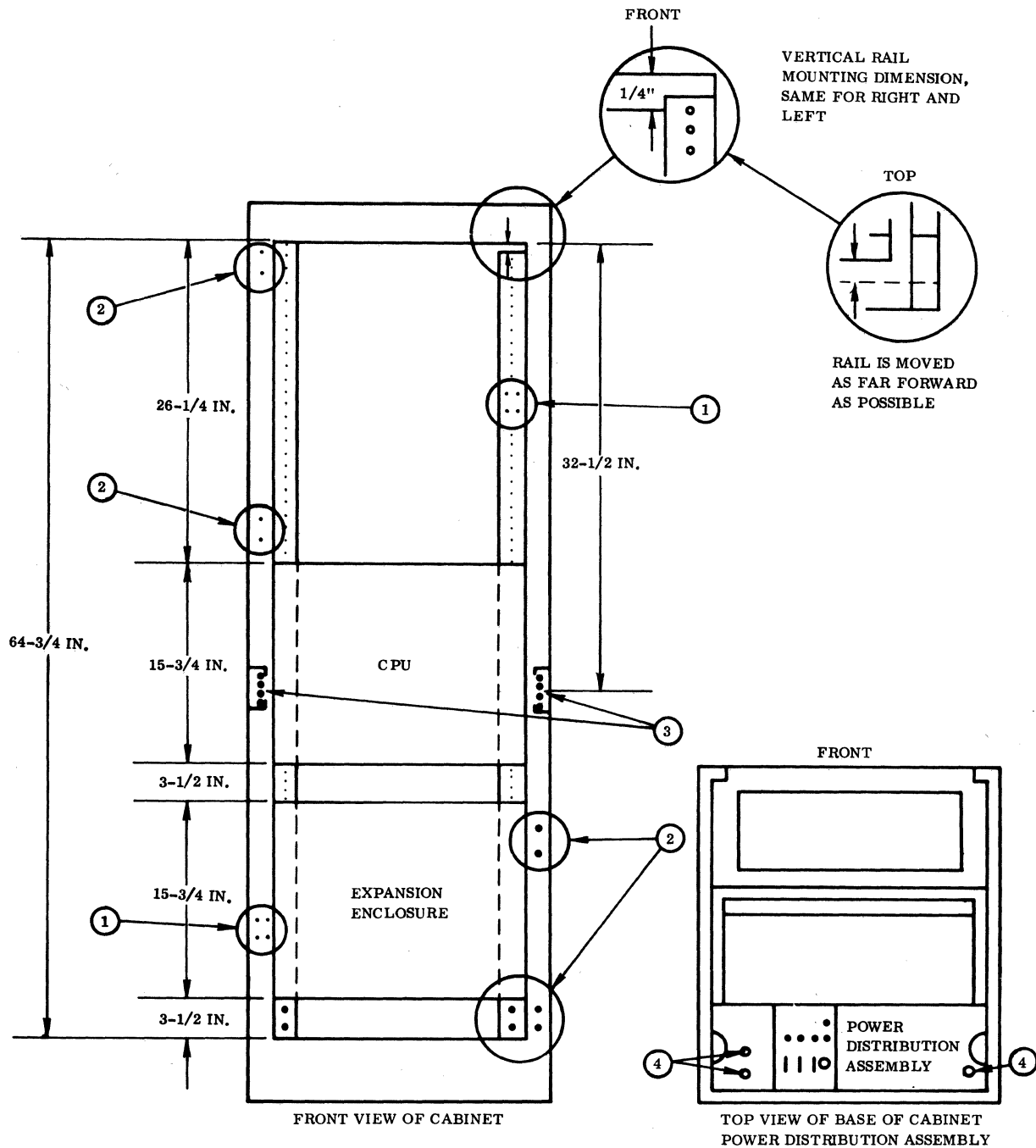
FRONT

VERTICAL RAIL
MOUNTING DIMENSION,
SAME FOR RIGHT AND
LEFT

1/4"

TOP

RAIL IS MOVED
AS FAR FORWARD
AS POSSIBLE

26-1/4 IN.

32-1/2 IN.

64-3/4 IN.

CPU

15-3/4 IN.

3-1/2 IN.

15-3/4 IN.

EXPANSION
ENCLOSURE

3-1/2 IN.

FRONT

POWER
DISTRIBUTION
ASSEMBLY

FRONT VIEW OF CABINET

TOP VIEW OF BASE OF CABINET
POWER DISTRIBUTION ASSEMBLY

NOTES: 1. PREDRILLED HOLES ON INSIDE EDGE FOR DOOR LATCH ASSEMBLY MOUNTING
2. PREDRILLED HOLES ON CABINET FOR DOOR HINGE ASSEMBLY MOUNTING
3. MIDDLE STRUT MOUNTING
4. PREDRILLED POWER DISTRIBUTION MOUNTING HOLES

Figure 2-2.   Cabinet Assembly and CPU Installation

88996000 A

NOTE

If other equipments use this cabinet, it may be necessary
to add additional struts before installing the mounting
rail, and it may be necessary to cut the rail before
installation. Additional rails may be installed to
accommodate other types of equipments (i.e., 1500
Series modules, magnetic tape transports, etc.).

Install the power distribution hardware assembly. Use the existing predrilled mounting holes in the
base and to the rear of the cabinet (see Figure 2-2). Electrical installation will be covered in a later
paragraph. Verify that all dimensions have been adhered to and ensure that all mounting hardware has
been tightened sufficiently to prevent slippage.

3. INSTALLATION. Remove the CPU from its shipping cartons. Inspect for and record any missing
parts (see Section 2.2). Record any physical damage. Use special care in handling the MOS memory
boards (see Section 4.3).

Install the CPU in the cabinet. At least two people will be required to do this job, although a third
person will make the job easier. Refer to Figure 2-2 to determine the proper mounting location within
the cabinet. Insert the CPU into the cabinet from the front. Utilize No. 10-32 screws (four on each
side) to fasten the CPU to the vertical mounting rail.

NOTE

If the system includes an expansion enclosure, install
it before proceeding with the installation of the doors.
Refer to Sections 3.3.2 and 3.3.3 for the expansion
enclosure installation procedure.

Locate the top and bottom door assemblies. Check their positions utilizing Figure 2-2 and ensure that
there will be ample clearance between the doors and the CPU. If the positioning is correct, attach the
doors. The holes for mounting the door hinge and latch assemblies to the cabinet are predrilled at the
correct locations for both the front and the rear door assemblies. If the positioning is not satisfactory,
the strut, rail, and CPU mounting dimensions will have to be rechecked and realigned before attaching
the doors.

NOTE

If a magnetic tape system is part of the system and is
to be installed in the cabinet, refer to Section 12.3 for
instructions on installing the magnetic tape transports.
If input/output module equipment is to be part of the
system and is to be installed in the CPU, refer to the
1500 Series module installation procedures outlined
in the Computer Interface Unit/Computer Expander manual.

2.3.2 IN EQUIPMENT CABINET

For installation of the CPU in an equipment cabinet, see the installation instruction manual listed in Section 2.1.

2.3.3 IN MINI CABINET

1. UNPACKING AND CHECKOUT. Unpack the mini cabinet and associated equipment. Check to see if all hardware parts listed in Section 2.2 are available. Record any damage or deficiencies. Order missing parts from the responsible division. Decide whether missing parts will impede assembly; if not, proceed with the assembly.

2. ASSEMBLY. Repeat the sequence of assembly instructions outlined in Section 2.3.1. Refer to Figure 2-3 for the proper dimensions.

3. INSTALLATION. Follow the installation instructions outlined in Section 2.3.1. Refer to Figure 2-3 for the proper dimensions.

2.3.4 ON TOP OF PEDESTAL CABINET, EQUIPMENT TABLE, OR DESK CONSOLE

This series of enclosures involves mounting the CPU on top of a pedestal cabinet, equipment table, or pedestal cabinet. A CPU hood type enclosure option is also available. These installations can be accomplished by two persons.

1. UNPACKING AND CHECKOUT. Unpack the enclosure hardware. Ensure that all parts, as listed in the installation instructions for the particular enclosure, are included. Record any deficiencies or damage.

2. ASSEMBLY. Follow the instructions outlined in the hardware assembly section of the installation instructions for each enclosure.

3. INSTALLATION. The installation instructions for the pedestal cabinet, equipment table, desk console, and table top enclosure include the procedures and the dimensions necessary to complete the CPU mechanical installation. The instructions also include the necessary information for installing the hood assembly.

2.3.5 60 HZ/50 HZ MODIFICATION

The basic CPU comes as a 60 Hz, 115 vac unit; however it can readily be converted to 50 Hz, 230 vac operation via jumper changes on the power supply and the blower assemblies.

Several jumpers on Terminal Board 2 (TB2) have to be changed. To gain access to TB2, open the front door of the CPU and remove the back panel of the power supply assembly. TB2 is to the left of the assembly.
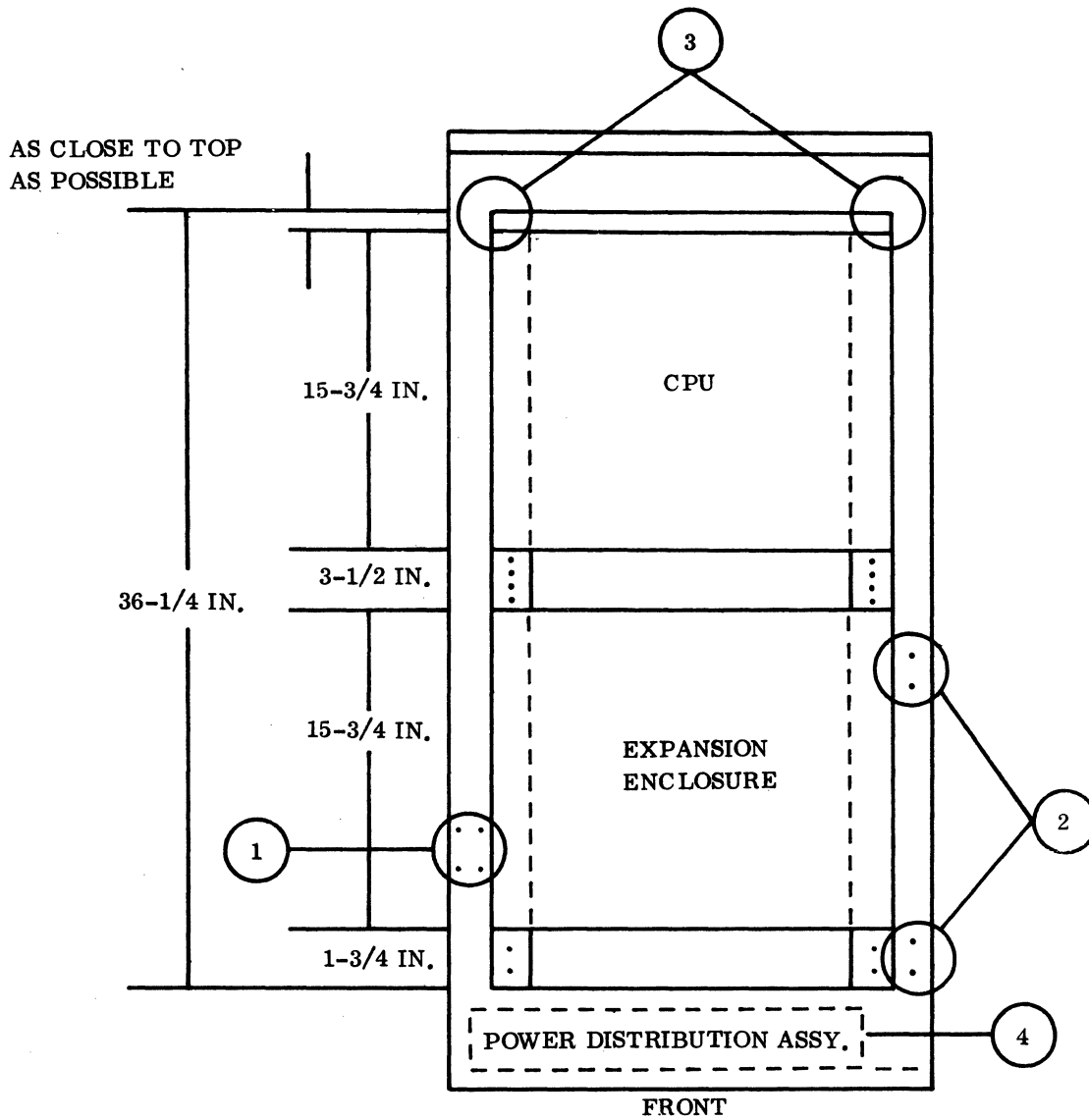
AS CLOSE TO TOP
AS POSSIBLE

15-3/4 IN.

36-1/4 IN.

3-1/2 IN.

15-3/4 IN.

1-3/4 IN.

CPU

EXPANSION
ENCLOSURE

POWER DISTRIBUTION ASSY.

FRONT

NOTES:

1. PREDRILLED HOLES ON INSIDE EDGE FOR DOOR LATCH ASSEMBLY MOUNTING
2. PREDRILLED HOLES ON CABINET FOR DOOR HINGE ASSEMBLY MOUNTING
3. VERTICAL RAIL DIMENSIONS ARE THE SAME AS GIVEN IN FIGURE 2.2.
4. POWER DISTRIBUTION LOCATION IS THE SAME AS SHOWN IN FIGURE 2.2.

Figure 2-3. Mini Cabinet Assembly and CPU Installation

Remove all U jumpers from TB2-1/2, TB2-3/4/5, TB2-6/7/8, and TB2-9/10. Use the same U jumpers and install them on TB2-2/3, TB2-5/6, and TB2-8/9. One of the three-terminal U jumpers will have to be cut to make a two-terminal U jumper. It should only be necessary to loosen the respective screws on each terminal to make the jumper change. Ensure that there are no loose, shorted, or broken wires. Tighten all screws on TB2, re-install the back cover, and close the door.

2.3.6 PRIMARY POWER INSTALLATION

2.3.6.1 CPU AND CABINET/MINI CABINETT

Remove the cover of the power distribution assembly. Install the CPU power cord into the CPU and route the cable along the center strut to the power distribution box. Use tyraps or lacing cord to tie the power cord to the struts. Cut off the male portion of the power cord and install the power cord conductors to TB01 of the power distribution panel. The green wire goes to TB01-6, the white wire goes to TB01-4 (neutral), and the black line goes to TB01-5 (line). CKT 1 now controls the CPU power.

Install a power cord from the power distribution assembly to the customer primary 50 Hz/60 Hz power outlet. The primary power input terminal board assignments are as follows: ground (green) = TB01-3, neutral (white) = TB01-1, and line (black) = TB01-2.

CAUTION

Do not turn the power on at this time.

2.3.6.2 CPU AND EQUIPMENT/PEDESTAL CABINET

Repeat the directions in Section 2.3.6.1, except route the input primary power to TB01-1 neutral (white), TB01-2 line (black), and E1 ground (green) terminals within the power distribution assembly.

Install the CPU power cord to TB02-3 neutral (white), TB02-2 line (black), and TB02-1 ground (green). TB02-3 is controlled by circuit breaker CKT1 (15 amp).

2.3.6.3 CPU AND EQUIPMENT TABLE

A power distribution box is not provided for this type of enclosure. The CPU primary power cord is routed directly to the customer 50/60 Hz power source.

The male portion of the power cord will have to be
changed if the system is to be configured for 50 Hz.

Do not power up the CPU at this time.

2.3.6.4 CPU AND DESK CONSOLE

This enclosure also utilizes a power distribution assembly. Repeat the installation of power cords as
outlined above in Section 2.3.6.2.

2.3.6.5 FUSES

Ensure that the CPU fuses are the proper value as listed in Table 2-1.

Table 2-1. CPU Fuse Size and Type

FUSE	FUSE SIZE	FUSE TYPE
F1	8 amp 125v	3 AG Standard
F2	1 amp 125v	3 AG Slow blow
F3	5 amp 250v	3 AG Standard
F4	0.1 amp 250v	3 AG Slow blow

2.3.6.6 GROUNDING

Install a one-inch braided ground strap between E1 (logic ground) and E2 (frame ground) of the CPU and
the system ground.

When installing the CPU in an equipment cabinet, install a one-inch braid between the vertical mounting
rail and the system ground.

2.3.7 CARD PLACEMENT

CAUTION

Never remove or insert logic cards with the CPU power
on.

Install the basic CPU cards in the slot positions designated by Figure 1-3.   Install the appropriate baud rate jumper on the teletypewriter (TTY) controller board.   See Figure 2-4 for the jumper locations.   The TTY will always require 110 baud.   If a conversational display terminal (CDT) is used instead of a TTY, the baud rate will be selected to agree with the baud rate set up at the CDT.   For reference purposes, record the serial numbers on the card placement sheet.   Put a copy of the card placement sheet on the back of the CPU or expansion enclosure power supply, and put another copy in the equipment log.

NOTE

Internal controllers and/or internal cable assemblies
for other peripherals may be installed at this time.
Refer to each specific equipment section for details
on these installations.

The basic CPU includes only one memory module, which provides 0 to $FFF memory locations.   The CPU can accept seven additional memory boards (see Section 4).

CAUTION

These boards should be handled carefully.   Hold the
boards in such a manner as to prevent body contact
with the individual MOS memory chips, or damage
to the chips can result.

These additional memory boards may be installed at this time.   Refer to Figure 1-3 for the proper board locations.

Install the external TTY/CDT cable between the 66-pin TTY continental connector on the CPU connector panel (normally J14) and the TTY/CDT.   Refer to Section 10 for cable installation at the TTY end or Section 11 for CDT cable preparation.   The internal TTY cable assembly is installed during manufacture and is routed from J20 P2 of the backplane to the connector panel J14.   The TTY common interrupt is installed during manufacture and is routed from J20 P2 A12 to J25 P1 B10.

NOTE

External cable assemblies from other peripherals
may be connected at this time provided that the
respective internal cable assembly and controllers
are installed.

Ensure that the CPU and/or expansion enclosure are de-energized.   The memory hold battery is physically mounted inside the CPU rear cover assembly.   The battery power cable consists of two wires.   The red insulated wire is connected to the positive (+) pin of the battery input jack (located on the upper rear right hand corner of the CPU).   The black insulated wire from the battery is connected to the negative (-) pin of the battery input jack.   The battery input jack is J0.

BAUD RATE SELECT JUMPERS
9600
1200
300
110
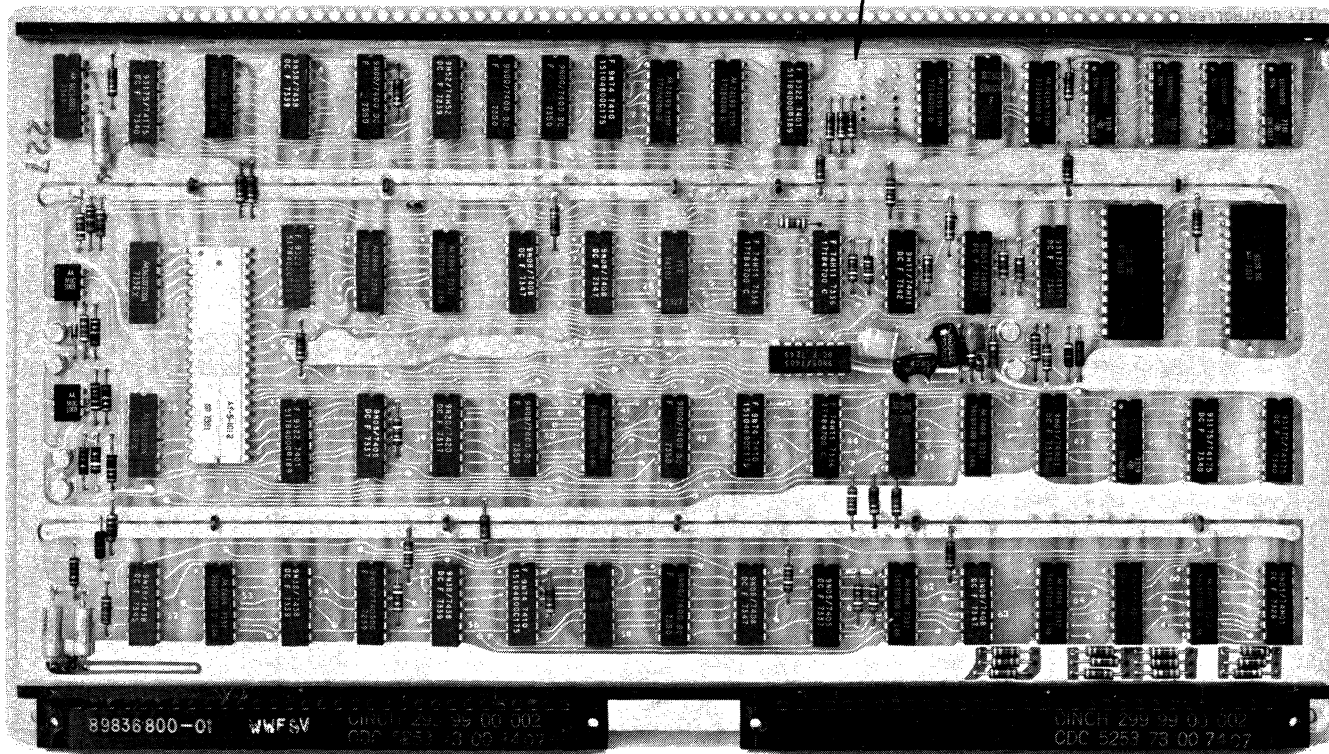
NOTE: JUMPER IN SELECTS BAUD RATE.

Figure 2-4.   Teletypewriter Controller Baud Rate Jumper Location

Position the back cover assembly so that the two open slots on the bottom edge fit over the raised flanges on the I/O connector panel. Close the cover assembly and tighten the knurled screws located in the upper corners.

NOTE

Since the battery power cable is short, it may be advisable not to install the memory hold battery until the remainder of the system is operational. This will eliminate needless removal and re-installing of the assembly. An alternative would be to connect the battery to the CPU or expansion enclosure temporarily via some longer wires.

2.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

2.4.1 POWER APPLICATION

Apply power to the CPU first and then to the expansion enclosure (if it is part of the system). Use a VOM or a DVM to measure and adjust the voltages listed in Table 2-2. Open the console door of the CPU.

The voltage adjustments are accessible through a slot on top of the console door/power supply assembly. Close the front door upon completion of the adjustments. This same procedure will apply to the expansion enclosure if it is part of the system.

2.4.2 PRELIMINARY CHECKOUT

Select each register (X, A, etc.), and ensure that the respective indicator illuminates. Select and enter data into each register. Data is entered by depressing the button corresponding to each bit position (bits 0 through 15). Depress the MASTER CLEAR button. Select and check the contents of all registers. All registers should be clear except the B (breakpoint) register. This register is cleared by depressing the REGISTER CLEAR button.

Clear memory parity errors. Set all switches to their middle position with the exception of the 32K/65K switch, the SELECTIVE STOP switch, and the SELECTIVE SKIP switch. The last two switches are two-position switches and should be in the lower (not enabled) position. If the system includes only a CPU, set the 32K/65K switch to 32K. If the system includes an expansion enclosure with additional memory, set this switch to 65K.

Table 2-2. CPU Nominal Voltage Set-Up

VOLTAGE	ADJUST FOR	MEASURED AT
+5 Vcc	+5 ± 0.1 vdc	P2 A31 of any CPU card position
+5 Vcc$_2$	+5.3 ± 0.05 vdc	TB1-10
-5	-5 ± 0.1 vdc	TB1-6
-12	-12 ± 0.1 vdc	TB1-5
Vss CPU (900 nsec)	16.7 ± 0.1 vdc (Adjust Vbb)	Memory board at location 20, Test Point 64 or
Vss CPU (600 nsec)	19.7 ± 0.1 vdc (Adjust Vbb)	J29 P2 A15/A16
NOTE: TB1 is located on the hinge side of the back of the console door/power supply assembly.		

Select the X register and enter all 0s or all Fs, set the ENTER/SWEEP switch to ENTER, and depress the GO button. The PARITY FAULT indicator should illuminate, and the CPU INACTIVE indicator should go out. Depress the STOP and MASTER CLEAR buttons and repeat the load/ENTER/GO sequence. This time the PARITY FAULT indicator should remain off.

If the PARITY FAULT indicator continues to illuminate during the load/ENTER/GO sequence, repeat the sequence with the PARITY FAULT STOP/AUTORESTART switch set to PARITY FAULT STOP. Repeat the sequence. The CPU should now stop with the PARITY FAULT light on. Select the P register and note each address.

If the system includes an expansion enclosure, turn its power off first, and then turn the power off on the CPU. Recheck all cable/card placements and connections.

Apply power to the system and repeat the entire clear memory procedure. Ensure that the PARITY FAULT STOP switch is deselected before doing the first load/ENTER/GO sequence. If the parity fault still occurs, set the PARITY FAULT STOP switch and again note the P register content. Repeat the load/ENTER/GO sequence. If the P register contents are consistent (i.e., one memory location), power down the system and exchange the memory board associated with the address noted in the P register. Addresses $0 through $FFF are in location 29, $1000 through 1FFF are in location 30, and so on. If the expansion enclosure is present, then memory $8000 through 8FFF will correspond to location 29 of the expansion enclosure.

NOTE

If a full 65K of core is installed in the system, set the P register to FFFF before doing the enter/GO sequence to clear core.

Reapply power and repeat the entire procedure. If the parity error remains, refer to the customer engineering manual and correct the problem before continuing with the installation checkout.

The memory hold battery must charge for a period of 32 hours to obtain a full charge. The quickest way to check the operation of the memory hold battery is to load the CPU and/or expansion enclosure with a known battery, turn off the main circuit breaker for the CPU and/or expansion enclosure, re-apply power, and sweep memory with the PARITY FAULT selector switch set. The system should not have any parity faults, and the contents of memory should be intact.

2.5 DIAGNOSTIC CHECKOUT

2.5.1 SMM TESTING

Load the SMM17 Version 3.1-2 Monitor into the CPU from the input device; i.e., card reader, magnetic tape or cartridge disk. Set up the SMM parameters as shown in Section 1.7.1. When BUILD TEST LIST is typed, select the following tests:

- COM001 — Command Test No. 1
- MEM02 — Memory Test No. 2
- MY1012 — Memory Test No. 12
- RPT009 — Random Protect Test No. 9
- MOS01E — MOS Memory Test No. 1E

The preset test parameters are used for acceptance and for normal testing. Refer to the SMM17 manual for details on setting up SMM and test parameters and for definitions of possible errors.

NOTE

When running memory tests on 65K computers, the 65K mode switch must be in the 65K position when SMM and the the memory tests are loaded.

2.5.2 SCMM TESTING

Load the MSOS 4.1 Monitor and call in SCMM. There are no SCMM tests for the CPU; however, the fact that MSOS 4.1 can be loaded and the SCMM routine can be called in constitutes a partial verification test of the system. See Section 1.7.2 for SCMM/MSOS loading and initialization procedures.

2.6 MULTIPLEX TESTING

The purpose of multiplex testing is to simulate system operation. Tests will be loaded sequentially, set into operation simultaneously, and run with either status or interrupt synchronization.

2.6.1 SMM

Multiple command tests may be run at one time, or they may be multiplexed with other tests such as the teletypewriter, disk, magnetic tape, or line printer tests. See Section 1.7.1.4 for details on setting SMM up for multiplex testing.

2.6.2 SCMM

Since there is no SCMM test for the CPU, other devices will have to be tested to verify operation of the system. SCMM tests can be run on all equipments of the system if there is an SCMM test for the equipment, if the equipment is included in the MSOS logical unit assignment table, and if the interrupt priority of the equipments is set up properly.

To run multiple SCMM tests, repeat the load and run procedure for each applicable equipment. See Section 1.7.2.6 for details on loading multiple tests.

2.7 VOLTAGE MARGIN TESTING

Voltage margin testing is an EPS requirement. It will be utilized during site installation of the SYSTEM 17 and when problems occur within the system that cannot be isolated by running standard diagnostics at nominal voltages.

Two voltages are normally changed when running voltage margins: +5 Vcc and Vbb (Vss). Set these voltages according to Table 2-3 and run several passes of memory and command tests.

Table 2-3. CPU Margin Voltage Set-Up

VOLTAGE	NOMINAL	RANGE[†]	MONITOR POINT	ADJUST POINT
-5 Vcc	+5.00 ±	4.75 - 5.25	P2 A31 - Any card position on backplane	Front door assembly
Vss (CPU, 900 nsec)	+16.70 ±	15.70 - 17.70	P2 A15/16 of location J29-J36	Front door assembly
Vss (CPU, 600 nsec)	+19.70 ±	18.70 - 19.70		Front door assembly
[†]Normal acceptance testing range				

The expansion enclosure, when used with the memory expansion control, provides the capability of increasing the CPU memory to 65K. The expansion enclosure may also be used with an A/Q-DSA channel expansion to increase the number of positions utilized for standard A/Q and DSA devices or for special equipments that interface with the standard A/Q-DSA bus. The expansion enclosure includes its own power supply that is identical to the one used in the CPU. See Figure 3-1 for a block diagram of the CPU, expansion enclosure, and memory expansion control.

A memory hold battery option is available that will preserve the memory content of the expansion enclosure in case of power failure. It is the same unit that is used on the CPU; however, each unit will require its own battery back-up.

The expansion enclosure may be housed in the same enclosure that contains the CPU or enclosures that attach to the one that holds the CPU. The following enclosures may be used to house the expansion enclosure:

- Cabinet (mounted above or below the CPU)

- Mini cabinet (mounted below the CPU)

- Below table enclosure (used in conjunction with the equipment table and desk console)

- Equipment cabinet (mounted above CPU)

3.1 APPLICABLE DOCUMENTS

The following list includes the pertinent documents associated with the expansion enclosure and its associated housings. The documents with asterisks (*) are required for installation and maintenance of the expansion enclosure and its enclosures.

Title	Publication No.
1784 Computer Customer Engineering Manual (includes expansion enclosure)	89633300
1784 Computer Reference Manual (includes expansion enclosure)	89633400
1784 Computer Input/Output Specification Manual	89673100
Installation Instruction 1787-4(*)	96711000
Installation Instruction, 10299-18(*)	88857500

CPU

A/Q

4 EACH

DSA

3 EACH

MAGNETIC TAPE
CONTROLLERS
(7 EACH)

MTT

CARTRIDGE DISK
CONTROLLERS
(5 EACH)

CDD

CPU (7 EACH)

TIMING CABLE
ASSEMBLY

MEMORY CONTROL AND
MEMORY (10 EACH)

J31 P1   J33 P1

J33 P1   J31 P1

J33 P2   J31 P2

J31 P2   J33 P2

EXPANSION ENCLOSURE

12 EACH

OPEN
SLOTS

4 EACH

DSA

10 EACH

A/Q

MEMORY EXPANSION
CONTROL WITH
ADDITIONAL MEMORY
(10 EACH)

P2 CABLE ASSEMBLY   P1 CABLE ASSEMBLY

Figure 3-1. Block Diagram of CPU, Expansion Enclosure, and Memory Expansion Control

Title	Publication No.
Installation Instruction, 1783/4	
Mini Computer Systems Preliminary Site Preparation Manual, Section 2	60437100

3.2 REQUIRED PARTS

The following is a list of the hardware required for the basic expansion enclosure and memory expansion control:

	Product No.	Equipment No.
Expansion Enclosure	1783-1	BT148-A
Memory expansion control	1786-1	BU120-A
Memory control[†]		
Memory address[†]		
Memory bus P1 cable assemblies (2 each)	89658100	
Memory bus P2 cable assemblies (2 each)	89658500	
Timing cable assembly	89802800	
Memory hold battery (optional)	10297-1	GD611-A

The expansion enclosure will normally be mounted in the cabinet or mini cabinet below the CPU. Section 2.2 lists all the hardware necessary to mount the expansion enclosure except the eight additional screws (No. 10-32) used to fasten the expansion enclosure to the vertical mounting rail.

NOTE

The expansion enclosure may be mounted above the CPU when installed in a cabinet. In this case the top door assembly will not be included. Blank filler panels will be included to fill in the open spaces at the top and bottom of the expansion enclosure.

Additional parts required for mounting the expansion enclosure in a cabinet are as follows:

Panel assembly, blank (1-3/4 in. x 19 in., two required, screws included)

Panel assembly, blank (8-3/4 in. x 19 in., one required, screws included)

[†]The memory control and memory address cards are the same as those used for the CPU.

The below-table enclosure is designed to fit under the equipment table or desk console CPU installation. Parts required and installation instructions are included in the installation instruction documents. The product numbers for these two enclosures are as follows:

	Product No.
Below-table enclosure	10299-18

3.3 INSTALLATION

The type of enclosure utilized for the expansion enclosure depends on the type of enclosure used to house the CPU.

1. UNPACKING AND CHECKOUT. Remove the expansion enclosure from its shipping carton. Inspect for and record any missing parts (see Section 3.2). Record any physical damage.

2. INSTALLATION. Install the expansion enclosure in the respective housing. A minimum of two persons will be required to do this task. A third person may be required in cases where the expansion enclosure is mounted below the CPU. Adhere to the precautions noted in Section 2.3.1.

3.3.1 IN A CABINET/MINI CABINET

The basic cabinet should already be assembled and the CPU installed. Refer to Section 2.3.1. Figures 2-2 and 2-3 give the dimensions required to mount the expansion enclosure below the CPU. Install the expansion enclosure and install the upper and lower door assemblies.

3.3.2 IN TOP PORTION OF CABINET

The basic cabinet configuration should be complete and the CPU should be installed. See Section 2.3.1, if necessary. Refer to Figure 3-2 for dimensions required to mount the expansion enclosure and the required blank filler panel assemblies.

3.3.3 IN TOP PORTION OF EQUIPMENT CABINET

For installation of the CPU in the top portion of an equipment cabinet, refer to the installation instruction listed in Section 3.1.

Figure 3-2. Cabinet and Expansion Enclosure Installation

The figure shows a cabinet layout with the following sections from top to bottom:

- BLANK PANEL — 8-3/4 IN.
- EXPANSION ENCLOSURE — 15-3/4 IN.
- BLANK PANEL — 1-3/4 IN.
- CPU — 15-3/4 IN.
- BLANK PANEL — 1-3/4 IN.
- SPACE AVAILABLE FOR OTHER EQUIPMENTS — 21 IN.
- POWER DISTRIBUTION ASSY.

Callouts: 1, 2, 2
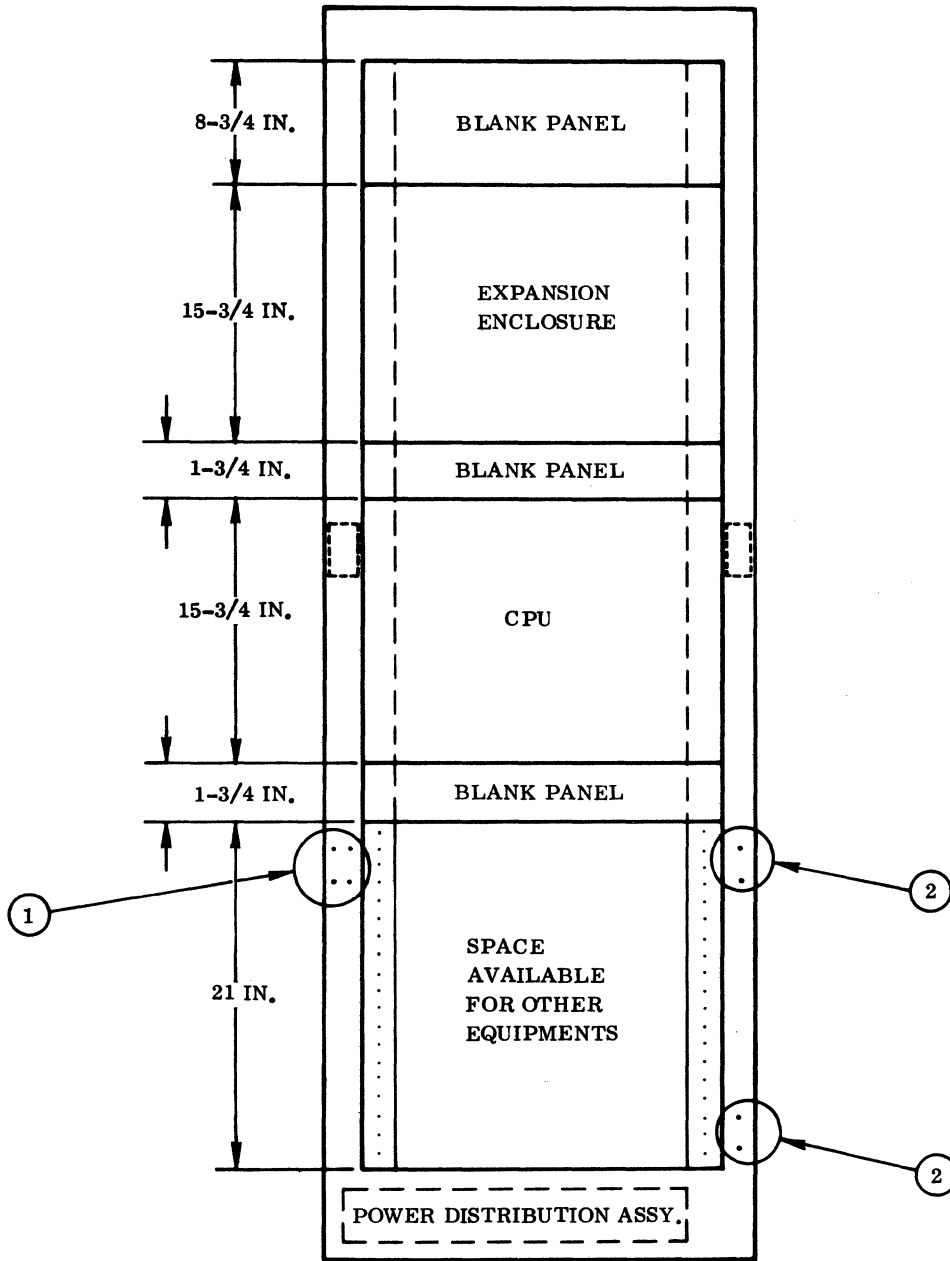
NOTES:

1. PREDRILLED HOLES FOR DOOR LATCH ASSEMBLY
2. PREDRILLED HOLES FOR DOOR HINGE ASSEMBLIES
3. RAIL, STRUT, AND POWER DISTRIBUTION PANEL ASSEMBLIES ARE MOUNTED AS IN DIMENSIONS LISTED IN FIGURE 2-2.

3.3.4 IN BELOW-TABLE ENCLOSURE

The below-table enclosure is utilized with the desk console and equipment table expansion enclosure installations. Determine which enclosure is to be utilized and check to see if all parts are included. Refer to Section 3.2. Unpack the enclosures and record any discrepancies and/or damage.

Install the below-table enclosure in the respective desk console or equipment table assembly. Install the expansion enclosure in its enclosure. Refer to the installation instructions for details and dimensions necessary to complete the task.

3.3.5 50/60 HZ MODIFICATION

The expansion enclosure utilizes the same power supply as the CPU; therefore, the 60 Hz to 50 Hz conversion procedure is the same. Refer to Section 2.3.4 for the conversion procedure.

CAUTION

Do not apply power to the system at this time.

3.3.6 PRIMARY POWER INSTALLATION

3.3.6.1 CABINET/MINI CABINET

Follow the instructions listed in Section 2.3.5 with the following exceptions: the power cord white conductor goes to TB01-7, the black conductor goes to TB01-8, and the green conductor goes to TB01-9. These terminal board assignments will be controlled by CKT2. The primary power to the cabinet or mini cabinet should already be installed.

3.3.6.2 EQUIPMENT CABINET

Install the expansion enclosure power cord to TB03-3 neutral (white), TB03-2 line (black), and TB03-1 ground (green). TB03 is controlled by CKT2 (15 amp).

CAUTION

Do not turn power on at this time.

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3.3.6.3 BELOW-TABLE ENCLOSURE

Repeat the procedure set forth in Section 2.3.5.2.

CAUTION

Do not power up the system at this time.

3.3.6.4 DESK CONSOLE/EQUIPMENT ENCLOSURE

Repeat the procedure set forth in Section 3.3.5.2. Use the same terminal board assignments. The CPU will be controlled by CKT1 and the expansion enclosure will be controlled by CKT2.

CAUTION

Do not power the system up at this time.

3.3.6.5 FUSES

Ensure that the fuses are operational and of the proper value as listed in Table 3-1.

Table 3-1. Expansion Enclosure Fuse Size and Type

FUSE	FUSE SIZE	FUSE TYPE
F1	8 amp 125v	3AG Standard
F2	1 amp 125v	3AG Slow blow
F3	5 amp 250v	3AG Standard
F4	0.1 amp 250v	3AG Slow blow

3.3.6.6 GROUNDING

Install a 1-inch braided ground strap between E1 (logic ground) and E2 (frame ground) of the expansion enclosure and the system ground.

Make sure that a 1-inch braid is installed from the vertical mounting rails of the cabinet to the system ground.

3.3.7 CARD PLACEMENT

CAUTION

Never remove or insert logic cards with the power
on. Handle the memory boards with care, and avoid
making contact with the MOS memory chips.

Install the memory expansion control cards and additional memory modules, as required by the system.
At least one memory module must be installed in the expansion enclosure and a full complement of
memory (32K) must be installed in the CPU to enable operation of the memory expansion control. A
total of eight memory modules (32K) may be installed in the expansion enclosure. Refer to Figure 1-3
for expansion enclosure card assignments. Ensure that the memory cards installed in the expansion
enclosure are the same type as those installed in the CPU.

NOTE

Other controllers and/or interface cards and their
respective internal cable assemblies may be installed
at this time.

Install the memory expansion control bus and timing cable assemblies between the CPU and the
expansion enclosure. Refer to Table 3-2 and Figure 3-1 to ensure that the cables are installed
as indicated.

Table 3-2. Memory Expansion Control Cable Connections

CPU	EXPANSION ENCLOSURE
J31 P1 89658100	J33 P1
J31 P2 89658500	J33 P2
J33 P1 89658100	J31 P1
J33 P2 89658500	J31 P2
J23 P1 A7 signal	J27 P2 A23
J23 P1 B11 ground	J27 P2 B21

When installing the memory bus cables, keep in mind that they must be routed correctly. The cables
exit the CPU and expansion enclosure via a slotted opening between the respective chassis and the back
cover. If an equipment table or desk console is involved in the installation, ensure that the cables get
routed through the cable port in the top of the table or desk assembly.

Install the memory hold battery as outlined in Section 2.3.6.

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3.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Apply power first to the CPU and then to the expansion enclosure. If necessary, measure and adjust the voltages as specified in Section 2.4.1.

For a preliminary checkout, follow the procedure as listed in Section 2.4.2 with the following exception: prior to initiating a load/ENTER/GO sequence to clear memory parity errors, select and set the P register to $FFFF. This procedure is necessary only if there is a full 65K of memory.

Refer to Section 2.4.2 for details on preliminary checkout of the memory hold battery.

3.5 DIAGNOSTIC CHECKOUT

All diagnostic checkouts will be performed as specified in Section 2.5, 2.6, and 2.7. Ensure that the 32K/65K select switch is in the 65K position.

3.6 TEST/MAINTENANCE AIDS

Applicable hand routines and test points will be the same for both the CPU and expansion enclosure where memory control and memory modules are concerned. The A/Q and DSA backplane pin assignments correspond to those utilized in the CPU.

The basic memory module consists of 4,096 eighteen-bit words of dynamic MOS storage. The memory is contained on one planar 50-PAK PWB and may have one of two different memory cycle times. There are two memory modules; one has a 900 nsec cycle time and the other has a 600 nsec cycle time. Memory refresh cycle time is 0.735 microsec every 48 microsec for the 900 nsec memory module and 0.490 microsec every 32 microsec for the 600 nsec memory module. The memory module may be installed in the CPU or the expansion enclosure (memory expansion control required).

4.1 APPLICABLE DOCUMENTS

The following documents are associated with the memory module:

Title	Publication No.
1784 Computer Customer Engineering Manual	89633300
1784 Computer Reference Manual	89633400

4.2 REQUIRED PARTS

The following parts are required for installation and checkout of the memory module:

	Product No.	Equipment No.
Memory module, 900 nsec	1782-1	BA201-B
Memory module, 600 nsec	1782-2	BA201-A

The number and type of these units will be dependent upon the customer requirements and/or system configuration.

4.3 INSTALLATION

1. UNPACKING AND CHECKOUT. Remove the memory module from its shipping package. Inspect and record any damage or discrepancies.

CAUTION

When installing the memory module refrain from
touching or handling the board so the body comes in
contact with the MOS memory chips. Body-
accumulated static charges may damage the chips.

2. INSTALLATION. Power down the expansion enclosure first and then power down the CPU.

Install the memory modules in the CPU. The basic CPU includes one memory module that is normally
installed in card position 29. Subsequent memory modules should be installed in ascending order; i.e.
positions 30, 31, 32, etc. The additional memory modules must be installed in consecutive locations.
When the CPU has its complement of memory (32K), additional memory modules may be installed in the
expansion enclosure provided that a memory expansion control is utilized. The memory modules in the
expansion enclosure must also be installed in consecutive ascending locations starting with location 29.

Install all of the system-required memory modules. Refer to Figure 1-3 for card placement
information. For reference purposes, record the memory module serial numbers on the card
placement assignment sheet in the site log and on the one behind the CPU/expansion chassis door
assembly.

4.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Clear the memory of parity errors as outlined in Section 2.4.2 and proceed with diagnostic testing.

4.5 DIAGNOSTIC CHECKOUT

Load SMM17 Version 3.1-2 Monitor into the CPU. If testing a 65K system, make sure that the 32K/
65K switch is on 65K. Set up the parameters as shown in Section 1.7.1. When BUILD TEST LIST is
typed out, call up the following tests:

- MY2002 — Memory Test No. 2 (includes MOS memory testing)
- MY1012 — Memory Test No. 12 (includes MOS worst case pattern and single cell inspection)
- MEM014 — Memory Test No. 14 (same as 2.3 version of Memory Test No. 2)
- RPT009 — Random Protect Test No. 9
- MOS01E — MOS Memory Test No. 1E

These tests must be called up separately and run one at a time.

4.6 VOLTAGE MARGIN TESTING

For margin testing refer to the procedure outlined in Section 2.7.

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The A/Q-DSA channel expansion is used to extend the CPU A/Q-DSA bus into the expansion enclosure. Each channel expansion consists of two 50-PAK board assemblies and one cable assembly. The boards are designated as main and remote and occupy one A/Q or DSA slot in the CPU and the expansion enclosure. The main boards are identical and may be used as A/Q or DSA depending upon how the jumpers are configured on each board. The remote boards are also identical and can be used as DSA or A/Q boards depending upon the jumper configuration. Figure 5-1 is a block diagram of the A/Q-DSA channel expansion configuration.
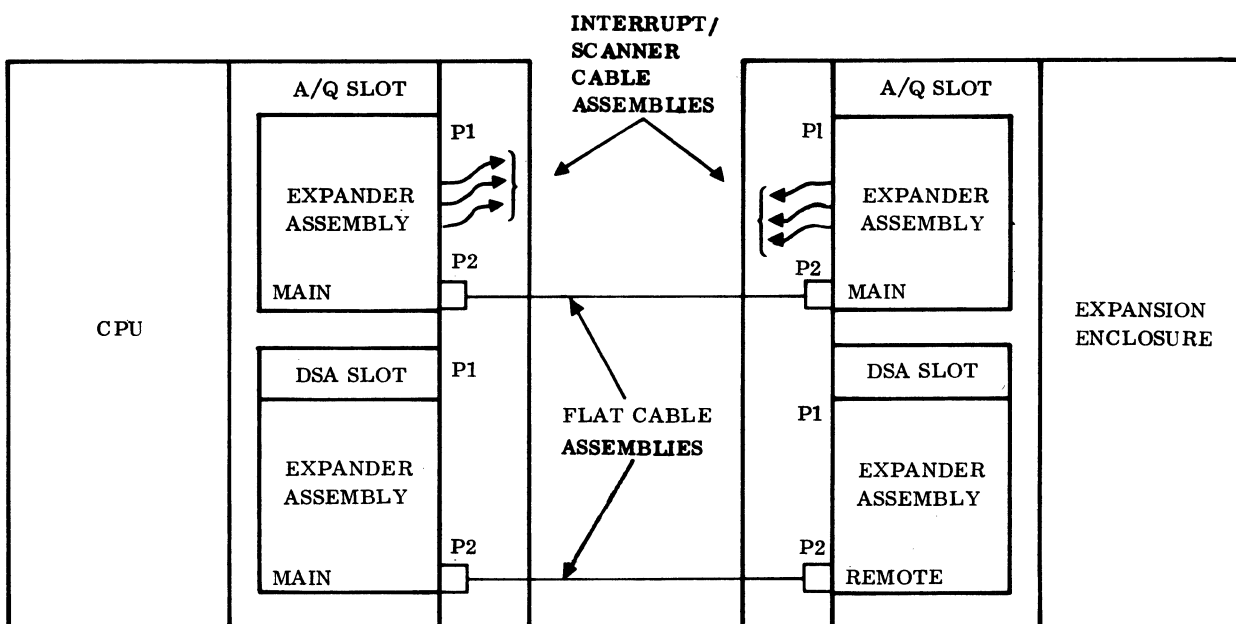
NOTES:

1. THE ABOVE DIAGRAM SHOWS THE EXPANSION OF BOTH A/Q AND DSA CHANNELS USING TWO SETS OF EXPANSION EQUIPMENT.

2. THE FLAT CABLE ASSEMBLY CONNECTS BETWEEN P2 OF EACH ENCLOSURE.

Figure 5-1. Block Diagram of A/Q-DSA Channel Expansion

5.1 APPLICABLE DOCUMENTS

The following documents are associated with the channel expansion. The documents with asterisks (*) are required for installation and maintenance of the channel expansions.

Title	Publication No.
TTL A/Q-DSA Bus Expander Hardware Reference/ Customer Engineering Manual(*)	89758600

5.2 REQUIRED PARTS

The following parts are required for installation and checkout of channel expansions:

	Product No.	Equipment No.
AQ/DSA channel expansion	1785-1/2	AT310-A
TTL master board assembly (AQM and DSM)†		
TTL remote board assembly (AQR and DSR)†		
TTL bus cable assembly†		89821800
Shorting jumper		89684100
Interrupt cable assemblies (10 each)		89724702

5.3 INSTALLATION

1.   UNPACKING AND CHECKOUT. Remove the A/Q-DSA channel expansion and cable assembly from the shipping package. Inspect for and record any damage.

2.   INSTALLATION. Identify the main board assembly, which has a partial row of resistors (see Figure 5-2) and the remote board assembly, which has a complete row of resistors (see Figure 5-3). See Figures 5-2 and 5-3 for the location of the jumper switches and Table 5-1 for the proper set-up of these jumpers.

Turn the power off on the expansion enclosure first, and then on the CPU. Install the AQM and DSM board(s) in the specified A/Q and DSA card position(s) in the CPU. Install the AQR and DSR boards(s) in the specified A/Q and DSA card positions in the expansion enclosure. Record these card installation assignments on the card placement assignment sheet. Install the TTL cable assembly between P2 of the respective assigned A/Q and DSA card positions in the CPU and the expansion enclosure.

3.   DSA SCANNER CONFIGURATION. The Scan Forward signal is routed through the DSA channel expansion on P1 B19 and carries the designation of SMTR. The Scanner Return signal is routed through the expander on P1 A19 and carries the designation of SRTM. Figure 5-4 shows a typical DSA scanner configuration.

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†One required for an A/Q expander and one required for a DSA expander
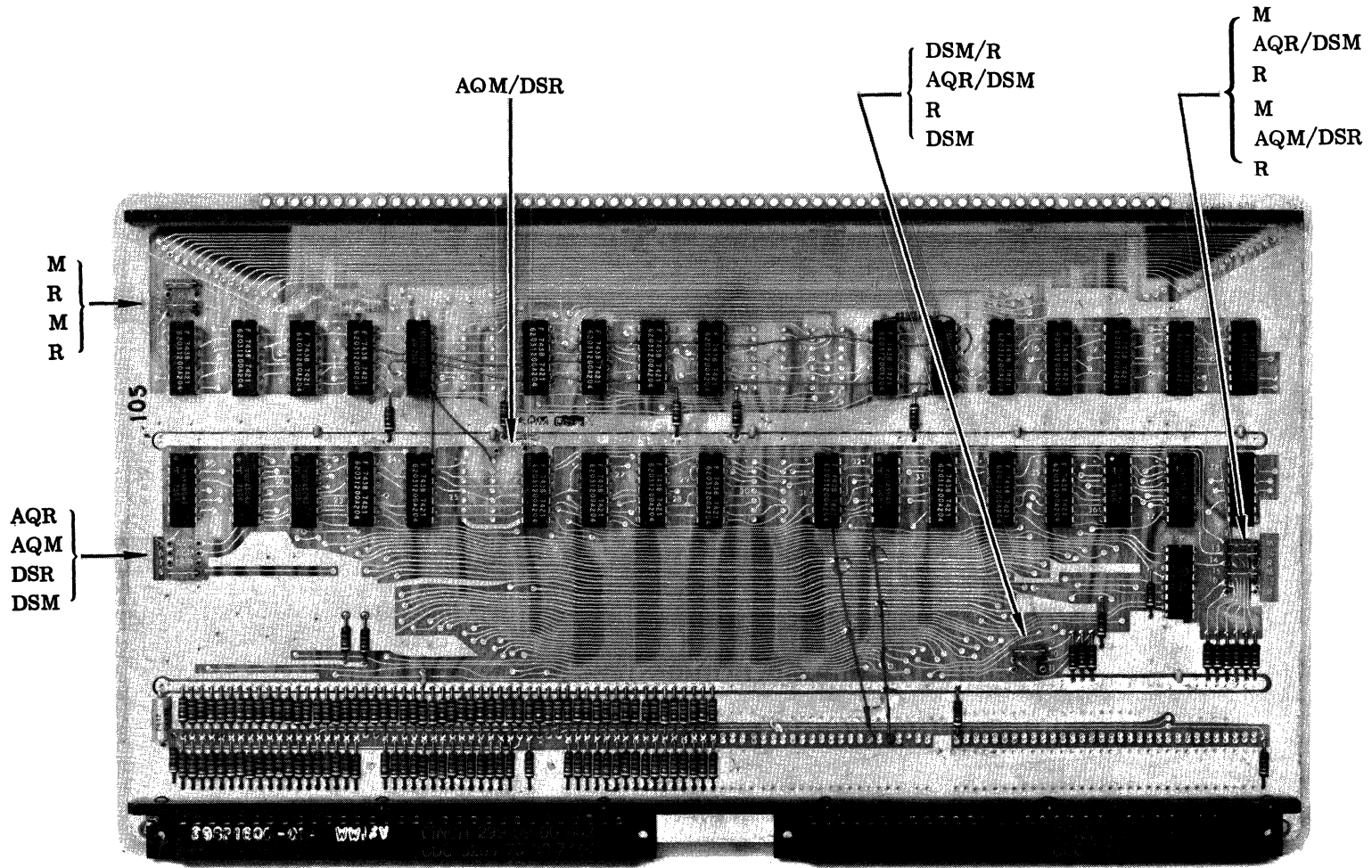
NOTE: JUMPER IN SELECTS DESIRED FUNCTION(S).

Figure 5-2. A/Q-DSA Master (Main) Channel Expansion Jumper Location

Figure 5-3. A/Q-DSA Remote Channel Expansion Jumper Location

NOTE: JUMPER IN SELECTS DESIRED FUNCTION(S).

AQM/DSR

DSM/R
ADR/DSM
R
DSM

M
AQR/DSM
R
M
AQM/DSR
R

M
R
M
R

AQR
AQM
DSR
DSM

R9759200-01   WWISV

Table 5-1. A/Q-DSA Channel Expansion Jumper Assignment

JUMPER NO.	NAME	AQM	AQR	DSM	DSR
1	M	−		−	
2	R		−		−
3	M	−		−	
4	R		−		−
5	AQR		−		
6	AQM	−			
7	DSR				−
8	DSM			−	
9	DSM/R		−	−	−
10	AQR/DSM		−	−	
11	DSM/R		−	−	−
12	M	−		−	
13	AQR/DSM		−	−	
14	R		−		−
15	M	−		−	
16	AQM/DSR	−			−
17	R		−		−
26	AQM/DSR	−			−

NOTES: 1. All positions are numbered except 17 and 26. No. 17 is adjacent to No. 16. No. 26 is located near chip U26 on each board assembly.

2. — = Short (jumper installed)

3. Blank = Open

4. INTERRUPT CONFIGURATION. The A/Q channel expansion is capable of carrying 15 interrupts from the expansion chassis to the CPU. Interrupts from specific equipments in the expansion enclosure may be routed to the assigned interrupt on the AQR board. In the CPU the corresponding interrupt is picked up at the AQM board and is jumpered to the assigned interrupt input of the CPU, (i.e., J25/26). Refer to Tables 5-2 and 5-3 for the interrupt assignments on the A/Q and DSA channel expansions. See Section 1.3.1 for J25/J26 interrupt assignments.

COMPUTER ENCLOSURE

P1 B19

SFI		SFO		SFI		SFO		P1 B19	SMTR
	F				M				SRTM
SRI		SRO		SRI		SRO			DSM

P1 A19

PART OF P2 CABLE ASSEMBLY

EXPANSION ENCLOSURE

P1 B19

SMTR		SFI		SFO		SFI		SFO
SRTM			M				L	
DSR		SRI		SRO		SRI		SRO

P1 A19
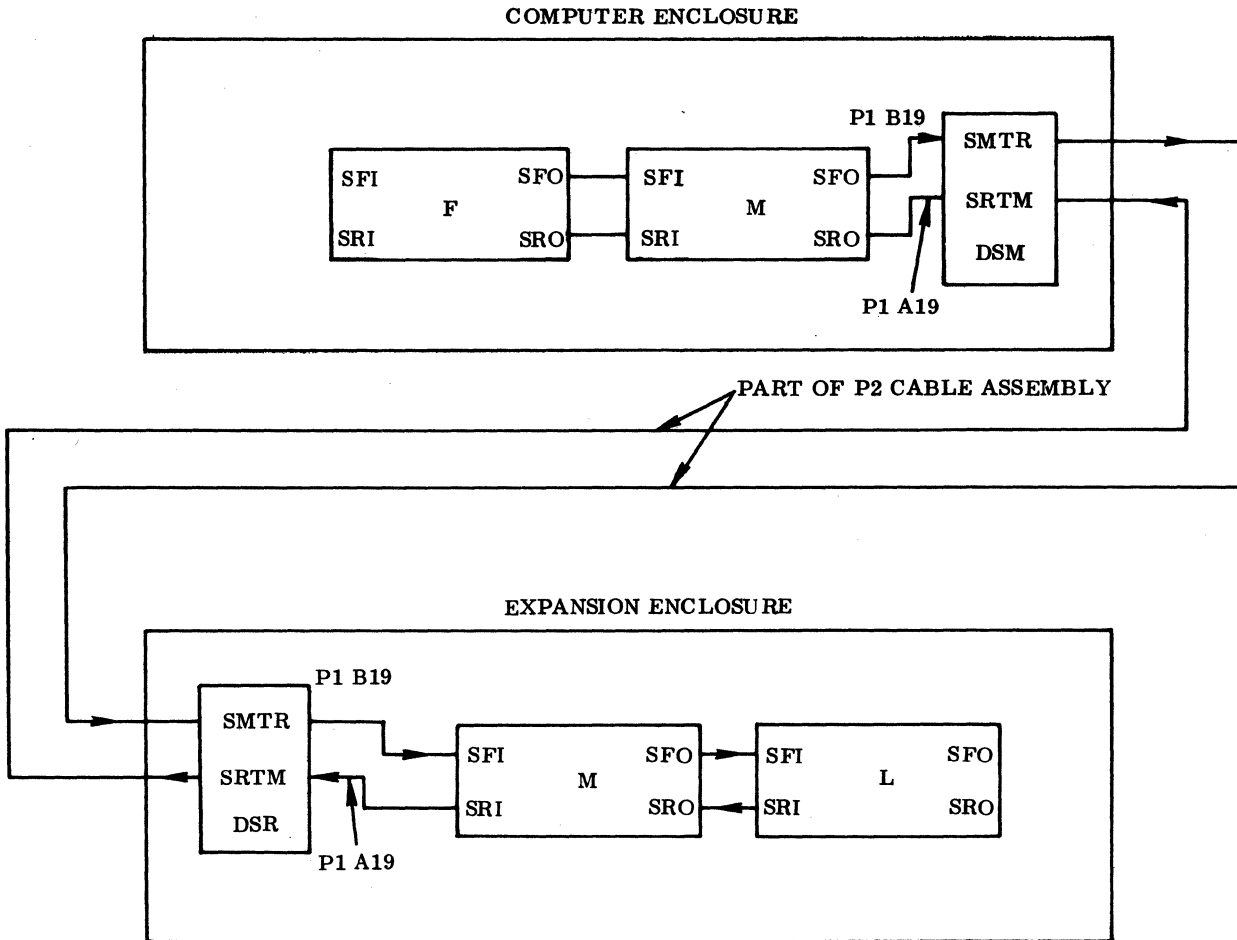
NOTES:

1. SFO = SCAN FORWARD OUT
   SFI = SCAN FORWARD IN   } IN CONTROLLERS
   SRO = SCAN REVERSE OUT
   SRI = SCAN REVERSE IN

2. SMTR } IN EXPANDER CARDS
   SRTM }

Figure 5-4. Typical DSA Scanner Connection

88996000 A

Table 5-2. A/Q-DSA Channel Expansion Pin Assignment for P1

A COLUMN		P1 PIN NO.	B COLUMN	
A/Q SIGNAL	DSA SIGNAL		A/Q SIGNAL	DSA SIGNAL
$\overline{A5}$	DA5	01	$\overline{A1}$	DA1
$\overline{A6}$	DA6	02	$\overline{A2}$	DA2
$\overline{A0}$	DA0	03	$\overline{A7}$	DA7
$\overline{A12}$	DA12	04	$\overline{A8}$	DA8
$\overline{A11}$	DA11	05	$\overline{A9}$	DA9
$\overline{A3}$	DA3	06	$\overline{A10}$	DA10
$\overline{A4}$	DA4	07	$\overline{\text{CHAR INPUT}}$	N.A.
VCC TER	VCC TER	08	N.C.	N.C.
$\overline{\text{TIMING PULSE}}$	MC	09	$\overline{A13}$	DA13
VCC TER	VCC TER	10	$\overline{A14}$	DA14
$\overline{A15}$	DA15	11	GND	GND
Q0	N.A.	12	Q1	$\overline{\text{PRIORITY}}$
Q2	$\overline{\text{RESUME}}$	13	Q3	N.A.
Q4	N.A.	14	Q5	PROTECT
Q6	$\overline{\text{REQUEST}}$	15	Q7	SCAN RTRN IN
Q8	N.A.	16	Q9	SCAN RTRN OUT
Q10	$\overline{\text{P.E.}}$	17	Q11	$\overline{\text{P.F.}}$
Q12	$\overline{\text{PAR BIT}}$	18	Q13	$\overline{\text{AUTOLOAD}}$
Q14	SCAN FWD IN	19	Q15	SCAN FWD OUT
$\overline{W=0}$	$\overline{\text{PROTECT BIT}}$	20	SINT 8	N.A.
$\overline{\text{READ}}$	N.A.	21	$\overline{\text{WRITE}}$	$\overline{\text{W.E.}}$
$\overline{\text{REPLY}}$	N.A.	22	$\overline{\text{REJECT}}$	N.A.
$\overline{\text{PROG. PROTECT}}$	AD8	23	$\overline{\text{MC}}$	AD0
$\overline{\text{SINT 1}}$	AD9	24	$\overline{\text{SINT 9}}$	AD1
$\overline{\text{SINT 2}}$	AD10	25	$\overline{\text{SINT 10}}$	AD2
$\overline{\text{SINT 3}}$	AD11	26	$\overline{\text{SINT 11}}$	AD3
$\overline{\text{SINT 4}}$	AD12	27	$\overline{\text{SINT 12}}$	AD4
$\overline{\text{SINT 5}}$	AD13	28	$\overline{\text{SINT 13}}$	AD5

Table 5-2. A/Q-DSA Channel Expansion Pin Assignment for P1 (Continued)

A COLUMN		P1 PIN NO.	B COLUMN	
A/Q SIGNAL	DSA SIGNAL		A/Q SIGNAL	DSA SIGNAL
GND	GND	29	N.C.	N.C.
$\overline{\text{SINT}}$ 6	AD14	30	$\overline{\text{SINT}}$ 14	AD6
$\overline{\text{SINT}}$ 7	AD15	31	$\overline{\text{SINT}}$ 15	AD7

Table 5-3. A/Q-DSA Channel Expansion Pin Assignment for P2

A COLUMN		P2 PIN NO.	B COLUMN	
A/Q SIGNAL	DSA SIGNAL		A/Q SIGNAL	DSA SIGNAL
$\overline{\text{PROG. PROT.}}$	$\overline{\text{XAD8}}$	01	XMC	$\overline{\text{XAD0}}$
XSINT1	$\overline{\text{XAD9}}$	02	XSINT9	$\overline{\text{XAD1}}$
GND	GND	03	XSINT10	$\overline{\text{XAD2}}$
XSINT2	$\overline{\text{XAD10}}$	04	XSINT11	$\overline{\text{XAD3}}$
XSINT3	$\overline{\text{XAD11}}$	05	XSINT12	$\overline{\text{XAD4}}$
XSINT4	$\overline{\text{XAD12}}$	06	XSINT13	$\overline{\text{XAD5}}$
XSINT5	$\overline{\text{XAD13}}$	07	XSINT14	$\overline{\text{XAD6}}$
XSINT6	$\overline{\text{XAD14}}$	08	XSINT15	$\overline{\text{XAD7}}$
XSINT7	$\overline{\text{XAD15}}$	09	N.C.	N.C.
XREPLY	N.A.	10	X CHAR. INPUT	N.A.
XREAD	N.A.	11	XA13	$\overline{\text{XDA13}}$
X. W=0	X PROTECT BIT	12	XA14	$\overline{\text{XDA14}}$
$\overline{\text{XQ14}}$	X SCAN FWD IN	13	$\overline{\text{XQ1}}$	X PRIORITY
$\overline{\text{XQ12}}$	X PAR BIT	14	$\overline{\text{XQ3}}$	N.A.
$\overline{\text{XQ10}}$	XP. E.	15	$\overline{\text{XQ5}}$	X PROTECT
$\overline{\text{XQ8}}$	N.A.	16	$\overline{\text{XQ7}}$	$\overline{\text{X SCAN RTRN IN}}$
$\overline{\text{XQ6}}$	X REQUEST	17	$\overline{\text{XQ9}}$	$\overline{\text{X SCAN RTRN OUT}}$
$\overline{\text{XQ4}}$	N.A.	18	$\overline{\text{XQ11}}$	XP. F.
$\overline{\text{XQ2}}$	X RESUME	19	$\overline{\text{XQ13}}$	X AUTOLOAD
$\overline{\text{XQ0}}$	N.A.	20	XQ15	$\overline{\text{X SCAN FWD OUT}}$

Table 5-3. A/Q-DSA Channel Expansion Pin Assignment for P2 (Continued)

A COLUMN		P2 PIN NO.	B COLUMN	
A/Q SIGNAL	DSA SIGNAL		A/Q SIGNAL	DSA SIGNAL
N.C.	N.C.	21	GND	GND
X TIMING PULSE	XMC	22	XSINT8	N.A.
XA4	$\overline{\text{XDA5}}$	23	XWRITE	XW.E.
XA15	$\overline{\text{XDA15}}$	24	XREJECT	N.A.
XA3	$\overline{\text{XDA3}}$	25	XA1	$\overline{\text{XDA1}}$
XA11	$\overline{\text{XDA11}}$	26	XA2	$\overline{\text{XDA2}}$
XA12	$\overline{\text{XDA12}}$	27	XA7	$\overline{\text{XDA7}}$
XA0	$\overline{\text{XDA0}}$	28	XA8	$\overline{\text{XDA8}}$
XA6	$\overline{\text{XDA6}}$	29	XA9	$\overline{\text{XDA9}}$
XA5	$\overline{\text{XDA5}}$	30	XA10	$\overline{\text{XDA10}}$
VCC	VCC	31	N.C.	N.C.

5.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Apply power first to the CPU and then to the expansion enclosure. The A/Q-DSA channel expansion derives its power from its housing (the CPU or the expansion enclosure).

The channel expansions can best be checked out by installing A/Q and/or DSA equipments in the expansion enclosure and performing a diganostic check of the particular device. The line printer controller, card reader controller, or equivalent device should suffice for the A/Q bus. If a DSA device is not available to check out the DSA channel expansion, the jumpers on the DSM and DSR boards may be changed to the AQM and AQR configuration, as in Table 5-1. The cards may then be checked out via an A/Q device on the expanded A/Q bus.

An alternate method of channel expansion checkout is to utilize a basic hand routine, CPU test mode, and an oscilloscope. Enter the following program:

$0	0AFF	ENA	$FFFF
1	0CFF	ENQ	$FFF
2	0301	OUT	*1
3	0B00	NOP	
4	0A00	ENA	$0
5	0C00	ENA	$0
6	0201	INP	*1
7	0B00	NOP	
8	0000	SLS	

Set the SELECTIVE STOP switch and select TEST MODE operation.

Use the oscilloscope and monitor the A/Q bus signals in the expansion enclosure. Refer to Table 5-2 for the A/Q bus pin assignments. The A, Q, read, write, and MC lines should all toggle. This procedure may be used to check out the DSA channel expansion by changing the jumpers to the A/Q bus configuration (see Table 5-1) and installing it in an A/Q slot.

5.5 DIAGNOSTIC CHECKOUT

Run SMM and SCMM tests applicable to those devices installed on the A/Q-DSA channel expansion.

5.6 MULTIPLEX TESTING

Follow the multiplex testing procedure as outlined in the sections pertaining to the equipments on the channel expansion that are to be tested.

5.7 VOLTAGE MARGIN TESTING

This is an EPS requirement for on-site installations. Run SMM and/or SCMM tests on A/Q and DSA devices that utilize the bus expander. The tests should run at all the settings noted in Section 2.7.

5.8 TEST/MAINTENANCE AIDS

See Section 5.4.

5.9 COMMONLY USED TEST POINTS

The CPU board assemblies do not have test points tied to the logic. Signal measurement is done on the backplane A/Q or DSA bus or on the card when it is extended.

The card reader subsystem consists of one card reader controller and one card reader.

The card reader controller is a one-card device that may be inserted into any available A/Q card position of the CPU or the expansion enclosure. It has equipment number and protect select capability and includes an internal data cable assembly and an interrupt cable assembly.

The card reader is a table-top-mounted card reader that reads 80-column ANSI-compatible cards at a rate of 300 cards per minute. The card reader has a reflective optical read station and an input hopper and stacker capacity of 1000 cards. The card reader has internal switches that allow selection of optional interface signals and off-line operation. See Figure 6-1 for a block diagram of the card reader subsystem.
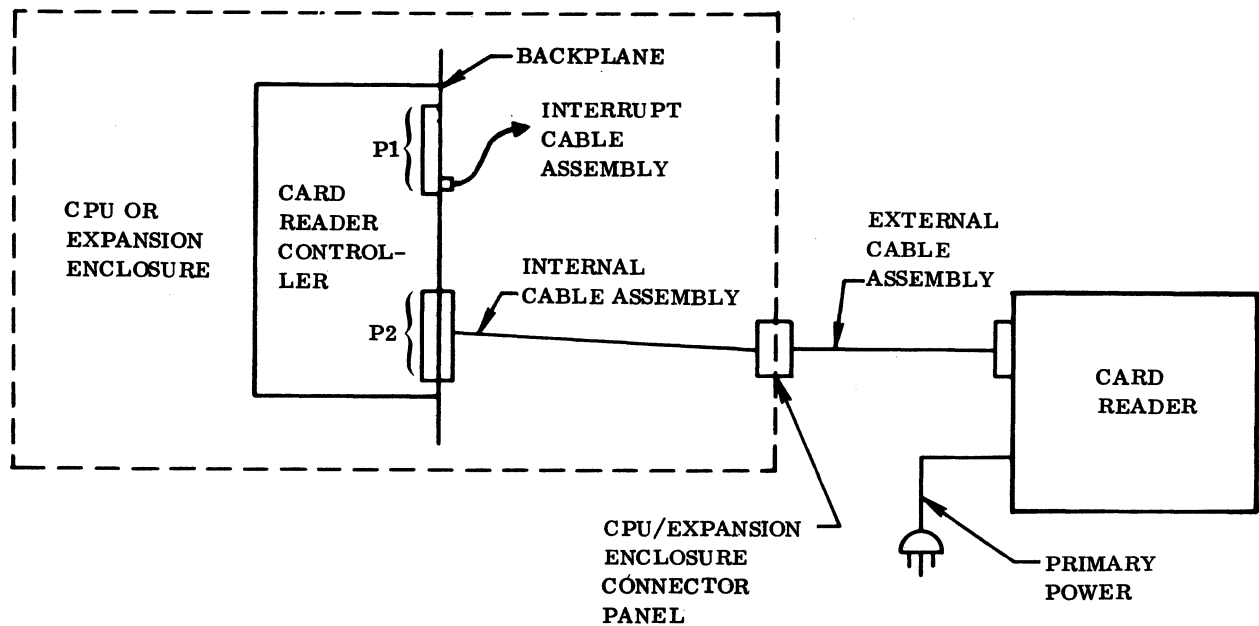
Figure 6-1. Block Diagram of the Card Reader Subsystem

6.1 APPLICABLE DOCUMENTS

The following lists include the documents associated with the card reader subsystem. Documents with asterisks (*) are required for the installation and maintenance of the card reader subsystem.

Documents pertaining to the card reader controller are as follows:

Title	Publication No.
SYSTEM 17 Card Reader Controller Reference Manual(*)	89637400
Card Reader Controller Customer Engineering Manual(*)	89637500

The document relating to the card reader is:

Title	Publication No.
CB101, 102, 103, 201-A/B Card Readers Field Service Manual(*)	49757800

6.2 REQUIRED PARTS

The following list includes all hardware required for installation and checkout of the card reader and controller:

	Product No.	Equipment No.
Card reader controller	1729-3	FE119-A
Card reader	1729-3	CB101-A/B
Shorting jumpers	89684100	
Cable assembly, internal	89641800	
Cable assembly, external	89669300	
Cable assembly, interrupt	89724702	

The SMM17 card reader test pattern deck and the SCMM card reader test pattern decks are also required for installation and checkout of the card reader subsystem. The SMM17 card reader test pattern deck is obtained by running the 1728/430 SMM17 punch test. The sections used when punching this deck should correspond to those sections used when conducting the 1729-3 Card Reader SMM17 test.

The SCMM card reader test pattern decks are obtained by running the corresponding tests on a 1728/430 Card Punch.

6.3 INSTALLATION

6.3.1 CARD READER

1. UNPACKING AND CHECKOUT. Remove the card reader from its shipping box and check for external damage. Record all damage.

Use a screw driver to release the screws on the back door and to loosen the two hold-down screws inside the feed hopper.

Lower the back door and swing the hopper/mechanical assembly to the front of the card reader. Grasp the left control panel of the front portion of the card reader and swing it out and to the left (see Figure 6-2). Remove all shipping blocks and/or retaining straps. Locate the pressure roller assembly and remove the Allen screw that prevents the roller assembly from making contact with the drive roller.

Inspect for and record any internal damage.
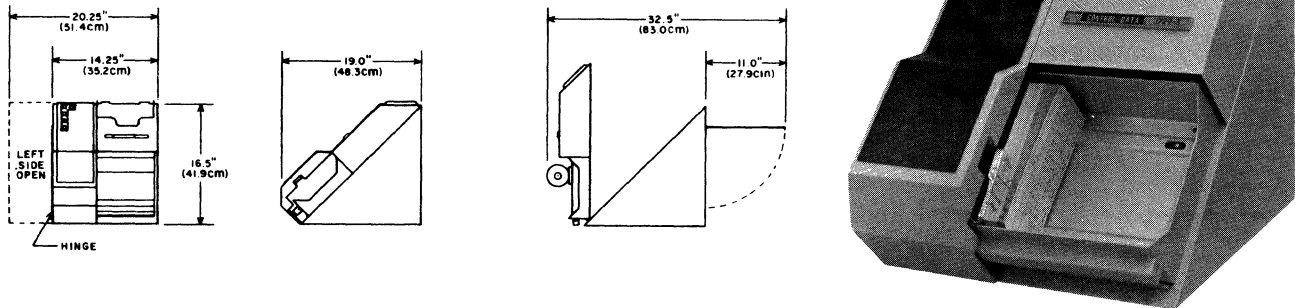
Figure 6-2. Card Reader Physical Representation

Locate control board A2 and data board A3, both of which are on the back door. Loosen the knurled screws on the top board (A3) and raise the board to gain access to the IC switch assemblies on both the A2 and A3 boards. Table 6-1 shows both on-line and off-line switch configurations. Set these switches to the configuration required for the immediate application. Return all boards and doors to their normally closed positions.

Table 6-1. On-Line/Off-Line Card Reader Switch Configuration

A2 CONTROL BOARD			A3 DATA BOARD LOCATION C4			A3 DATA BOARD LOCATION E4		
	ON-LINE	OFF-LINE		ON-LINE	OFF-LINE		ON-LINE	OFF-LINE
1 MARK	Off	Off	NU	On	On	ESP	On	On
2 51 Column	Off	Off	DP	On	On	EPP	On	On
3 SLOW	On	On	DSP	On	On	EFP	On	Off
4 FDST	Off	On	HEP	On	On	SEP	On	On
5 TOR	Off	Off	BP	Off	Off	FEP	On	On
6 TO	Off	Off	1P	On	On	MEP	On	On
7 FNR	Off	Off	SFP	On	On	RCP	On	On
8 SYNC	Off	Off	CSP	On	On	RP	Off	Off

6.3.2 CARD READER CONTROLLER

1. UNPACKING AND CHECKOUT. Remove the card reader controller from its shipping package. Inspect for and record any damage.

2. INSTALLATION. Install the card reader equipment select jumpers and the protect jumper on the controller card. See Figure 6-3 for the location of these jumpers and Table 6-2 for the proper set-up of these jumpers. This is the configuration for the standard assigned equipment number.

Turn the power off on the expansion enclosure first, if it is part of the system. Then turn the power off on the CPU. Install the card reader controller in its specified A/Q card slot. Install the internal cable assembly between P2 of the backplane of the selected A/Q slot and the CPU expansion enclosure connector panel. Install the external cable assembly between the connector on the connector panel and the card reader. Install the interrupt cable assembly between P1 B27 of the selected A/Q slot and J26 P1 B07 (interrupt No. 13, the normally assigned interrupt). The following interrupts are also available: data interrupt at P1 B24, EOP interrupt at P1 B26, and alarm interrupt at P1 B26 of the card position assigned to the card reader controller.

6.3.3 GROUNDING

No separate ground is used with the card reader. All grounding is provided through the green safety ground of the primary power cord.
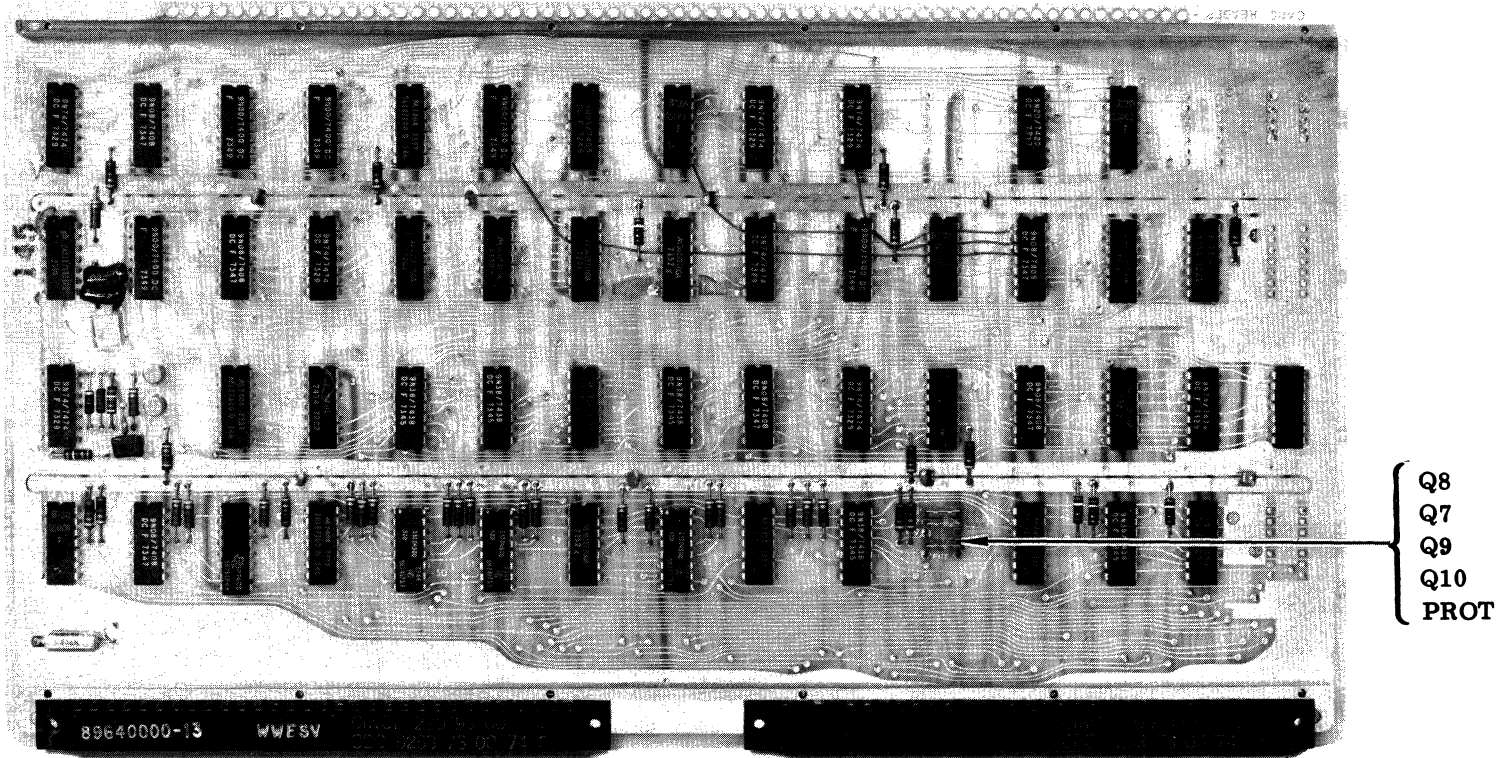
Q8
Q7
Q9
Q10
PROT

NOTES: 1. Q-BIT JUMPER IN SELECTS THE BIT.
2. PROTECT JUMPER IN = THE CONTROLLER IS NOT PROTECTED.

Figure 6-3. Card Reader Controller Equipment Number and Protect Jumper Location

Table 6-2. Card Reader Controller Equipment Number Selection

BIT	EQUIPMENT NUMBER SELECTION															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
07		X		X		X		X		X		X		X		X
08			X	X			X	X			X	X			X	X
09					X	X	X	X					X	X	X	X
10									X	X	X	X	X	X	X	X

NOTES:
1. X = A jumper is installed for this bit position.
2. Protect jumper installed = The controller is not a protected device.
3. Equipment No. 13 (B) is the equipment number normally used for the card reader.

6.3.4 60 Hz/50 Hz MODIFICATION

The card reader controller does not require any 50/60 Hz consideration since its power is provided by the CPU or the expansion enclosure.

The card reader is purchased as a 50 Hz or a 60 Hz unit. However, the primary power cord may not have the required plug needed to mate correctly to the customer's power receptacle. Ensure that the primary power cord has the correct connector installed and that the primary power, neutral, and safety ground leads are installed correctly.

Ensure that F1 is a 5 amp 3 AG slow blow fuse on all 60 Hz 115 vac units and 3 amp 3 AG slow blow fuse for 50 Hz 230 vac units. F2 is a 3 amp 3 AG slow blow fuse for both units. F1 and F2 are located on the lower portion of the back side of the card reader.

6.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Apply power to the CPU and/or the expansion enclosure. Power on the CPU first if both the CPU and expansion enclosure are part of the system. Measure Vcc at TP63 of the card reader controller card. Vcc should be +5 ± 0.1% vdc. Install the card reader primary power cord.

Turn on the card reader's main power switch (located between F1 and F2). Depress the READ CHECK button to check the lamps of all the indicators. Insert a deck of cards into the feed hopper and depress the RESET button on the console. All fault indicators, if lit, should go out, and the motor should start. It should run for approximately 14 seconds and then stop. Configure the IC switch assemblies on the card reader A2 and A3 PC boards for the off-line configuration (see Table 6-1). Depress the RESET button.

The cards in the input hopper should feed without jamming or getting damaged. If either of these problems occurs, refer to the card reader customer engineering manual. Otherwise return the IC switch assemblies to the on-line configuration as in Table 6-1.

6.5 DIAGNOSTIC CHECKOUT

6.5.1 SMM TESTING

Load SMM17 Version 3.1-2 Monitor into the CPU. Set up the SMM parameters according to the general instructions in Section 1.7.1. When BUILD TEST LIST is typed out, call up CR3A (Card Reader Test No. 13). Set up the test parameters according to Table 6-3. These are the parameters that are normally run during acceptance testing. Ensure that the SMM test deck is loaded into the card reader. Depress the RESET button.

Refer to the SMM17 manual for further details on setting up the SMM and test parameters and for a description of errors in case the test does not run.

Table 6-3. Card Reader SMM17 Parameter Set-Up

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	1341	Test ID	STJP	Typically 0241 or 024D
2nd	003D	Sections	0BBB	Interrupt No. 13
3rd	004E	Preset	0000	Read cards at full speed
4th	0001	Selects card reader and controller type	Not used	

6.5.2 SCMM TESTING

To perform SCMM tests, MSOS must include the SCMM routines, and the MSOS on-line monitor must be loaded into the CPU. After the MSOS monitor is loaded and running, the card reader SCMM test may be requested through the monitor, as illustrated in Table 6-4. Refer to Section 1.7.2 for instructions on loading the MSOS monitor.

NOTE

The test deck should be installed into the card reader
and the card reader should be reset before the test
calling sequence has been completed.

Table 6-4. Card Reader SCMM Parameter Set-Up

OPERATOR ENTRY SCMM REPLY	COMMENTS
Press MANUAL INTERRUPT 　　MI SCMM (CR) 　　SCMM IN 　　CONTROL, TEST ID SRT, CRD (CR) 　　BEGIN CARD READER TEST 　　LU, TEST, CARDS lu, x, y (CR)	lu = The logical unit of the card 　　　reader as defined by MSOS x = Sections: 　　0020 = Random data pattern; 　　0040 = AAAA/5555 pattern; 　　0080 = User-defined pattern; 　　0100 = Read sync pattern 　　(Columns 1 and 80 are 　　punched with all ones). y = The number of cards in the 　　　test deck

6.6   MULTIPLEX TESTING

The purpose of multiplex testing is to simulate system operation. Tests will be loaded sequentially, set into operation simultaneously, and run with either status or interrupt synchronization.

6.6.1   SMM

SMM test multiplexing is not permissible. The SMM card reader test is written as a stand-alone test.

6.6.2   SCMM

SCMM multiplex testing may be performed utilizing all equipments on the system provided that there is an SCMM test for the device, the device is included in the MSOS logical unit table, and the MSOS interrupt priority is set up correctly.

6.7 VOLTAGE MARGIN TESTING

This is an EPS requirement for on-site installations and may be utilized if problems occur within the SYSTEM 17 that cannot be isolated via standard diagnostics.

Logic voltage margins on the card reader controller may be performed by following the procedure outlined in Section 2.7. The SMM and SCMM tests should be run at each setting. Vss margins need not be run for this device.

The card reader does not contain an adjustable logic supply. It is therefore recommended that margins not be run on the card reader.

6.8 TEST MAINTENANCE AIDS

The card reader and controller are program compatible with the standard 1728/430 Card Reader/Punch. Therefore, existing programs may be utilized in the checkout of the card reader and controller.

This line printer subsystem consists of one line printer controller and one 300 line per minute printer.

The line printer controller is a one-card device that may be inserted into any available A/Q card position of the CPU or the expansion enclosure. It has equipment number and program protect select capability and includes internal, external, and interrupt cable assemblies.

The 300 line per minute (lpm) printer is housed in a quietized cabinet. The cabinet is mounted on heavy duty casters for maneuverability. The printer has a 64-character drum, 136 columns, 12 format channels, a self-testing print feature, and pre-print capability.

A block diagram of the 300 lpm line printer subsystem is shown in Figure 7-1.
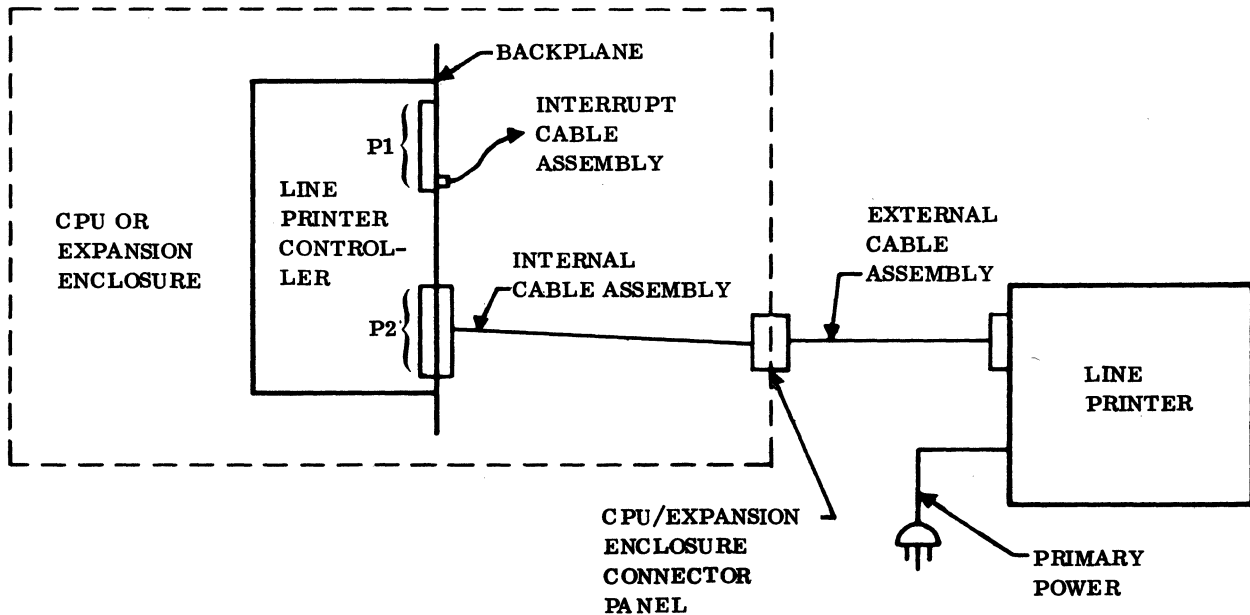
Figure 7-1. Block Diagram of 300 Lpm Line Printer Subsystem

7.1 APPLICABLE DOCUMENTS

The following list includes the pertinent documents associated with the line printer subsystem. The documents with asterisks (*) are required for installation and maintenance of the line printer subsystem.

Documents relating to the line printer controller are listed below:

Title	Publication No.
Line Printer Controller Customer Engineering Manual(*)	89637300
1784 Computer System 1742-30/120 Line Printer Controller Reference Manual(*)	89637200

Documents pertaining to the 300 lpm printer are as follows:

Title	Publication No.
CL408/9322 Reference Manual(*)	59709100
CL408/9322 Operator Handbook	59708900
CL408/9322 Field Service Manual, Vol. I(*)	91858400
CL408/9322 Field Service Manual, Vol. II(*)	91858500
CL408/9322 Parts Manual	91859100

7.2 REQUIRED PARTS

Required hardware for the 300 lpm printer and controller includes the following:

	Product No.	Equipment No.
Line printer controller	1742-30	FF524-A
Select jumpers	89684100	
Cable assembly, internal	89641800	
Cable assembly, external	89669200	
Cable assembly, interrupt	89724702	
Line printer, 300 lpm	1742-30	CL408-A/B/C/D
Printer ribbon	95330700	
Format tape	44713800	

The following printer paper is available:

Printer paper – 4 PT, quantity 750 (14112TL)

Printer paper – 2 PT, quantity 1500 (14112TL)

Printer paper – 1 PT, quantity 3000, 18 lb. (14112TL)

Printer paper – 1 PT, quantity 2700, 20 lb. (14112HTL)

7.3 INSTALLATION

7.3.1 LINE PRINTER

1. UNPACKING AND CHECKOUT. Remove the shipping carton from the line printer and remove the line printer from the shipping pallet. Inspect for external damage and missing parts. Record all discrepancies.

CAUTION

Use extreme care in opening the top hood. The hood
hinges, located on the back of the printer, are made
of plastic and will break easily.

Open all doors and hoods (see Figure 7-2). Remove all shipping blocks and retaining straps. Inspect and record all internal damage.
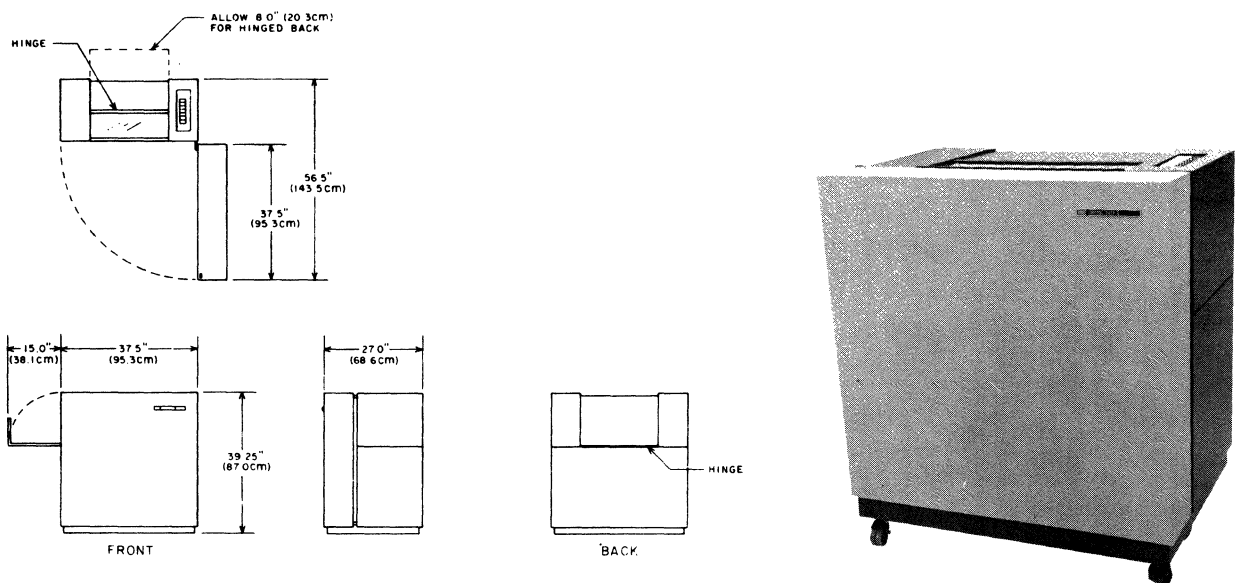
Figure 7-2. 300 Lpm Line Printer Physical Representation

2. INSTALLATION. Locate the format tape and the format read station. Ensure that the tape is punched correctly (see Table 7-1). Install the tape so that the direction-of-travel arrow on the tape indicates that the tape travel is counter-clockwise. The format read station is located at the left end of the line printer.

NOTE

The format tape for the 300 lpm line printer is the
same as that used by the standard 1742 Line Printer.

Table 7-1. 300 Lpm Line Printer Ribbon Format

6 LPI ROW	LEVEL	6 LPI ROW	LEVEL
1	1	66	1
2	2	68	2
5	3	71	3
9	4	75	4
13	5	80	5
20	6	86	6
22	7	88	7
25	8	91	8
29	9	95	9
34	10	100	10
40	11	106	11
42	2	108	2
45	3	111	3
49	4	115	4
54	5	120	5
60	6	126	6
62	12	128	12

NOTE: This table shows the format in which the format tape is
punched. Holes are punched in the designated level
opposite the six lpi row markers.

CAUTION

Ensure that the spools are installed so that the metal
foil at each end of the tape will contact the reversing
drive mechanism. Failure to do so will result in a
damaged printer ribbon.

Install the printer ribbon (see Figure 7-3).

METAL FOIL SIDE
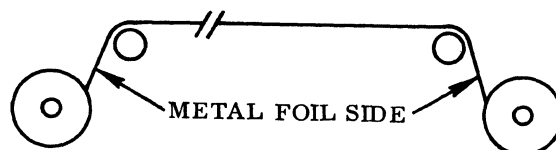
Figure 7-3. 300 Lpm Line Printer Ribbon Installation

Install and align the paper. Open the front door and open the printer drum assembly. Insert the
printer paper and align the tractors so that the paper is centered over the hammer bank. To align the
tractors, turn the spring-loaded knurled knob on the outside of each tractor towards the printer, and
then position the tractors to the right or left along the spline drive shaft. When the paper is aligned
correctly, release the knobs.

7.3.2 LINE PRINTER CONTROLLER

1. UNPACKING AND CHECKOUT. Remove the controller board from its shipping package. Inspect
and record any damage and/or missing parts.

2. INSTALLATION. Install line printer equipment select jumpers and the protect jumpers (if
required) on the controller card. See Figure 7-4 for the location of the jumpers on the board and
Table 7-2 for the proper selection of the jumpers.

Turn the power off on the expansion enclosure if it is included in the system. Then turn the power off
on the CPU. Install the line printer controller in the customer-specified A/Q card slot. If the
customer does not specify a particular slot position and if no CDC system documents specify a card
slot, choose an A/Q slot that will not interfere with the installation of other equipments (some
equipments require two or more card slots that must be adjacent to each other). Record the assigned
card position on the card position assignment sheet. This assignment sheet should be in the site log
or located on the back of the door of the respective chassis.

PROT
Q10
Q9
Q8
Q7

NOTES: 1. Q-BIT JUMPER IN SELECTS THE BIT.
2. PROTECT JUMPER IN = THE CONTROLLER IS NOT PROTECTED.

Figure 7-4. 300 Lpm Line Printer Controller Equipment Number
and Protect Jumper Location

Table 7-2. 300 Lpm Line Printer Controller Equipment Number Selection

BIT	EQUIPMENT NUMBER SELECTION															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
07		X		X		X		X		X		X		X		X
08			X	X			X	X			X	X			X	X
09					X	X	X	X					X	X	X	X
10									X	X	X	X	X	X	X	X

NOTES:
1. X = A jumper is installed for this bit position.
2. Equipment No. 4 is normally selected for the line printer.
3. Protect jumper installed = The controller is a protected device.

Remove the back cover of the CPU or expansion enclosure. If a battery pack is part of the system, pay particular attention to where the battery leads connect to the CPU or expansion enclosure before removing them.

Install the internal cable assembly between P2 of the backplane of the selected A/Q slot and the CPU/expansion enclosure connector panel. Use four 4-40 screws to mount the 66-pin continental connector to a convenient location on the CPU/expansion enclosure connector panel. Record this position (i.e., J6, J7, etc.) on the card position assignment sheet.

Connect the CPU end of the external cable assembly to the line printer controller connector on the connector panel. Route the printer end of the cable to and through the cable port of the line printer and connect it to the jack located in the center of the back of the printer. To facilitate the installation of this cable, open the front door and remove the fiber panel assembly located inside the pedestal opening.

Install the interrupt cable assembly between P1 B25 of the line printer controller A/Q slot and J25 P1 A05. This selects the common interrupt as No. 4 for the line printer. Other interrupts from the line printer controller are available. These are the EOP interrupt at P1 B24, the Data interrupt at P1 B26, and the Alarm interrupt at P1 B27 of the assigned card position.

If an A/Q channel expansion is used, the interrupt line should be routed through the appropriate line of the channel expansion. See Section 5.3 for details on routing interrupts through the channel expansion. The interrupt line may be reassigned according to customer requirements. Replace the back cover and close the CPU or expansion enclosure door.

7.3.3 PRIMARY POWER INSTALLATION

7.3.3.1 LINE PRINTER CONTROLLER

The line printer controller does not require 50 Hz/60 Hz consideration since its power is provided by the expansion enclosure or the CPU.

7.3.3.2 LINE PRINTER

The line printer is manufactured as a 60 Hz unit or a 50 Hz unit. The printer will require single phase 115 vac or 230 vac respectively. The printer primary power cord comes equipped with a 15 amp, 3-prong Hubbell twist lock. The male power cord connector may have to be changed to mate with the customer primary power outlet. Ensure that the voltage, neutral, and safety ground lines are wired correctly.

7.3.3.3 FUSES

Ensure that all fuses, located on the fuse block on the back of the right corner, are functional. These are signal indicating fuses with a tab that is released when the fuse blows. The fuse block contains logic voltage fuses and hammer driver fuses. One additional logic fuse is located beneath the paper guide shroud. The shroud must be removed to gain access to this fuse. Refer to the customer engineering manuals for details on gaining access to the fuse.

7.3.3.4 GROUNDING

Open the front door of the line printer. Route a 1-inch braided ground strap through the printer cable port and connect it to the ground bus located inside and to the rear of the pedestal opening. Install the other end of the ground strap to the system ground.

7.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

7.4.1 POWER APPLICATION

Apply power to the CPU. Then apply power to the expansion enclosure, if it is part of the system. Use a VOM or DVM to measure the presence of +5 ±0.2 vdc on test point 63 of the line printer controller card.

Connect the line printer primary power cord to the primary power source. Turn on the line printer. Depress the SINGLE SPACE button several times. The printer paper should advance one space each time the button is depressed. Depress the PAGE EJECT button several times. The paper should do a top-of-form each time the button is depressed.

Ensure that the format tape drives in the correct direction. Align the printer paper top-of-form with the hammer bank. Depress the START button (equivalent to Ready). The indicator should illuminate if the equipment and all interlocks are operating satisfactorily. Depress the STOP (equivalent to Clear) button to clear the start condition.

7.4.2 PRELIMINARY CHECKOUT

To check out the printer, open the top hood (if it is not already open), and make sure that the line printer is in the stop condition. Locate the toggle switch on board 27 and depress this switch. The line printer should print successive rows of the character E. Use the phase adjustment knob, located behind the fault indicator, to obtain a clearly printed character. Restore all hoods and doors to their normally closed positions.

7.5 DIAGNOSTIC CHECKOUT

7.5.1 SMM TESTING

Load the SMM17 Version 3.1-2 Monitor into the CPU. Set up the SMM parameters as shown in Section 1.7.1. When BUILD TEST LIST is typed out, call up LP100C (Line Printer Test No. C). Set up the test parameters according to Table 7-3. Ensure that the printer is in the start condition. These parameters reflect those normally used for acceptance testing. Refer to the SMM17 manual for further details on setting up the SMM, for test parameters, and for a description of errors in case the test does not run.

Table 7-3.   300 Lpm Line Printer SMM17 Parameter Set-Up

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	0C41	Test ID	STJP	Typically 0241 or 024D
2nd	23EA	Sections	0010	Interrupt No. 4, standard number assignment
3rd	0010	Interrupt No. 4	0010	Interrupt No. 4
4th	004D	Preset	0001	Selects line printer and controller type

7.5.2 SCMM TESTING

To perform SCMM testing, MSOS must include the SCMM routines and the MSOS on-line monitor must be loaded into the CPU. The line printer SCMM test may be requested through the monitor (see Table 7-4). Refer to Section 1.7.2 for details on loading the MSOS monitor and for more details on loading and running SCMM. The test should begin to run after the line printer test has been requested. Ensure that the printer is in the START condition.

Table 7-4. 300 Lpm Line Printer SCMM Parameter Set-Up

OPERATOR ENTRY SCMM REPLY	COMMENTS

Press MANUAL INTERRUPT
 	
    MI
SCMM (CR)
 	
    SCMM IN
    CONTROL, TEST ID
SRT, PRT (CR)
 	
    BEGIN LINE PRINTER TEST
    LU, TESTS, RUNS
lu, 3E, x
	lu = Refer to MSOS for assigned
	logical unit (see Section
	1.7.2).
	
	3E = Sections normally selected
	for acceptance testing
	
	x = Number of runs

7.6 MULTIPLEX TESTING

The purpose of multiplex testing is to simulate system operation. Tests will be loaded sequentially, set into operation simultaneously, and run with either status or interrupt synchronization.

7.6.1 SMM

The line printer may be multiplexed with the following tests:

- Teletypewriter Test No. 5
- Command Test No. 1
- MDC Test No. 7A

- 1732-1 Magnetic Tape Test No. 15
- 1732-3 Magnetic Tape Test No. 4B

7.6.2 SCMM

SCMM multiplex testing may be performed utilizing all equipments on the system provided that an SCMM test exists for the device, the device is included in the MSOS logical unit table, and the interrupt priority is set up correctly. To run multiple tests, repeat the SCMM test loading procedure specified in the SCMM testing section of the applicable equipments.

7.7 VOLTAGE MARGIN TESTING

This is an EPS requirement for on-site installations and may be utilized if problems occur within the SYSTEM 17 that cannot be isolated via standard diagnostics.

Logic voltage margins on the line printer controller may be performed by following the procedure outlined in Section 2.7.

The line printer does not contain a readily adjustable logic power supply. It is therefore recommended that margin testing not be performed on the line printer.

The line printer subsystem consists of one line printer controller and one high-speed line printer.

The line printer controller is a one-card device that may be inserted into any available A/Q card position of the CPU or the expansion enclosure. It has equipment number and protect select capability and includes an internal, external, and interrupt cable assembly.

The high-speed line printer is rated at 1200 lines per minute. Its speed is dependent on the unique characters printed. Its maximum speed is 2400 lines per minute. The printer is housed in a quietized cabinet with a power hood. Printing is done by using a train print cartridge consisting of 72 print slugs with four characters per slug. The printer has an image memory that must be loaded to reflect each character on the train in the exact sequence in which it appears on the train. A block diagram of the 1200 lpm line printer and controller is shown in Figure 8-1.
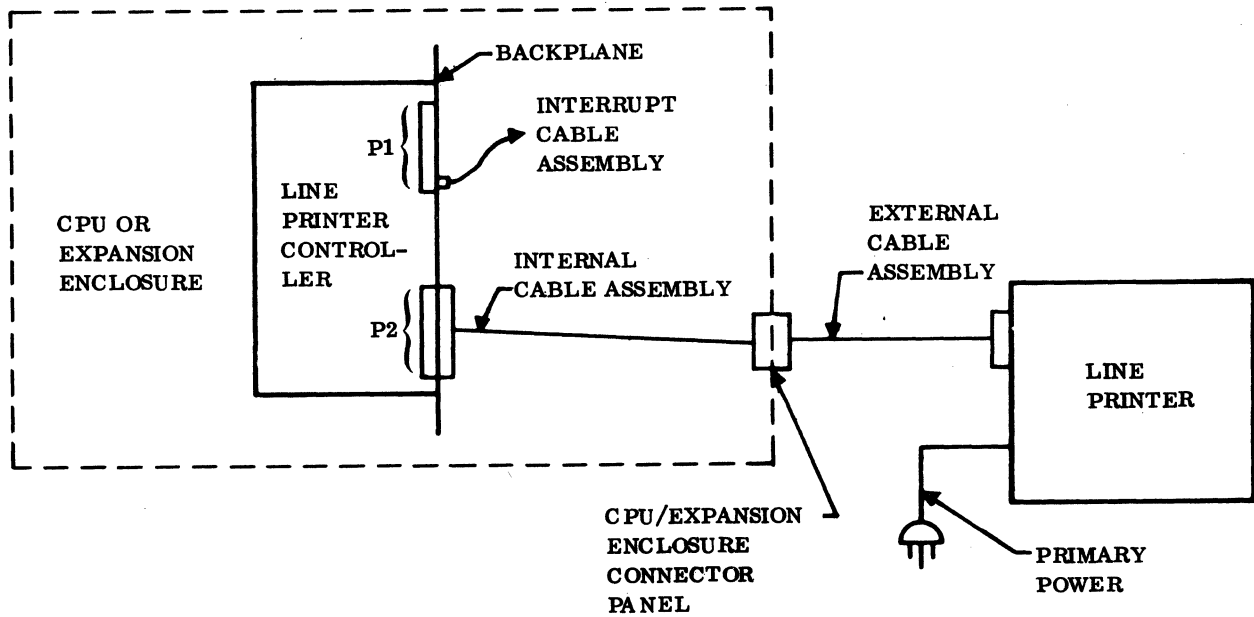
Figure 8-1. Block Diagram of 1200 Lpm Line Printer Subsystem

8.1 APPLICABLE DOCUMENTS

The following lists include the documents associated with the line printer subsystem. The documents with asterisks (*) are required for installation and maintenance of the line printer subsystem.

The following documents are associated with the line printer controller:

Title	Publication No.
Line Printer Controller Customer Engineering Manual(*)	89637300
1784 Computer System Line Printer Controller Reference Manual(*)	89637200

Documents pertaining to the line printer include the following:

Title	Publication No.
Field Service Manual, Vol. I	95390500
Parts Manual(*)	95390700
Field Service Manual, Vol. II(*)	95390600
Reference Manual, GJ105-C/D Power Stacker(*)	50583500
595 Print Cartridge Hardware Reference/Customer Engineering Manual(*)	91860100

8.2 REQUIRED PARTS

Following is a list of required hardware for the line printer and controller:

	Product No.	Equipment No.
Line printer controller	1742-120	FF524-A
Select jumpers	89684100	
Cable assembly, internal	89641800	
Cable assembly, external	89669200	
Cable assembly, interrupt	89724702	
Line printer, 1200 lpm	1742-120	CL409-A/B
Printer ribbon	44713004	
Format tape	44713800	
Power stacker		GJ105-C/D
Type array cartridge		CL833

The following printer paper is also required:

Printer paper – 4 PT, quantity 750 (14112TL)

Printer paper – 2 PT, quantity 1500 (14112TL)

Printer paper – 1 PT, quantity 3000, 18 lb. (14112TL)

Printer paper – 1 PT, quantity 2700, 20 lb. (14112HTL)

8.3 INSTALLATION

8.3.1 LINE PRINTER

1. UNPACKING AND CHECKOUT.

<div align="center">

CAUTION

The printer weighs approximately 1600 lbs. Special
lifting equipment will be required to remove it from
its shipping pallet.

</div>

Remove the shipping carton from the line printer and remove the line printer from the shipping pallet. Inspect for external damage and missing parts and for missing documentation. Record all discrepancies. Open all doors and hoods (see Figure 8-2). Remove all shipping blocks and retaining straps. Inspect and record all internal damage.
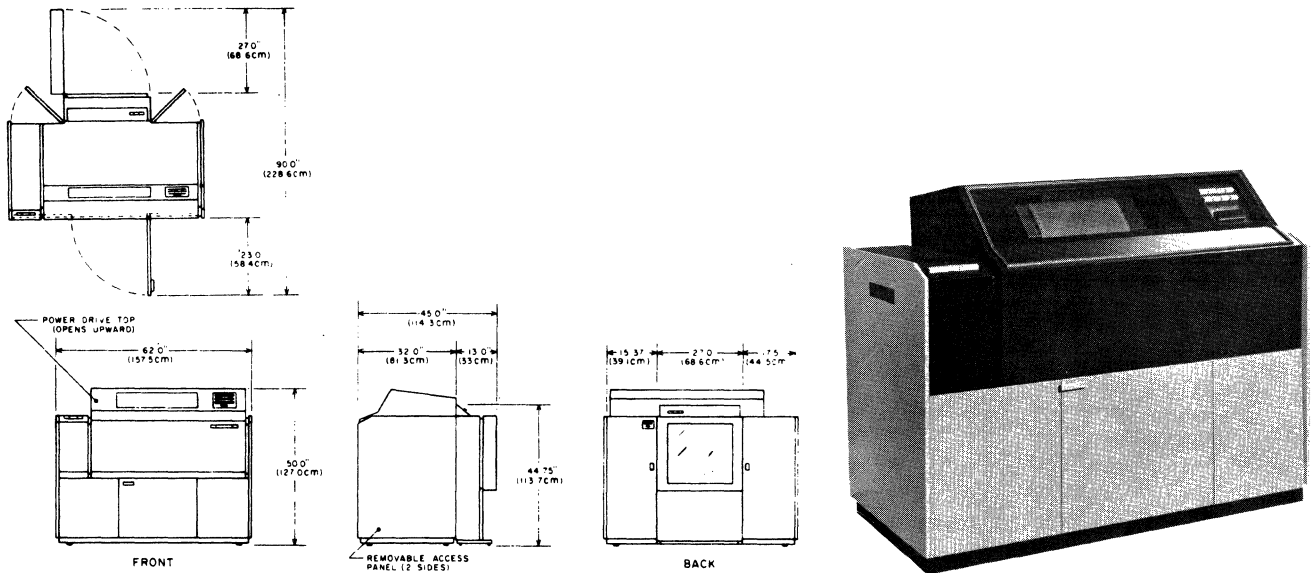
Figure 8-2. 1200 Lpm Line Printer and Controller Physical Representation

The top hood can be raised manually before power is applied by lifting from the front and engaging the hood support rod located inside the hood on the right side.

2. INSTALLATION. The installation and initial checkout of the powered stacker and the type array cartridge assembly are covered in detail in their respective manuals.

Locate the format ribbon and the format read station. Ensure that the tape is punched as in Table 8-1. Install the tape so that the direction of travel arrow on the tape indicates that the tape travel is counter clockwise. The format read station is located at the left end of the line printer.

NOTE

The format tape for the line printer is the same as that used by the Standard Line Printer.

Ensure that the 6/8 coincident lines on the tape are aligned with the marked sprocket teeth on the drive hub.

Table 8-1. 1200 Lpm Line Printer Ribbon Format

SIX LPI ROW	LEVEL	SIX LPI ROW	LEVEL	SIX LPI ROW	LEVEL
1	1	45	3	88	7
2	2	49	4	91	8
5	3	54	5	95	9
9	4	60	6	100	10
13	5	62	12	106	11
20	6	66	1	108	2
22	7	68	2	111	3
25	8	71	3	115	4
29	9	75	4	120	5
34	10	80	5	126	6
40	11	86	6	128	12
42	2				

NOTE: This table shows the format in which the format tape is punched. Holes are punched in the designated level opposite the six lpi row markers.

This format tape is used on printers that do not have automatic paper movement options installed. Refer to the Line Printer Controller Reference Manual to verify which options have been installed.

The format tape may be punched according to customer specification.

Install the print cartridge as described in Section 2 of the print cartridge C.E. manual.

Install the printer ribbon by opening the print gate and closing the line finder. Install the supply roll of ribbon on the lower spools located on the front of the print gate. Bring the take-up roll under the print gate up over the front of the print cartridge and attach it to the top drive sprockets.

Install and align the printer paper as described in Section 3 of the line printer manual.

8.3.2 LINE PRINTER CONTROLLER

1. UNPACKING AND CHECKOUT. Remove the controller board from its shipping package. Inspect it and record any damage and/or missing parts.

2. INSTALLATION. Install line printer equipment select jumpers and the protect jumpers, if required, on the controller card. See Figure 8-3 for the location of the jumpers on the board and Table 8-2 for the proper selection of the jumpers.

Turn the power off first on the expansion enclosure (if it is part of the system) and then on the CPU. Install the line printer controller in the customer-specified A/Q card slot. If the customer does not specify a particular slot position and if no CDC system documents specify a card slot, choose an A/Q slot that will not interfere with the installation of other equipments (some equipments require two or more card slots that must be adjacent to each other). Record the assigned card position on the card position assignment sheet. This assignment sheet should be in the log or located on the back of the door of the respective chassis.

Remove the back cover of the CPU or expansion enclosure. If a battery pack is part of the system, pay particular attention to where the battery leads connect to the CPU or expansion enclosure.

Install the internal cable assembly between P2 of the backplane of the selected A/Q slot and the CPU/ expansion enclosure connector panel. Use four 4-40 screws to mount the 66-pin continental connector to a convenient location on the CPU/expansion enclosure connector panel. Record this position (i.e., J6, J7, etc.) on the card position assignment sheet.

Connect the CPU end of the external cable assembly to the line printer controller connector on the connector panel. Route the printer end of the cable to the printer. Open the door on the right rear corner of the printer. Route the cable underneath the printer through a cable port in the base of the printer, and connect it to FJ100 of the line printer logic assembly. Install the interrupt cable assembly between P1 B25 of the line printer controller A/Q slot and slot position J25 P1 A5. This selects interrupt No. 4 for the line printer. If an A/Q channel expansion is used, the interrupt line should be routed through the appropriate line of the channel expansion. See Table 5-2 for details on routing interrupts through the channel expansion. The interrupt line may be reassigned according to customer requirements. Replace the back cover and close the CPU or expansion enclosure door.
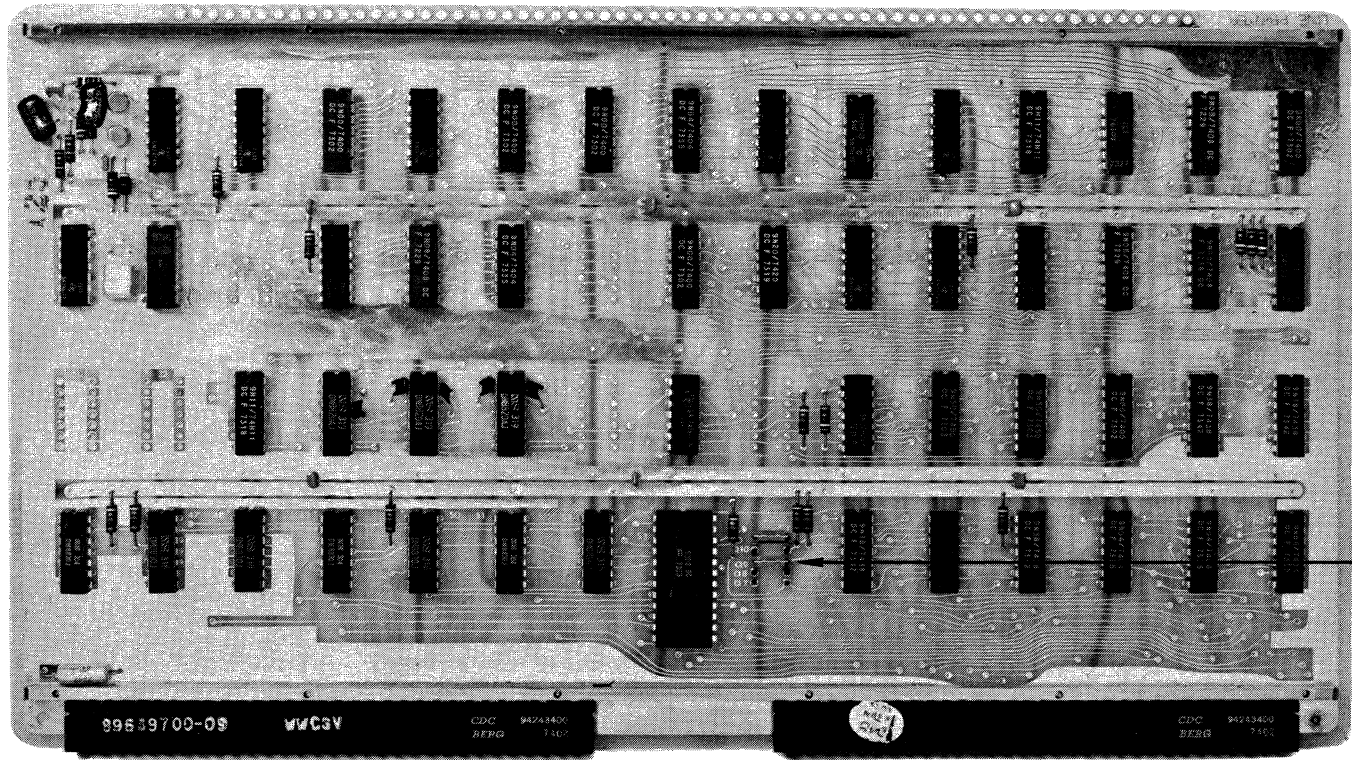
                                                              ⎫ PROT
                                                              ⎪ Q10
                                                              ⎬ Q9
                                                              ⎪ Q8
                                                              ⎭ Q7

NOTES: 1. Q-BIT JUMPER IN SELECTS THE BIT.
        2. PROTECT JUMPER IN = THE CONTROLLER IS NOT PROTECTED.

Figure 8-3. 1200 Lpm Line Printer Controller Equipment Number and Protect Jumper Location

Table 8-2. 1200 Lpm Line Printer Controller Equipment Number Selection

BIT	EQUIPMENT NUMBER SELECTION															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
07		X		X		X		X		X		X		X		X
08			X	X			X	X			X	X			X	X
09					X	X	X	X					X	X	X	X
10									X	X	X	X	X	X	X	X

NOTES:
1. X = A jumper is installed for this bit position.
2. Equipment No. 4 is normally selected for the line printer.
3. Protect jumper installed = The controller is a protected device.

8.4 PRIMARY POWER PREPARATION

8.4.1 LINE PRINTER CONTROLLER

The line printer controller does not require 50 Hz/60 Hz consideration since its power is provided by the expansion enclosure or the CPU.

8.4.2 LINE PRINTER

The line printer is manufactured as a 60 Hz printer that uses three-phase 208 vac input power. A 50 Hz printer is optional and uses three-phase 380 vac input power.

8.4.3 FUSES

Ensure that all fuses, located on the back of the left-hand logic chassis, are functional. These are signal indicating fuses with a tab that is released when the fuse blows. The fuse block contains all logic voltage fuses and the hammer driver fuses.

8.4.4 GROUNDING

Install a 1-inch braided ground strap to the printer chassis near the main power input. Connect the other end to system ground.

8.5 POWER APPLICATION AND PRELIMINARY CHECKOUT

Apply power to the CPU; then apply power to the expansion enclosure if it is part of the system. Use a VOM or DVM to measure the presence of +5 ± 0.2 vdc on test point 63 of the line printer controller card.

Connect the line printer primary power cord to the primary power source. Proceed as indicated in Section 2 of the line printer manual for initial start-up procedures.

If the printer is equipped with a power stacker, refer to the power stacker manual for installation and set-up procedures.

8.6 DIAGNOSTIC CHECKOUT

8.6.1 SMM TESTING

Load SMM17 Version 3.1-2 Monitor into the CPU. Set up the SMM parameters as shown in Section 1.7.1. When BUILD TEST LIST is typed out, call up LP100C (Line Printer Test No. C). Set up the test parameters (see Table 8-3). Before running the initial test, depress the printer STOP button, then depress the LOAD IMAGE pushbutton, then depress the READY pushbutton. When SMM is started, it will automatically load the image memory of the printer with the correct characters.

The parameters in Table 8-3 reflect those normally used for acceptance testing. Refer to the SMM17 manual for further details on setting up the SMM and test parameters and for a description of errors in case the test does not run.

Table 8-3. 1200 Lpm Line Printer SMM17 Parameter Set-Up

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	0C41	Test ID	STJP	Typically 0241 or 024D
2nd	23EA	Sections	0010	Interrupt No. 4, standard assignment
3rd	0010	Interrupt No. 4	0010	Interrupt No. 4
4th	004D	Preset	0001	Selects line printer and controller type

8.6.2 SCMM TESTING

To perform SCMM testing, MSOS must include the SCMM routines and the MSOS on-line monitor must be loaded into the CPU. The line printer SCMM test may be requested through the monitor (see Table 8-4). Refer to Section 1.7.2 for details on loading the MSOS monitor and for more details on loading and running SCMM.

Table 8-4. 1200 Lpm Line Printer SCMM Parameter Set-Up

OPERATOR ENTRY SCMM REPLY	COMMENTS

Press MANUAL INTERRUPT
 	
  MI
 	
SCMM (CR)
 	
  SCMM IN
  CONTROL, TEST ID
 	
SRT, PRT (CR)
 	
  BEGIN LINE PRINTER TEST
  LU, TESTS, RUNS
 	
lu, 3E, x
	
	lu = Refer to MSOS for assigned
	       logical unit.
	
	3E = Sections normally selected
	       for acceptance testing
	
	x = Number of runs

The test should begin to run after the line printer test has been requested. Ensure that the printer is in the start condition.

8.7 MULTIPLEX TESTING

The purpose of multiplex testing is to simulate system operation. Tests will be loaded sequentially, set into operation simultaneously, and run with either status or interrupt synchronization.

8.7.1 SMM

The line printer may be multiplexed with the following tests:

- Teletypewriter Test No. 5

- Command Test No. 1

- MDC Test No. 7A

- Magnetic Tape Test No. 7

8.7.2 SCMM

SCMM multiplex testing may be performed utilizing all equipments on the system providing an SCMM test exists for the device, the device is included in the MSOS logical unit table, and the interrupt priority is set up correctly.

8.8 VOLTAGE MARGIN TESTING

This is an EPS requirement for on-site installations and may be utilized if problems occur within SYSTEM 17 that cannot be isolated via standard diagnostics.

Logic voltage margins on the line printer controller may be performed by following the procedure outlined in Section 2.7. SMM and SCMM tests should run at each setting. Vss margins need not be run.

The line printer does not contain a readily adjustable logic power supply. It is therefore not recommended that margin testing be performed on the line printer.

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The cartridge disk drive subsystem consists of one cartridge disk controller and from one to four cartridge disk drives in any combination.

The cartridge disk controller consists of five cards which must be inserted into prewired CPU slots No. 15 through 19. The device includes equipment number and protect select, DSA scanner position select, and disk drive density select. Also included are the internal, external, and interrupt cable assemblies.

The cartridge disk drive (CDD) has either 100 tracks per inch or 200 tracks per inch. The disk drive chassis is mounted on heavy-duty casters for maneuverability. It utilizes a voice coil to position the read/write heads and contains one fixed disk with two recording surfaces. The unit also has provisions for accepting one 848-29 Cartridge Disk.

See Figure 9-1 for a block diagram of the cartridge disk drive subsystem.
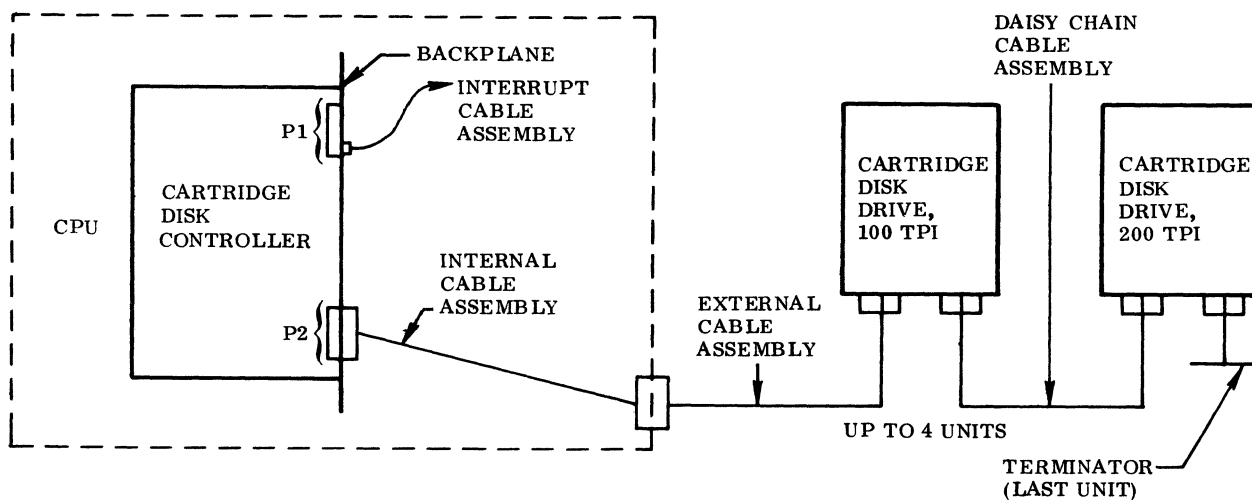
Figure 9-1. Block Diagram of Cartridge Disk Drive Subsystem

9.1 APPLICABLE DOCUMENTS

The following documents are pertinent to the cartridge disk drive subsystem. The documents with asterisks (*) are required for installation and maintenance of the cartridge disk drive subsystem.

Title	Publication No.
Cartridge Disk Drive Controller Customer Engineering Manual(*)	89638100
Cartridge Disk Drive Controller Reference Manual(*)	89638000
Cartridge Disk Drive Customer Engineering Manual(*)	70621000
Cartridge Disk Drive Customer Engineering Manual(*)	70621100
Cartridge Disk Drive Parts Manual(*)	70623300

9.2 REQUIRED PARTS

The following is a list of hardware required for installation and checkout of the cartridge disk drive subsystem:

	Product No.	Equipment No.
Cartridge disk controller	1733-2	FA716-A
Disk shifter board assembly		
Disk A/Q		
Disk sector count		
Disk DSA		
Disk daisy chain		
Internal cable assembly	89700200	
External cable assembly	89700400	
Interrupt cable assembly	89724700	
Cartridge disk drive (100 tpi, 50 Hz, 220 vac)	856-2	BR603-B
Cartridge disk drive (100 tpi, 60 Hz, 120 vac)	856-2	BR603-A
Cartridge disk drive (200 tpi, 50 Hz, 220 vac)	856-4	BR701-B
Cartridge disk drive (200 tpi, 60 Hz, 120 vac)	856-4	BR701-A
Daisy chain cable assembly (10 ft.)	46337801	
Terminator assembly	46338700	

Other material required for installation and checkout of the CDD subsystem includes:

Cartridge disk pack (high density certified)	89290007
C. E. alignment pack	89296000
Shorting jumpers	89684100

9.3 INSTALLATION

9.3.1 CARTRIDGE DISK DRIVES

1. UNPACKING AND CHECKOUT. Remove the CDD from its container. Open the top cover and remove the shipping blocks from between the deck and the frame. Ensure that the head positioner locking pin is in its storage location. Inspect for and record all internal or external damage.

CAUTION

To avoid damage to the cartridge access cover, lock
it by engaging the slide latch on the left edge of the
handle before opening or removing the top cover from
the cabinet.

For local set-up and checkout procedures, refer to Sections 3 and 6 of the CDD customer engineering manual.

9.3.2 CARTRIDGE DISK CONTROLLER

1. UNPACKING AND CHECKOUT. Remove the controller boards from their shipping packages. Inspect and record any damage and/or missing parts.

2. INSTALLATION. Install the CDD equipment select, protect select, density select, and DSA scanner position jumpers as required. See Figures 9-2 and 9-3. Install the jumpers on the disk daisy chain (see Table 9-1). See Section 1.5 for more details on establishing DSA scanner positions and jumper requirements to other devices.

Turn off the power on the expansion enclosure first. Then turn off the CPU's power. Install the cartridge disk controller in the CPU chassis as shown in Figure 1-3.

OUT
MID
LAST
ONE
FIRST
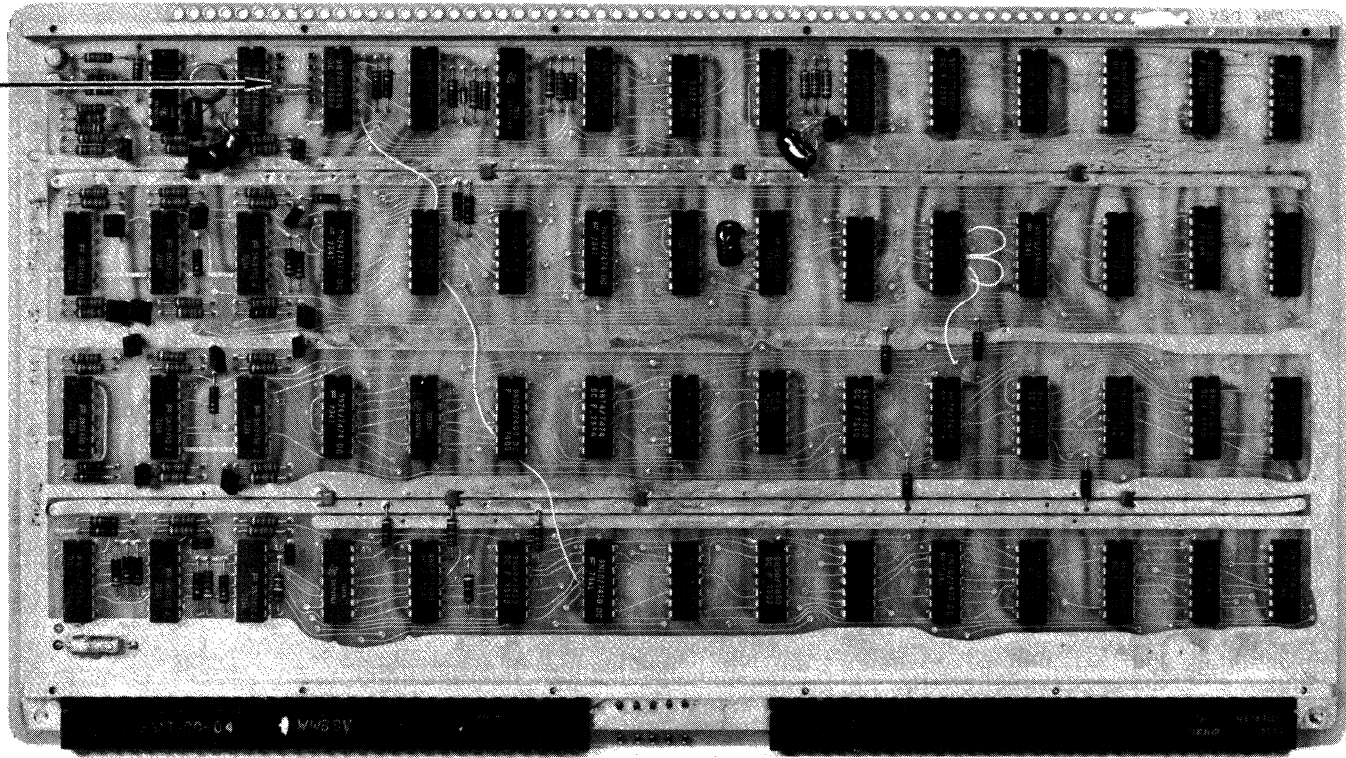
NOTE: JUMPER IN SELECTS SCAN POSITION.

Figure 9-2. Cartridge Disk Controller Scanner Jumper Location

PROT 0
1
2
3
TP1 0
1
2
3

SPARE JUMPERS

267

Q10
Q9
Q8
Q7
CHD

89617700 06   WWGSV
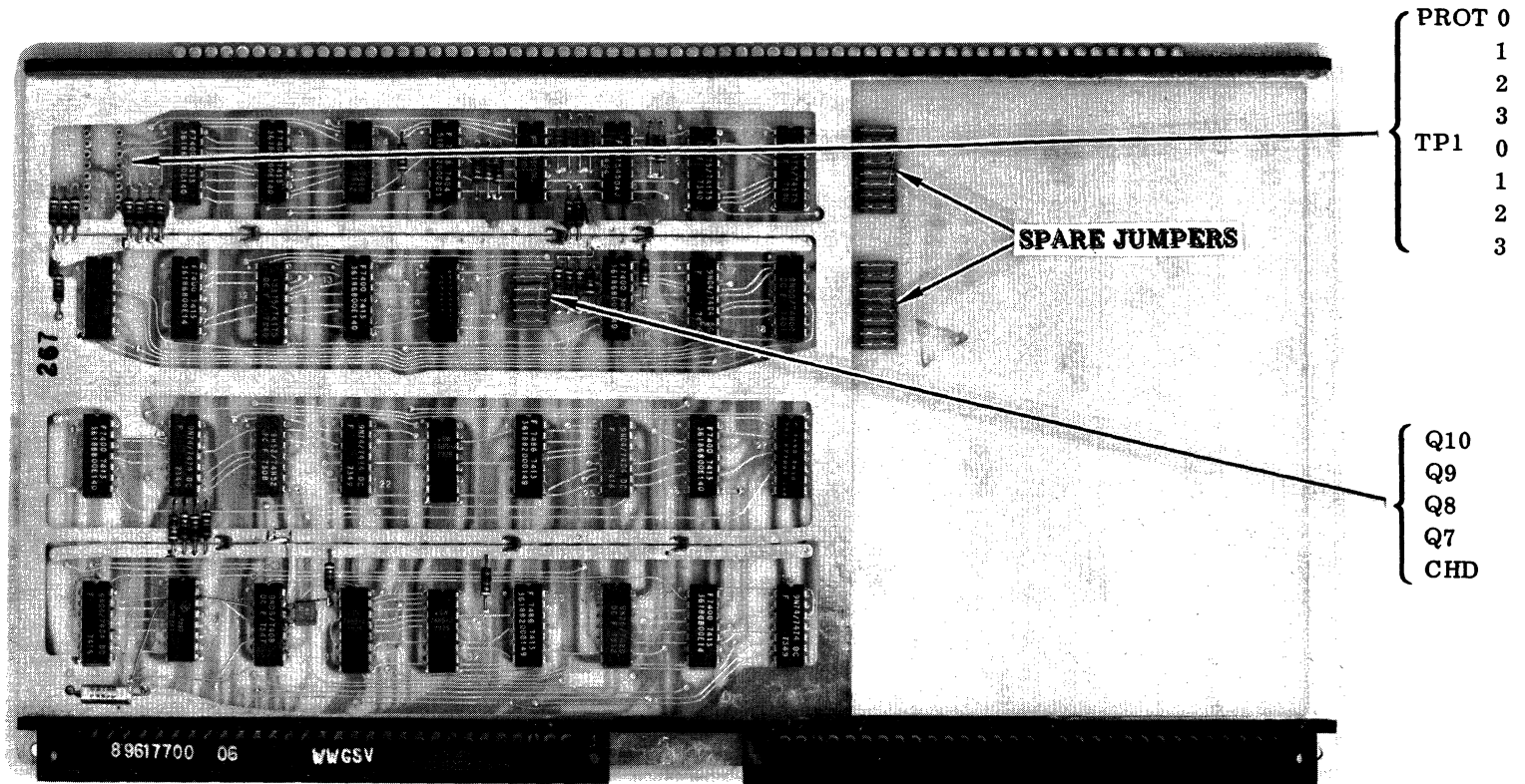
NOTES: 1. Q-BIT JUMPER OUT SELECTS THE BIT.
2. CHD JUMPER IN SELECTS AUTOLOAD FROM CARTRIDGE DISK
3. CHD JUMPER OUT SELECTS AUTOLOAD FROM FIXED DISK.
4. PROTECT JUMPER IN = RESPECTIVE DISK UNIT (0 THROUGH 3) IS NOT PROTECTED.
5. TP1 JUMPER IN SELECTS 200 TPI CDD FOR RESPECTIVE UNIT (0 THROUGH 3).
6. TP1 JUMPER OUT SELECTS 100 TPI CDD FOR RESPECTIVE UNIT (0 THROUGH 3).

Figure 9-3. Cartridge Disk Controller Equipment Number, Protect, Density, and Autoload Jumper Locations

Table 9-1. Cartridge Disk Controller Equipment Number Selection

BIT	EQUIPMENT NUMBER SELECTION															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
07	X		X		X		X		X		X		X		X	
08	X	X			X	X			X	X			X	X		
09	X	X	X	X					X	X	X	X				
10	X	X	X	X	X	X	X	X								

NOTES:
1. X = A jumper is installed for this bit position.
2. Jumper out = The bit is selected.
3. Equipment No. 3 is the normally selected equipment number for the disk equipments.

Install the internal cable assembly between P2 of slot 16 and the CPU I/O connector panel. Use four No. 4-40 screws to mount the 66-pin continental connector to a convenient location on the CPU I/O connector panel. Connect the CPU end of the cartridge disk drive external cable to the connector just installed. Install the other end to 8J1 of the cartridge disk drive unit (see Figure 9-4).

NOTE

The last unit in line must have a terminator installed (Part No. 46338700). The cabling sequence of the CDD units determines which one is unit 0, 1, 2, or 3. The unit select determination is made via hardwire between 8J1 and 8J2. Therefore, the first unit on the daisy chain becomes unit 0, the second unit is unit 1, etc. Install the interrupt cable assembly between J19 P2 B18 and J25 P1 B07. This selects the common interrupt on line 3, but this may be changed according to customer specifications.

9.3.3 PRIMARY POWER INSTALLATION

9.3.3.1 CARTRIDGE DISK CONTROLLER

The cartridge disk controller does not require 50 Hz/60 Hz consideration since its power is provided by the CPU.

CARTRIDGE DISK DRIVE CIRCUIT BREAKERS.
LIFT TOP HOOD ASSEMBLY FOR ACCESS.
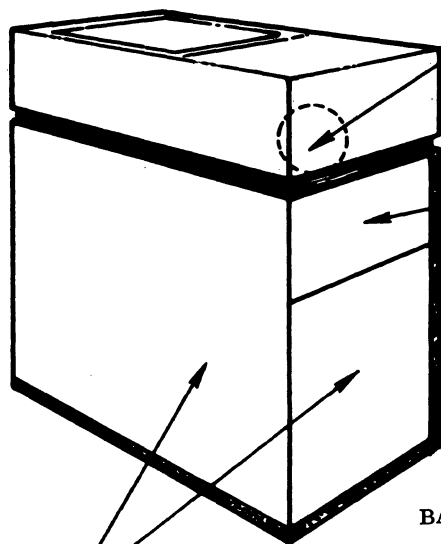
REMOVE THIS PANEL TO INSTALL
EXTERNAL CABLE CONNECTORS.
LOOSEN TWO NO. 10 SCREWS ON
EACH SIDE. 8J1 IS THE IN
JACK. 8J2 IS THE OUT JACK
AND WILL BE TERMINATED IF
ON THE LAST DRIVE UNIT OF A
DAISY CHAIN CONFIGURATION.

BACK

BACK, FRONT, AND SIDE PANELS ARE HELD ON
BY SPRINGS. TO REMOVE, PULL OUTWARD AT THE TOP.

Figure 9-4. Cartridge Disk Drive Breaker and I/O Cable Location

9.3.3.2   CARTRIDGE DISK DRIVE

The cartridge disk drive will require 50 Hz or 60 Hz single phase input power depending on unit
specification. It will be delivered as either a 50 Hz or 60 Hz device. The connector on the primary
power cord may have to be changed to mate with the customer primary power outlet. Ensure that
the voltage, neutral, and safety ground lines are wired correctly.

9.3.3.3   GROUNDING

Install a 1-inch braided ground strap to the grounding block located inside the top cover on the left
side (from the front) of the unit. Install the other end of the ground strap to the system ground.

9.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Apply power to the CPU first and then to the expansion enclosure if it is part of the system.

Connect primary power to the cartridge disk drives and perform local checkout as recommended in Section 3 of the CDD customer engineering manual. The CDD circuit breakers are located on the lower left portion of the rear of the drive mechanism (see Figure 9-4).

9.5 DIAGNOSTIC CHECKOUT

9.5.1 SMM TESTING

CAUTION

Before running SMM on the cartridge disk drive, remove the SMM disk pack and install a scratch pack, or ensure that the autoload test section is not selected and that the low cylinder parameter is set to a value greater than the last cylinder address used to store the SMM17 diagnostic.

Load the SMM17 Version 3.1-2 Monitor into the CPU. Install a cartridge disk pack containing SMM on the first cartridge disk drive. Apply power, and then autoload from the CPU. If the cartridge disk drive is properly aligned and the scanner is set up properly, SMM will be loaded into the CPU. Set up the SMM parameter as described in Section 1.7.1.

When BUILD TEST LIST is typed out, call up MDC07A (Cartridge Disk Test No. 7A). Set up the parameters as in Table 9-2. Ensure that the WRITE PROTECT switch on the cartridge disk drives to be tested is off.

NOTE

The WRITE PROTECT switch acts like a write ring on a magnetic tape transport unit. When selected, no writing will be accomplished on the particular cartridge disk drive unit. No status is sent back to the cartridge disk controller or the CPU to reflect the condition of the switch.

The parameters in Table 9-2 reflect those normally used for acceptance testing. Refer to the SMM17 manual for further details on selecting SMM and test parameters and for descriptions of errors if they occur.

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Table 9-2. Cartridge Disk Drive SMM17 Parameter Set-Up

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	7A41	Test ID	STJP	Typically 0241, 0201, or 024D
2nd	D7FB	Sections to be run	nnpp	nn = 0 pp = Unit(s) to be tested
3rd	1111	Lowest cylinder to be tested	hhhh	Highest cylinder to be tested 200 tpi CDD = 195 100 tpi CDD = CA
4th	vvvv	0008, interrupt No. 3 typically	uuuu	0000 for 100 tpi CDD, low density 0001 for 200 tpi CDD, high density

9.5.2 SCMM TESTING

To perform SCMM testing, MSOS must include the SCMM routines, and the MSOS on-line monitor must be loaded into the CPU.

The cartridge disk test may be requested through the monitor by following the procedure shown in Table 9-3. The cartridge disk test should start running when the last comment is terminated by a carriage return. Refer to Section 1.7.2 for details on loading the monitor and for more details on loading and running SCMM.

Table 9-3. Cartridge Disk SCMM Parameter Set-Up

OPERATOR ENTRY SCMM REPLY	COMMENTS
Press MANUAL INTERRUPT MI SCMM (CR) SCMM IN CONTROL, TEST ID SRT, CD1 (CR) BEGIN CARTRIDGE DISK TEST LU, TEST, BEG SEC, END SEC, RUNS	

Table 9-3. Cartridge Disk SCMM Parameter Set-Up (Continued)

OPERATOR ENTRY SCMM REPLY	COMMENTS
lu, 7E, 1, h, x (CR)	lu = MSOS assigned logical unit 7E = Sections normally selected for acceptance testing 1 = Lowest legal sector to start testing h = Highest legal sector to be tested x = Number of times test is to be run

9.6 MULTIPLEX TESTING

The purpose of multiplex testing is to simulate system operation. Tests will be loaded sequentially, set into operation simultaneously, and run with either status or interrupt synchronization.

9.6.1 SMM

The cartridge disk test may be multiplexed with the following tests:

- Teletypewriter Test No. 5
- Command Test No. 1
- Line Printer Test No. C
- Magnetic Tape Test No. 15
- Magnetic Tape Test 4B

See Section 1.7.1.4 for more details.

9.6.2 SCMM

SCMM multiplex testing may be performed utilizing all equipments on the system provided that there is an SCMM test for all of the equipments, all devices are included in the logical unit table, and the system interrupt priority is set up correctly. To multiplex SCMM tests, use the call-up procedure as outlined in the section pertaining to the equipments to be tested. For additional information on SCMM testing, refer to Section 1.7.2.6.

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9.7 VOLTAGE MARGIN TESTING

This mode of testing should be performed to fulfill the EPS requirements of on-site installations.

Logic voltage margins of the cartridge disk controller may be performed by following the voltage measurement and adjustment procedure outlined in Section 2.7. The cartridge disk SMM17 and/or the SCMM tests should perform satisfactorily at these settings. Include Vss margins as a method of verifying proper DSA operation.

It is recommended that voltage margins not be run on the cartridge disk drives.

9.8 TEST/MAINTENANCE AIDS

The following two hand programs allow users to write address tags and data on new cartridge disk packs.

9.8.1 WRITE ADDRESS TAGS

START	E000	LDQ	=N$181	SELECT UNIT 0
	0181			
	C000	LDA	=N$100	
	0100			
	0B00	NOP		
	03FE	OUT	-1	
	0A00	ENA	0	LOAD ADDRESS
LODADR	0D01	INQ	1	
	0B00	NOP		
	03FE	OUT	-1	
	580A	RTJ*	STATUS	
	0D06	INQ	6	WRITE ADDRESS TAG
	0B00	NOP		
	03FE	OUT	-1	
	5806	RTJ*	STATUS	
	C804	LDA*	ADDRESS	INCREMENT ADDRESS VALUE
	0920	INA	$20	
	6802	STA*	ADDRESS	
	18F4	JMP*	LODADR	
ADDRESS	0000			ADDRESS VALUE

STATUS	0000				
	E000	LDQ	=N$181	TAKE DIRECTOR STATUS	
	0181				
	0B00	NOP			
CKSTAT	02FE	INP	-1		
	A000	AND	=N$2	CHECK IF DEVICE NOT BUSY	
	0002				
	0101	SAZ	RETURN		
	18FB	JMP*	CKSTAT	BUSY	
RETURN	1CF6	JMP*	(STATUS)	NOT BUSY	

9.8.2 WRITE DATA

START	E000	LDQ	=N$181	SELECT UNIT 0	
	0181				
	C000	LDA	=N$100		
	0100				
	0B00	NOP			
	03FE	OUT	-1		
	0A00	ENA	0	LOAD ADDRESS	
	0D01	INQ	1		
	0B00	NOP			
	03FE	OUT	-1		
	580C	RTJ*	STATUS		
	0DFE	INQ	-1	LOAD BUFFER LENGTH	
	C000	LDA	=N$8000		
	8000				
	0B00	NOP			
	03FE	OUT	-1		
	5806	RTJ*	STATUS		

WRITE	0D02	INQ	2	WRITE DATA BUFFER
	0A00	ENA	0	
	03FE	OUT	-1	
	5802	RTJ*	STATUS	
	18FB	JMP*	WRITE	
STATUS	0000			
	E000	LDQ	=N$181	TAKE STATUS
	0181			
	0B00 .	NOP		
CKSTAT	02FE	INP	-1	
	A000	AND	=N$2	CHECK IF DEVICE NOT BUSY
	0002			
	0101	SAZ	RETURN	
	18FB	JMP*	CKSTAT	BUSY
RETURN	1CF6	JMP*	(STATUS)	NOT BUSY

The teletypewriter subsystem consists of one teletypewriter and one teletypewriter controller card which is part of the basic CPU.

The teletypewriter (TTY) controller occupies card position 20 of the CPU. It provides an RS232-C interface with the CPU; has a baud rate select of 110, 300, 1200, or 9600; and contains CPU breakpoint and console manual interrupt processing logic. Included with the TTY controller are an internal and external TTY cable assembly.

The TTY controller is capable of interfacing with the devices listed below. All of these devices are free-standing devices (on their own pedestals), or they can be mounted on a table or desk top.

- Teletypewriter (33 KSR, 50/60 Hz)
- Teletypewriter (35 KSR, 50/60 Hz)
- Teletypewriter (33 ASR, 50/60 Hz)
- Teletypewriter (35 ASR, 50/60 Hz)
- Conversational display terminal[†]
- Non-impact printer[†]

See Figure 10-1 for a block diagram of the teletypewriter subsystem.

10.1 APPLICABLE DOCUMENTS

The following lists include the documents pertinent to the teletypewriter subsystem. Documents with asterisks (*) are required for installation and maintenance of the TTY subsystem.

Documents relating to the teletypewriter controller are as follows:

Title	Publication No.
1784 Computer Customer Engineering Manual (*)	89633300
1784 Computer Reference Manual (*)	89633400

[†] These devices are covered in Section 11.

The following is a list of manuals relating to the teletypewriters. (Teletypewriter manuals are included with each TTY.)

For 33 ASR/KSR teletypewriters:

Teletype Bulletin 310B, Volume 1(*)

Teletype Bulletin 310B, Volume 2(*)

Teletype Bulletin 1184B, Parts Schematic package WDPO316 includes document Nos. 11805D, 9334WD, 9335WD, 4405WD, 9336WD, 4970WD, 7887WD, 181821, 183079, 183087(*)

For 35 ASK/KSR teletypewriters:

Teletype Bulletin 281B, Volume 1(*)

Teletype Bulletin 281B, Volume 2(*)

Teletype Bulletin 1201B, Parts Schematic Package(*)
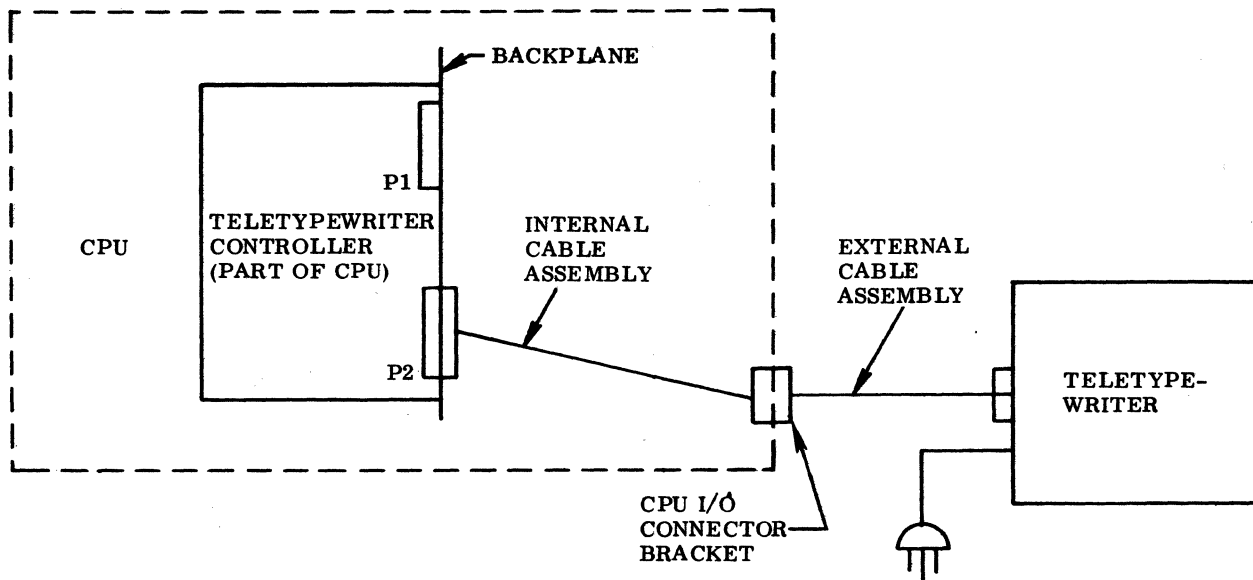
Figure 10-1. Block Diagram of the Teletypewriter Subsystem

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10.2 REQUIRED PARTS

The following parts are required for installation on the teletypewriter controller. (Each CPU is equipped with a teletypewriter controller card.)

Teletypewriter controller card

Cable assembly, conversational display terminal/
teletypewriter, internal   89684200

Cable assembly, teletypewriter, external   89642300

Shorting jumper   89684100

One of the following teletypewriters is required:

	Product No.	Equipment No.
Teletypewriter, 60 Hz, 33 KSR	1711-4	CK511-A
Teletypewriter, 50 Hz, 33 KSR	1711-4	CK511-B
Teletypewriter, 60 Hz, 33 ASR	1713-4	CK512-A
Teletypewriter, 50 Hz, 33 ASR	1713-4	CK512-B
Teletypewriter, 60 Hz, 35 KSR	1711-5	CK513-A
Teletypewriter, 50 Hz, 35 KSR	1711-5	CK513-B
Teletypewriter, 60 Hz, 35 ASR	1713-5	CK514-A
Teletypewriter, 50 Hz, 35 ASR	1713-5	CK514-B

Other required material is as follows:

Teletype paper   485333-1908

Teletype ribbon   12240905

60 Hz/50 Hz conversion kit for 1711-5 and 1713-5 Teletypewriters

Gear set   307852

Thermal detector   193782

Fan assembly   123769

10.3   INSTALLATION

10.3.1 TTY CONTROLLER

Turn the power off on the expansion enclosure first, if it is part of the system. Then power down the CPU. Remove the card at slot 20 of the CPU. Ensure that the baud rate jumper is at the appropriate position. The teletype requires 110 baud. After selecting the baud rate, re-install the card at slot 20.

Ensure that the internal cable assembly is installed between P2 of the backplane at slot 20 and the CPU chassis connector panel. Use four No. 4-40 screws and nuts to mount the 66-pin continental connector to the CPU I/O connector panel. Connect the CPU end of the external cable assembly to the TTY/conversational display terminal controller connector on the I/O connector panel. Route the TTY end of the cable to the teletypewriter, and connect it to the connector or terminal strip on the TTY. Connection of the external cable to the TTY is covered in the sections for each specific TTY type.

10.3.2 33 KSR/ASR TTY

1. UNPACKING AND CHECKOUT. These TTY assemblies are received in a partially disassembled mode. Unpack these units carefully and ensure that packages of parts do not get lost. Inspect for and record any damage to the equipments.

Set the pedestal assembly in an accessible area. Remove the shipping pallet from the top assembly. Utilizing the hardware and instructions provided, install the top assembly to the pedestal assembly.

2. PRELIMINARY SET-UP. These units come prewired to run at half duplex with a 60 ma current loop. The units will have to be modified to run full duplex with a 20 ma current loop.

Remove the four screws from the back of the TTY top cover assembly. Remove the platen knob and the POWER ON/OFF knob. (This knob pulls off.) Remove the chrome trim plate by grasping at the bottom and pulling down and out. Remove three more screws from the front of the cover assembly. The cover assembly should now be removed. (Ensure that there are no other shipping straps or blocks on the typer assembly.)

Locate the terminal strip assembly (BL(X)) and resistor (R-1). Refer to Figure 10-2 for the relative location of these assemblies and to teletype documents 9336WD-B1, B2, and B1A for more details pertaining to this change.

Perform the following changes: remove the cover from the terminal strip assembly. Then move the purple wire from BL(X)-8 to BL(X)-9, move the white/blue wire from BL(X)-4 to BL(X)-5, move the brown/yellow wire from BL(X)-3 to BL(X)-5, and move the blue wire from AC R-1 tab 3 to R-1 tab 4.

Install the TTY end of the TTY external cable assembly to the second jack from the right on the top row. See Figure 10-2. Replace the terminal board cover, TTY cover, all screws, trim, and knobs.

10.3.3 35 KSR/ASR TTY

1. UNPACKING AND CHECKOUT. These teletypewriter units are shipped with the pedestal and top units already assembled.

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BL(X) TERMINAL
STRIP

EXTERNAL
CABLE

TYPEWRITER
ASSEMBLY

EXTERNAL I/O
CONNECTOR
LOCATION

R-1

KEYBOARD
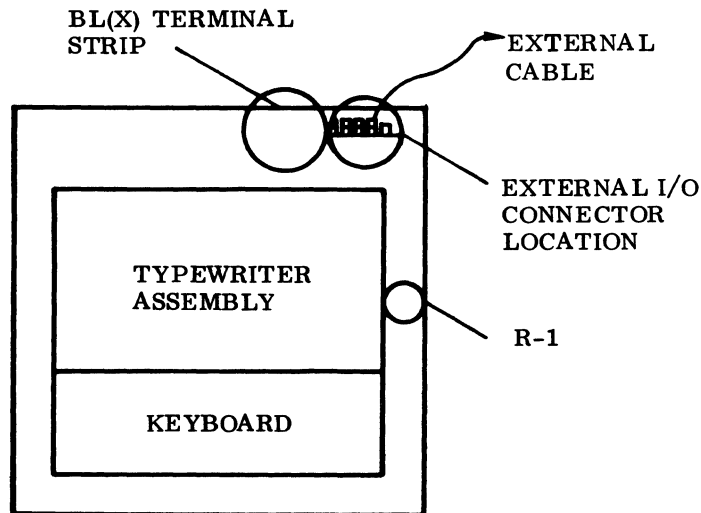
Figure 10-2. Teletypewriter Top View, Cable, and BL(X) Location

Remove the TTY units from their shipping cartons and inspect for and record any damage. Remove
two shipping screws from the underside of the front of the TTY top assembly. Open the TTY top
cover assembly. Locate the teletypewriter assembly, which is shipped in a separate carton.
Remove it from the shipping carton and inspect for damage. Record any damage to the unit.

NOTE

An optional 60 Hz to 50 Hz mechanical conversion kit
is available for these units. Install the kit at this
time if the unit is to receive 50 Hz primary power.
Installation instructions are included in the kit.

2. ASSEMBLY. Install the typewriter assembly in the TTY top assembly. Install four screws, one
on each corner, to fasten the typewriter assembly to the typewriter mounting base and install the
data/power interface cable. This cable connects to a jack located to the right of the platen assembly.

Ensure that all shipping straps are removed and that the shipping spacers on the typewriter mounting
base have been removed.

3. PRELIMINARY SET-UP. Open the top cover to expose the I/O connector location as shown in
Figure 10-2. This type of TTY does not have the same jack/connector configuration as the
33 KSR/ASR teletypewriter, so it does not utilize the connector on the TTY external cable assembly.
The connector must be cut off and terminal lugs should be installed on the wires.

Remove the terminal strip cover of the terminal strip located in the place normally occupied by the
I/O connectors. Remove the shorting brackets from TB 5, 6, 7, and 8, if they exist.

Connect the TTY external cable wires to TB5, 6, 7 and 8 (see Table 10-1). Then replace the terminal strip cover and close the TTY top cover.

Table 10-1. 35 KSR/ASR Teletypewriter I/O Cable Connections

66-PIN CONTINENTAL CONNECTOR PIN AT CPU END	TB PIN
Pin 47	5
Pin 43	6
Pin 49	7
Pin 45	8

10.3.4 PRIMARY POWER INSTALATION

10.3.4.1   33 KSR/ASR TTY

The 33 KSR/ASR TTYs come equipped as either 60 Hz or 50 Hz devices. Both units require single phase 120 vac. It may be necessary to replace the male connector of the TTY primary power cord to make it compatible with the customer power source.

10.4.3.2   35 KSR/ASR TTY

The 35 KSR/ASR teletypewriters are shipped as 60 Hz units. A 50 Hz mechanical conversion kit is available. When installed, these TTYs will accept 50 Hz, 120 vac. Install this kit if applicable. The kit contains the necessary instructions to accomplish the change. This change may/should have been done when the TTYs were installed (see Section 10.3.3). The primary power cord connector may have to be changed to interface with the customer power source.

Make sure that TTY paper and the TTY typewriter ribbon have been installed.

10.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Apply power to the TTY unit. Select the off line mode if available and ensure that the TTY types correctly.

If the off line feature does not exist, set the CPU TEST MODE switch to TEST MODE. This allows the TTY to be operated as if in off-line or local mode. When in the on-line mode and starting from a CPU master clear condition, the TTY will accept and type only two characters.

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10.5 DIAGNOSTIC CHECKOUT

10.5.1 SMM TESTING

Load SMM17 Version 3.1-2 Monitor into the CPU. Set up the SMM parameters as shown in
Section 1.7.1. When BUILD TEST LIST is typed out, call up Teletypewriter Test No. 5.

The parameters shown in Table 10-2 reflect those normally used for acceptance testing. Refer to the
SMM17 manual for further details on setting up the SMM and test parameters and for a description of
errors in case the test does not run.

Table 10-2. Teletypewriter SMM17 Parameter Set-Up

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	0531	Test ID	STJP	Typically 0201, 0241, or 024D
2nd	0E0F	Test section	0010	Number of lines to be typed
3rd	0000	N/A	0000	N/A

10.5.2 SCMM TESTING

To perform SCMM testing, MSOS must include the SCMM routines, and the MSOS on-line monitor must
be loaded into the CPU. The teletypewriter SCMM test may be requested through the monitor by per-
forming the sequence of operations shown in Table 10-3. Refer to Section 1.7.2 for more details on
loading the MSOS monitor and for details on loading and running SCMM. This SCMM test requires use
of the TTY I/O port of the CPU.

10.6 MULTIPLEX TESTING

The purpose of multiplex testing is to simulate system operation. Tests will be located sequentially,
set into operation simultaneously, and run with either status or interrupt synchronization.

10.6.1 SMM

Teletypewriter Test No. 5 may be multiplexed with the following tests:

- Command Test No. 1
- MDC Test No. 7A

- Magnetic Tape Test No. 15

- Magnetic Tape Test No. 4B

- Line Printer Test No. C

See Section 1.7.1 for test multiplexing information.

Table 10-3. Teletypewriter SCMM Parameter Set-Up

OPERATOR ENTRY SCMM REPLY	COMMENTS

Press MANUAL INTERRUPT
 	
   MI
 	
SCMM (CR)
 	
   SCMM IN
   CONTROL, TEST ID
 	
SRT, TTY (CR)
 	
   BEGIN TTY TEST
   LU, TESTS, RUNS
 	
lu, x, y (CR)
	lu = MSOS assigned logical unit
	
	x = Sections normally selected
	      for acceptance testing.
	
	     0002 = All legal characters
	     0004 = Echo test
	     0008 = Same as 0004 but x
	           specifies the number
	           of lines. 0004 and
	           0008 require
	           operator interruption
	
	y = Number of runs

10.6.2 SCMM

This type of testing may be performed utilizing equipments on the system if an SCMM test exists for the device, if the device is included in the MSOS logical unit table, and if the interrupt priority is set up correctly.

To run multiple tests, repeat the SCMM test loading procedure specified in the SCMM section for each of the applicable equipments. See Section 1.7.2 for details on SCMM multiplex testing.

10.7 VOLTAGE MARGIN TESTING

This is an EPS requirement for on-site installations and may be utilized if problems occur within the SYSTEM 17 that cannot be isolated via standard diagnostics at nominal voltages.

Only the CPU ±5 vdc Vcc logic voltages need to be changed while running the SCMM and/or SCMM diagnostics. Refer to Section 2.7 for voltage margin set-up and measurement procedures. The tests should run satisfactorily at all settings. Testing at the Vss margin setting need not be done.

The teletypewriter units do not have adjustable power supplies. Therefore, it is not recommended that margin testing be performed on these units.

The conversational display terminal (CDT) is an RS232-C device that operates in conjunction with the teletypewriter controller card that is part of the basic CPU. The CDT connects to the TTY/CDT I/O port. The CDT can operate at 75, 110, 150, or 300 baud; at full or half duplex; and with odd, even, or no parity (MARK). The CDT may drive a non-impact printer (NIP), which may be daisy-chained to other NIPs. The CDT may be coupled directly or through appropriate modems to the synchronous and asynchronous communications controllers. This section will deal primarily with the use of the CDT as a CPU operator comment device.

The non-impact printer, when placed on-line, acts as a slave printer and provides a hard copy of data that is displayed on the CDT.

See Figure 11-1 for a block diagram of the conversational display terminal and the non-impact printer station.
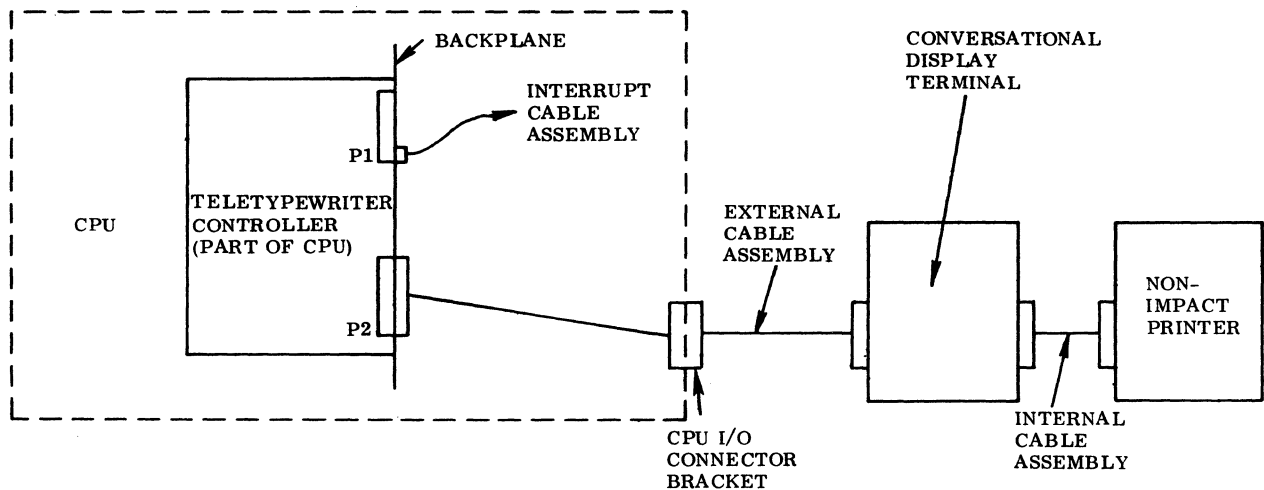
Figure 11-1. Block Diagram of CDT/NIP as a Comment Device

11.1 APPLICABLE DOCUMENTS

The following lists include the documents associated with the conversational display terminal and the non-impact printer station. The documents with asterisks (*) are required for installation and maintenance of the CDT and the NIP.

The following list includes the documents associated with the conversational display terminal:

Title	Publication No.
713-10 Operator's Guide(*)	62037900
713-10 Reference Manual(*)	62033400
713-10 On-Site Maintenance Manual(*)	62048500
713-10 Installation Instruction(*)	62048700

Following is a list of documents relating to the non-impact printer station:

Title	Publication No.
713-11 Operator's Guide	62149600
713-11 Reference Manual	62149700
713-11 Installation Instructions	62149800
713-11 On-Site Maintenance Manual	62149900

11.2 REQUIRED PARTS

Following is a list of parts required for installation and checkout of the CDT/NIP station:

	Product No.	Equipment No.
Conversational display terminal	713-10	CC535-A
Inter CDT/modem cable assembly	62032101	
CDT external cable assembly	89668300	
Non-impact printer, 50 Hz	713-120	CN503-B
Non-impact printer, 60 Hz	713-120	CN503-A
Non-impact printer cable assembly	62078801	
Terminator assembly	62078900	

In addition, the following types of NIP thermal paper are required:

Paper Color	Print Color	Length	Part No.
White	Blue	430 ft.	51772000
White	Blue	100 ft.	51772001
White	Black	430 ft.	51772002
White	Black	100 ft.	51772003
Canary	Blue	430 ft.	51772004
Canary	Blue	100 ft.	51772005
Canary	Black	430 ft.	51772006
Canary	Black	100 ft.	51772007

11.3 INSTALLATION

11.3.1 INSTALLATION OF CDT/NIP

1. UNPACKING AND CHECKOUT. Remote the CDT from its shipping carton and from its shipping pallet. Remove the CDT cover by removing the mounting screws on the back of the unit; then slide the cover back and lift it off. Inspect for internal and external damage and for missing parts. Record all discrepancies and re-install the CDT cover.

Remove the NIP, if it is part of the system, from its shipping carton. Inspect it, and record any damage or missing parts.

Both the CDT and the NIP are table- or desk-top mounted devices. Position the devices according to customer requirements.

11.3.2 PRIMARY POWER INSTALLATION

11.3.2.1 CDT

The CDT can be utilized as a 50 Hz/60 Hz 120 vac device without any internal changes. It may be necessary to change the connector on the primary power cord before connecting it to the customer power source.

11.3.2.2   NIP

The NIP is delivered as either a 60 Hz device or a 50 Hz device. It may be necessary to change the primary power cord connector to allow proper connection to the customer power source. When connecting primary power, ensure that all line, neutral, and ground connections are made correctly.

For more details pertaining to each of these equipments, refer to the installation instruction document for each device.

11.3.2.3   GROUNDING

Grounding of both the CDT and the NIP is accomplished by use of the green wire safety ground of the primary power cord. No additional grounding is required.

11.3.3 CABLE INSTALLATION

Install the CDT/NIP cables. Ensure that the internal cable assembly is installed between J20 P2 and the CPU I/O connector panel. Connect the external CDT cable between the CDT and the teletypewriter I/O connector of the CPU.

If the NIP is part of the system, install cable assembly 62078801 between the CDT and the NIP. The printer daisy chain output on the NIP must be terminated with terminator assembly 62078900.

Install the cables in the proper configuration. See Figure 11-1.

11.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Apply power to the CDT and the NIP (if installed). Ensure that the CB1 (located on the rear of each unit) is reset on both units.

Perform local checkout as outlined in the respective reference and operator manuals.

Ensure that the switches on the rear of the CDT are set properly. FULL DUPLEX and MARK positions must be selected. The baud rate should be set to match that rate set on the TTY controller card.

CAUTION

If an NIP is used, the first character(s) after a
carriage return may be lost if baud rates of greater
than 110 baud are used.

Odd or even parity operation of the CDT may be required by specific applications. In that event, changes will have to be made to the internal TTY/CDT cable assembly. Pin 41 of the 66-pin continental connector must be grounded to enable parity checking. In this condition, even parity is selected. To select odd parity, pin 53 of the same connector must also be grounded.

NOTE

The following is an optional method of selecting odd or even parity. Remove the TTY controller from slot 20. Install a wire between P2 B22 and U53-7 on the component side of the board to select even parity and seven data bits per character. To select odd parity and seven data bits per character, add another wire between P2 B28 and U52-7 on the component side of the board.

No equipment number select capability exists for the TTY controllers. They utilize the standard teletype equipment number for I/O communication; i.e., $0091 for function transfers and $0090 for data transfers. The CDT/NIP will be compatible with all TTY diagnostic and user routines.

11.5 DIAGNOSTIC CHECKOUT

11.5.1 SMM TESTING

Load SMM17 Version 3.1-2 Monitor into the CPU. Set up the SMM parameters as shown in Section 1.7.1. When BUILD TEST LIST is typed out, call up Teletypewriter Test No. 5. This test will run only if the CDT and NIP are connected to the TTY I/O port.

The parameters shown in Table 11-1 reflect those normally used for acceptance testing of a TTY interface. Refer to the SMM17 manual for further details on setting up the SMM and test parameters, and for a description of errors in case the test does not run.

11.5.2 SCMM TESTING

To perform SCMM testing, MSOS must include the SCMM routines, and the MSOS on-line monitor must be loaded into the CPU. The TTY SCMM test may be requested through the monitor by performing the sequence of operations shown in Table 11-2. Refer to Section 1.7.2 for more details on loading the MSOS monitor and for details on loading and running SCMM. This SCMM test requires use of the TTY I/O port of the CPU.

Table 11-1. Conversational Display Terminal/Teletypewriter
SMM17 Parameter Set-up

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	0531	Test ID	STJP	Typically 0201, 0241, or 024D
2nd	0E0F	Test section	0010	Number of lines to be typed
3rd	0000	N/A	0000	N/A

Table 11-2. Conversational Display Terminal/Teletypewriter
SCMM Parameter Set-Up

OPERATOR ENTRY SCMM REPLY	COMMENTS

Press MANUAL INTERRUPT
 	
   MI
SCMM (CR)
 	
   SCMM IN
   CONTROL, TEST ID
SRT, TTY (CR)
 	
   BEGIN TTY TEST
   LU, TESTS, RUNS
lu, x, y (CR)
	lu = MSOS assigned logical unit
	
	x = Sections normally selected for acceptance testing
	
	$0002^\dagger$ = All legal characters
	$0004^\dagger$ = Echo test
	$0008^\dagger$ = Same as 0004, but x specifies the number of lines. (0004 and 0008 require operator interruption.)
	
	y = Number of runs

†These entries correspond to hexadecimal bit positions; i.e., 0002 = bit 1 set.	

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11.6 MULTIPLEX TESTING

The purpose of multiplex testing is to simulate system operation. Tests will be loaded sequentially, set into operation simultaneously, and run with status or interrupt synchronization.

11.6.1 SMM

Teletypewriter Test No. 5 may be multiplexed with the following tests:

- Command Test No. 1
- MDC Test No. 7A
- Magnetic Tape Test No. 15
- Magnetic Tape Test No. 4B
- Line Printer Test No. C
- Card Punch Test No. 88

See Section 1.7.1.4 for test multiplexing information.

11.6.2 SCMM

SCMM multiplex testing may be performed utilizing equipments on the system if an SCMM test exists for the device, the device is included in the MSOS logical unit table, and the interrupt priority is set up correctly.

To run multiple tests, repeat the SCMM test loading procedure specified in the SCMM section for each of the applicable equipments. See Section 1.7.2.6 for further details on setting up for multiple tests.

11.7 VOLTAGE MARGIN TESTING

This is an EPS requirement for on-site installations and may be used if problems occur within the SYSTEM 17 that cannot be isolated via standard diagnostics at nominal voltages.

Only the CPU ± 5 vdc Vcc logic voltages need to be changed while running the SMM and/or SCMM diagnostics. Refer to Section 2.7 for the voltage margin set-up and measurement procedures.

The CDT and the NIP do not contain readily adjustable power supplies. Therefore, it is not recommended that margin testing be performed on the CDT and NIP.

The magnetic tape transport subsystem consists of one magnetic tape controller, up to four magnetic tape transports (MTTs), and an optional phase encode formatter.

The magnetic tape controller is a four-card device designed to be inserted into prewired slots 11, 12, 13, and 14 of the CPU. It has the following select capabilities: equipment number select, protect select, speed select for each MTT, track number select for each MTT, mode select (dual/single) for each MTT, modulation select (NRZI/phase encode) for each MTT, and DSA scanner select. It includes two internal cable assemblies, one external cable assembly, one interrupt cable assembly, and one universal translator board which mounts in the first MTT of a daisy chain configuration.

The phase encode formatter (PE) is a three card optional device that provides phase encode format capability for the magnetic tape controller and is designed to be inserted into prewired slots 8, 9, and 10 of the CPU.

The controller will handle one to four magnetic tape transports on a daisy chain configuration. The following three model types may be intermixed on the daisy chain:

- BW101A Magnetic Tape Transport, NRZI, 7-track, 25 in. per second, 800/556 density
- BW303A Magnetic Tape Transport, dual mode, 9-track, 25 in. per second, 800/1600 density
- BW305A Magnetic Tape Transport, dual mode, 9-track, 50 in. per second, 800/1600 density

See Figure 12-1 for a block diagram of the magnetic tape transport subsystem.

12.1 APPLICABLE DOCUMENTS

The following documents are associated with the magnetic tape transport subsystem. Documents with asterisks (*) are required for installation and maintenance of the MTT subsystem.

Documents that relate to the magnetic tape controller are as follows:

Title	Publication No.
NZRI-LCTT Magnetic Tape Transport Controller Customer Engineering Manual (*)	89769500
1732-3 Magnetic Tape Transport Controller Reference Manual (*)	89769400

INTERRUPT CABLE ASSEMBLY GOES BETWEEN J12 P2 A16 AND THE DESIRED INTERRUPT LEVEL AT J25/J26, NORMALLY J25 P1 B05.

CPU

8 9 10 11 12 13 14

P.E. INTERFACE CONTROL

P. E. DATA

P. E. DATA

TAPE INTERFACE

Q CHANNEL

LOWER DATA

UPPER DATA

P2   P2 — INTERNAL CABLE ASSEMBLY

FIRST MAGNETIC TAPE TRANSPORT UNIT ASSEMBLY

EXTERNAL CABLE ASSEMBLY

TRANSLATOR BOARD

FLAT RIBBON CABLE ASSEMBLIES

FIRST MAGNETIC TAPE TRANSPORT UNIT

SECOND MAGNETIC TAPE TRANSPORT UNIT

ADDITIONAL MAGNETIC TAPE TRANSPORT UNITS (UP TO FOUR TOTAL)

NOTES:

1. MULTIPLE MAGNETIC TAPE TRANSPORT DAISY CHAIN CONFIGURATION (A MAXIMUM OF FOUR UNITS OF ANY MODEL TYPE)

2. MAXIMUM CABLE LENGTH FROM CONTROLLER TO UNIVERSAL TRANSLATOR BOARD IS 20 FEET. MAXIMUM CABLE LENGTH BETWEEN SUBSEQUENT MAGNETIC TAPE TRANSPORTS IS 20 FEET.

3. TERMINATORS ARE NOT REQUIRED ON THE TRANSLATOR BOARD OR ON THE LAST MAGNETIC TAPE TRANSPORT UNIT.

Figure 12-1. Block Diagram of the Magnetic Tape Transport Subsystem

The publication associated with the phase encoding formatter is:

Title	Publication No.
FV497/FV618 Phase Encoding Formatter Customer Engineering Manual (*)	89796100

Documents relating to the magnetic tape transport are:

Title	Publication No.
Magnetic Tape Transport Field Service Manual (*)	49756400
Magnetic Tape Transport Field Service Training Manual	49756300
Magnetic Tape Transport Interface Manual (*)	49756700
Magnetic Tape Transport Parts Identification Manual (*)	49756500

Publications relating to the enclosures for the MTT units are:

	Publication No.
Installation Instruction for 1787-3/4	96720300

12.2 REQUIRED PARTS

The following hardware is required for the magnetic tape controller and phase encoding formatter:

	Product No.	Equipment No.
Magnetic tape controller	1732-3	FA446-A
Select jumpers		
Cable assembly, internal (two required)	89700200	
Cable assembly, external (up to Rev 03 controllers)	89805300	
Cable assembly, external (Rev 03 controllers and up)	89899000	
Cable assembly, interrupt	89724702	
CDC Interface Kit (includes universal translator assembly, cables, mounting hardware	86953901	
Universal translator assembly		BW805
Magnetic tape Q channel		
Magnetic tape interface		
Upper data		
Lower data		
Phase encoding option	10300-2	FV618-A

Phase encode interface

    Data I board

    Data II board

One to four of the following magnetic tape transports are required:

	Product No.	Equipment No.
Magnetic tape transport (NRZI, 7-track, 25 ips)	616-72	BW101-A
Magnetic tape transport (DM, 9-track, 25 ips)	616-92	BW303-A
Magnetic tape transport (DM, 9-track, 50 ips)	616-95	BW305-A
Ribbon cable assemblies (two required, two feet each) — between universal translator board assembly and first unit (part of interface kit)	95875201	
Mode select jumper (for each magnetic tape transport)	86722601	
Ribbon cable assemblies (two required, 20 feet each) — part of each magnetic tape transport	95875203	
Power cord (with each magnetic tape transport)	88820000	

The MTT, as delivered, must be mounted in an enclosure. Two basic types of enclosures are available: the cabinet and mini cabinet and the pedestal cabinet and equipment table enclosures.

Parts required for installation of the MTT in a cabinet or mini cabinet are as follows:

	Product No.
Cabinet	1787-1
Mini cabinet	1787-2
Vertical mounting rails (two per cabinet)	
Power distribution assembly	
Magnetic tape transport mounting kit (part of MTT)	
Magnetic tape transport supply mounting kit (part of MTT)	

To install the MTT in the pedestal cabinet or equipment cabinet, the following parts are required:

	Product No.
Pedestal cabinet	1787-3
Equipment cabinet	1787-4
Magnetic tape transport mounting kit (part of MTT)	
Magnetic tape transport power supply mounting kit (part of MTT)	

Other required material includes the following:

Magnetic tape supply reels

2400 ft.		46740264
1200 ft.		46751245
800 ft.		46752297
400 ft.		47668297
200 ft.		46753298

Part No.

Master alignment tape (7-track, 9-track, and
9-track phase encode)   64216000

Refer to the MTT Field Service Manual for a list of special tools and test equipment.

12.3 INSTALLATION

Unpacking and inspection of the MTT units is covered in detail in the field service manual. Refer to
this manual and complete as specified.

NOTE

Some of the packing/shipping bolts are utilized to
install the magnetic tape units. Do not discard
shipping hardware until all tape units are installed.

Record all damage and/or missing parts.

12.3.1 IN CABINET/MINI CABINET

1. PREPARATION OF CABINET ASSEMBLY. The cabinet should contain two vertical mounting rails
which are positioned flush with the front frame. Two more vertical mounting rails may be located
approximately eight inches behind the front rails. The MTT will mount on the front rails and the
power supply will mount on the rear set of rails. If the rear set of rails is not provided, the power
supply can be mounted on the front rails.

Use Figure 12-2 to locate the hinge mounting holes on the rail. The upper hinge of the upper MTT will
be located in the third hole from the top of the rail. Locate and mark the other hinge mounting holes.
Cover the marked holes with masking tape, then use a drill and a 5/16-in. bit to enlarge the holes.
Use care in centering the drill bit on the existing hole.
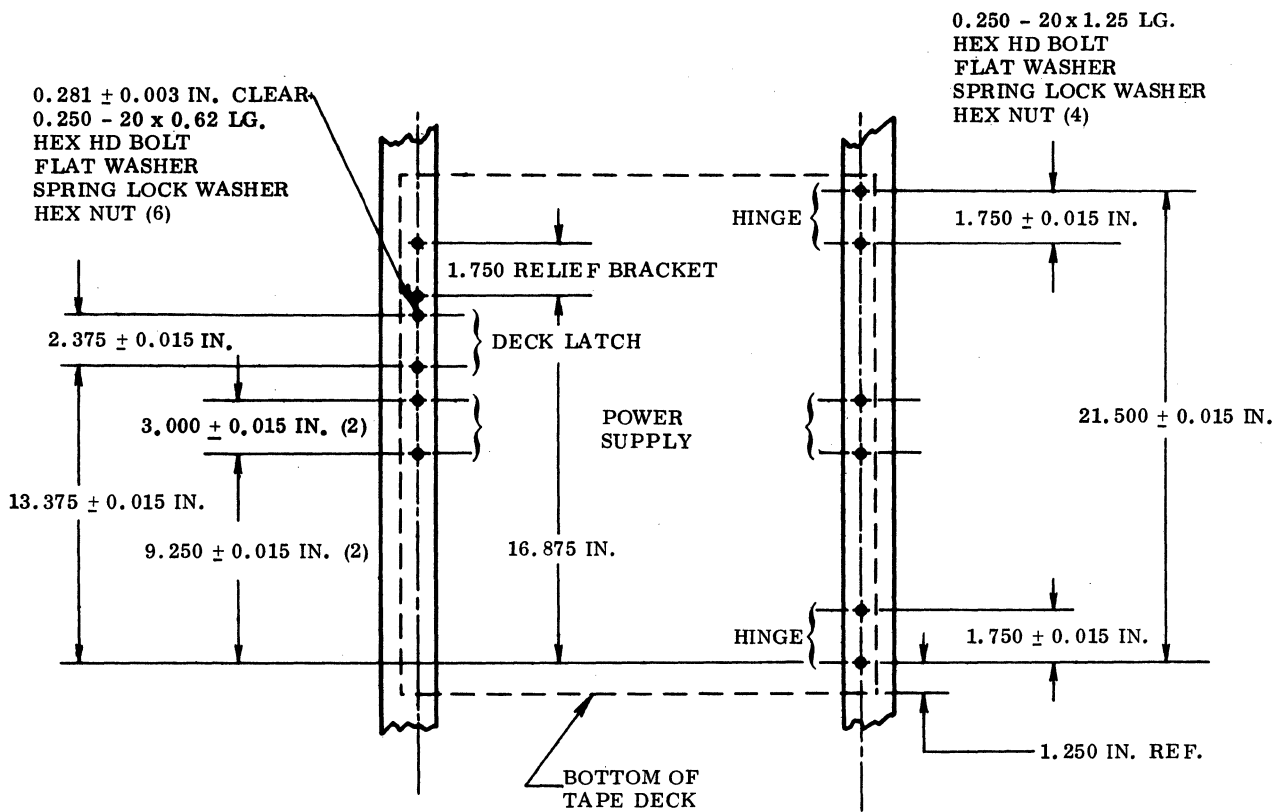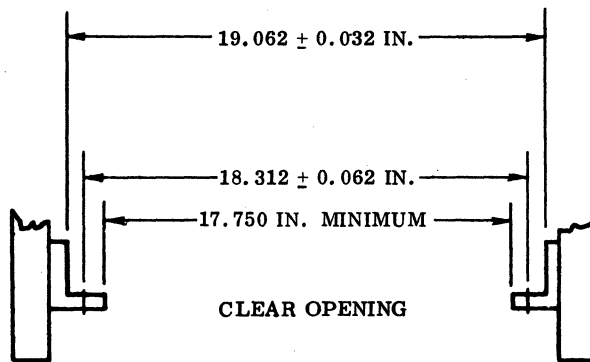
Figure 12-2. Magnetic Tape Transport Installation in a Cabinet/Mini-Cabinet

88996000 A

Clean up the debris and remove the masking tape. Using the hardware item numbers shown on Figure 12-3, install the hinges as shown in the same figure. Figure 12-4 shows other dimensions to be considered when mounting the MTT.

2. INSTALLATION. The actual installation of the MTT and its power supply is covered in detail in the MTT field service manual. Refer to this manual to complete the physical installation of the MTT.

12.3.2 IN EQUIPMENT CABINET

This installation is specified in the installation instruction document for the equipment cabinet. Parts required and the procedures to install them are included.

Install the MTT and its power supply according to the procedure specified in the MTT field service manual.

12.3.3 50/60 HZ MODIFICATION

The magnetic tape controller and the phase encoding formatter require no 50/60 Hz consideration. To convert the MTT units to 50 Hz, 115 vac operation, refer to the MTT manual.

NOTE

Many sites utilizing 50 Hz primary power do not have 115 vac single phase power available. A transformer option (product No. 10299-22) may be utilized to drop existing 50 Hz voltages to 115 vac single phase. The transformer will service four MTT units.

12.3.4 PRIMARY POWER PREPARATION

12.3.4.1 MTT

The cabinet, mini cabinet, and equipment cabinet are provided with a power distribution assembly that has three primary power circuits, each with its own circuit breaker. The enclosures require single-phase 115 vac, 50 Hz/60 Hz power from the customer source.

Each MTT unit receives its primary power from the TB01 in the power distribution assembly and is wired as in Table 12-1 when installed in the cabinet or mini cabinet. MTT units will receive primary power from TB02 or TB03 when installed in an equipment cabinet (refer to Table 12-2).
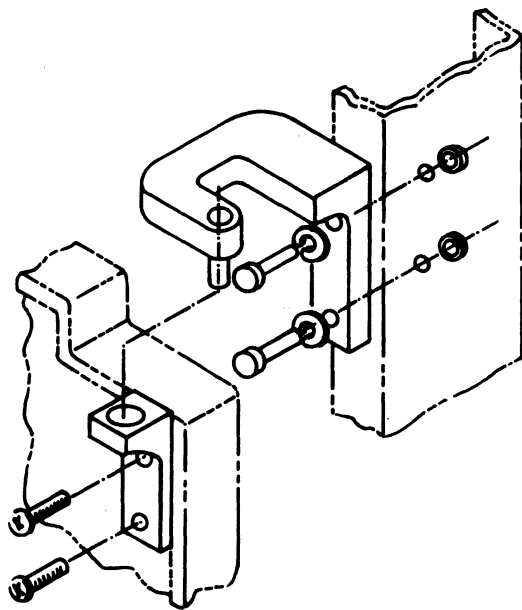
HINGE ASSEMBLY
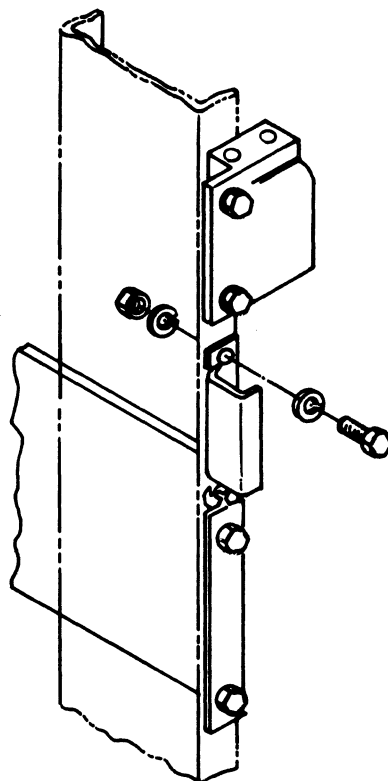
RELIEF BRACKET ASSEMBLY

Figure 12-3. Magnetic Tape Transport Hinge Installation
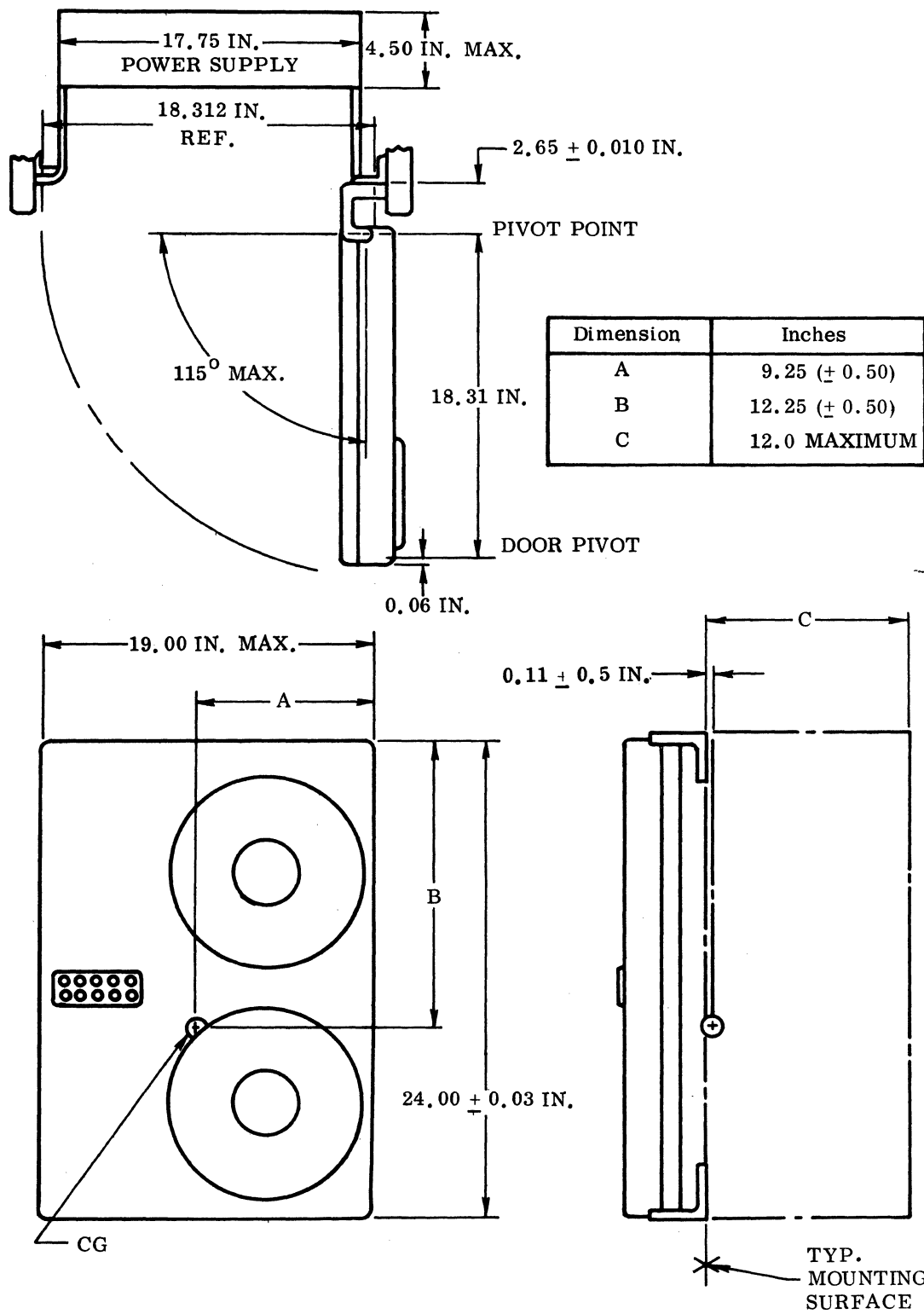
Figure 12-4. Magnetic Tape Transport Equipment Outline

Dimension	Inches
A	9.25 (± 0.50)
B	12.25 (± 0.50)
C	12.0 MAXIMUM

Table 12-1. Power Distribution Terminal Assignment for Cabinet/Mini Cabinet

TB01 TERMINAL NO.	DESCRIPTION	CONTROLLED BY	DESTINATION/SOURCE
1	Neutral	Customer input CKT breaker	Provides primary power to the cabinet assembly
2	Line		
3	Ground		
4	Neutral	CKT 1	Provides power to the upper MTT
5	Line		
6	Ground		
7	Neutral	CKT 2	Provides power to the lower MTT
8	Line		
9	Ground		
10	Neutral	CKT 3	Provides power to the additional equipments; i.e., 1500 series equipment, etc.
11	Line		
12	Ground		
22-23	Ground	No control	System ground/rack frame ground

The primary power cord is routed to and connected to the power supply assembly of each MTT via a Hubbel 15 amp twistlock connector. Install the primary power cable to the power distribution assembly from the customer power source. Do not energize the cabinet assembly at this time.

12.3.4.2 MAGNETIC TAPE CONTROLLER AND P.E. FORMATTER

The magnetic tape controller and the phase encoding formatter do not require primary power. They obtain their power (+5 vdc Vcc) from the CPU.

12.4.3 GROUNDING

Install a 1 inch braided ground strap between TB01-22 in the power distribution assembly and the system ground. Install a 1-inch braided ground strap between TB01-23 and one of the vertical mounting rails in the cabinet. In the equipment cabinet, route a 1-inch braided ground strap from ground TB01 (in front of the power distribution assembly) to the system ground.

Install a ground strap between E1 on the MTT power supply and the quick-connect terminal on the upper right-hand corner on the back of the MTT unit.

Table 12-2. Power Distribution Terminal Assignment
for Pedestal Cabinet and Equipment Cabinet

TB TERMINAL NO.	DESCRIPTION	CONTROLLED BY	DESTINATION/SOURCE
TB01-1	Neutral		
TB01-2	Line	Customer input CKT breaker	Provides primary power to cabinet assembly
E1	Ground		
TB02-1	Ground		
TB02-2	Line		
TB02-3	Neutral		
TB02-4	Ground	CKT1 breaker, 15 amp	Provides power to cabinet equipment
TB02-5	Line		
TB02-6	Neutral		
TB03-1	Ground		
TB03-2	Line		
TB03-3	Neutral		
TB03-4	Ground	CKT2 breaker, 15 amp	Provides power to cabinet equipment
TB03-5	Line		
TB03-6	Neutral		
TB03-7	-20 Terminal Power		Provides terminal power to cabinet equipments
TB03-8	+20 Terminal Power		

12.3.4.4 UTB ASSEMBLY

Install the universal translator board (UTB) bracket assembly on the top rear of the MTT power supply (see Figure 12-5). Use the screws provided to fasten the bracket to the screw holes provided on the power supply. Position the bracket to allow mounting of the UTB board with the component side facing the rear of the MTT. Mount the UTB board to the bracket. Check to see that the board is flat. If the board is bowed, unscrew the upright portion of the bracket from the UTB and slightly twist each upright portion of the bracket away from the direction of the bow, and then screw the board to the bracket again. Repeat if required until the board no longer has a bow.

Assemble the 5 vdc supply to the bracket provided with the UTB kit. Mount the UTB power supply to the lower right rear of the MTT power supply with the transformer facing toward the rear of the MTT. Connect the ac input lines from the transformer with the black lead going to TB1-1 and the white lead to TB1-2. Connect the ground to the ground lug adjacent to the ac input plug on the bottom of the MTT power supply. Connect E1 and E2 of the UTB supply to E1 and E2, respectively, of the UTB board.

TRANSLATOR
POWER SUPPLY

TRANSLATOR
BOARD

POWER SUPPLY
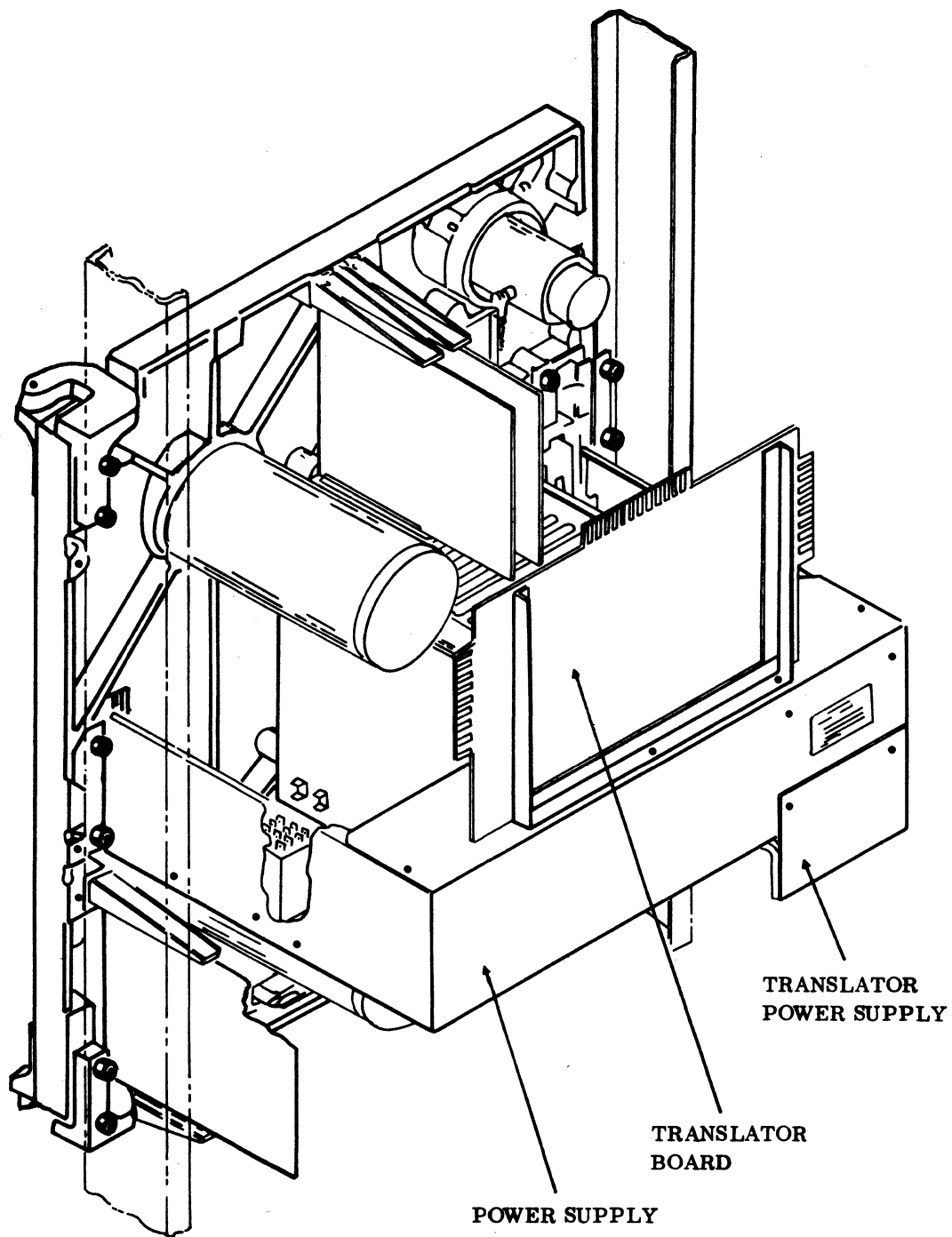
Figure 12-5. Translator Board Location

12.3.5 MTT CABLE INTERCONNECTION AND UNIT JUMPER

MTT unit assignment is determined by installing jumpers on the XA1 electronics cage assembly of the
MTT (see Table 12-3).

Table 12-3. MTT Unit Jumper Installation

UNIT	JUMPER	
0	Pin 17A	Pin 16A
1	Pin 18A	Pin 16A
2	Pin 19A	Pin 16A
3	Pin 20A	Pin 16A

Install a jumper between pins 15B and 14B at location XA4 of the electronics cage assembly. This
jumper enables the optional stop mode and is required if the universal translator board is used.

Locate the W1, W2, and W3 cable assemblies that are attached to the MTT power supply. Connect P1
of each of these cables to their respective mating connector on the MTT unit. The cables are color-
coded and keyed to prevent cross connections.

12.3.6 PRIMARY POWER INSTALLATION

Following satisfactory completion of the initial visual inspection, the unit is ready to power up and
check out. Apply primary power to the cabinet assembly and energize the circuit breakers in the
bottom rear of cabinet. Energize the MTT with the switch on the right-hand side of the tape deck under
the front door.

Perform the local/off-line tests listed in Sections 1 through 3.4 of the MTT field service manual.
Complete the checkout as designated in the manual.

12.3.7 MAGNETIC TAPE CONTROLLER AND P. E. FORMATTER

Unpack the magnetic tape controller and phase encoding formatter (if included) and associated cable
assemblies.

Inspect for and record any damage and/or missing parts.

Turn the power off on the CPU and install the tape interface card into slot 11. Install the upper data card into slot 14. On the Q-channel card, determine the equipment number depending on customer requirements, and install the jumpers on the board. See Figure 12-6 for jumper location. Determine customer DSA scanner position and install the proper jumper.

NOTE

No scanner jumper implies out.

See Section 1.6 for additional scanner jumpering information. Having positioned the jumpers, insert the card into slot 12. On the lower data card, determine customer requirements for the following selectable parameters and install the jumpers in the locations shown in Figure 12-7.

- Protect — There is a position for each tape unit. If the jumper is installed, it means that the unit is a protected device.

- Speed — There is a position for each tape unit. If the jumper is installed, it means that the unit is a high-speed or 50 ips unit.

- Modulation — There is a position for each tape unit. If the jumper is installed, it means that phase encode is selected. NRZI is selected if the jumper is out. If the phase encode jumper is installed, the corresponding unit must be jumpered for 9-track and not dual mode operation. See Table 12-4 for legal jumper settings.

- Mode — There is a position for each tape unit. A jumper in means dual mode (800/1600 bpi) has been selected. A jumper out means single mode has been selected. If dual mode is selected, the corresponding MTT unit must be jumpered for 9-track and not for phase encode. See Table 12-4 for legal jumper settings.

- Track — There is a position for each tape unit. A jumper in selects 9-track. See Table 12-4 for legal jumper settings.

Install the desired jumpers and insert the lower data board into slot 13.

If the phase encoding formatter is provided, install these boards into slots 8, 9, and 10. See Figure 12-1 for proper slot locations.

Table 12-4. Legal Track, Mode, and Modulation
Jumper Selection

TRACK	MODE	MODULATION	DENSITY
7 out	Out	Out	556/800 bpi
9 in	Out	Out	800 bpi
9 in	Out	In	1600 bpi
9 in	In	Out	800/1600 bpi

EQUIPMENT SELECT SCANNER SELECT
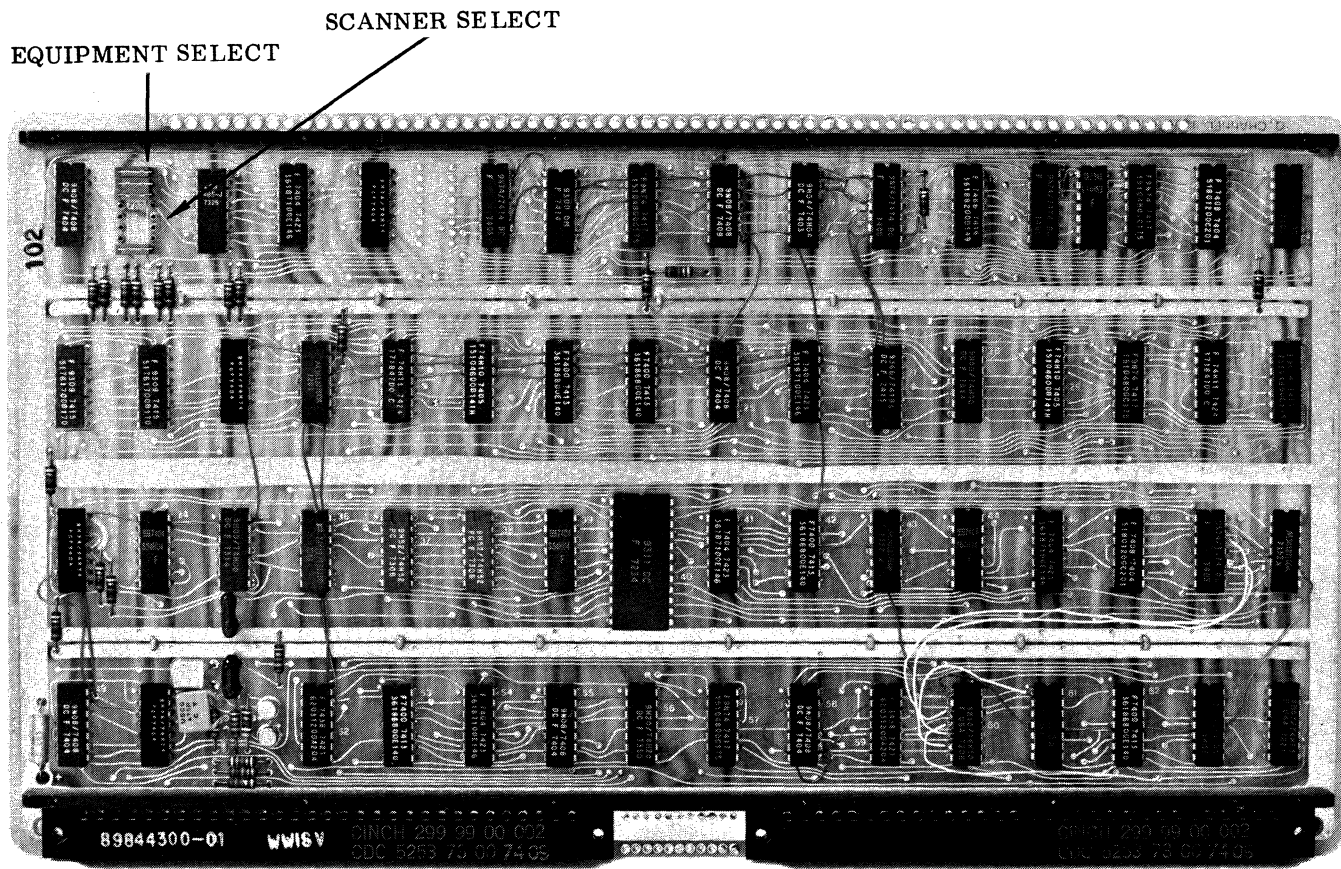
NOTES: 1. Q-BIT JUMPER IN SELECTS THE BIT.
2. SCANNER JUMPER IN SELECTS THE SCANNER POSITION.

Figure 12-6. Q-Channel Equipment Number and Scanner Jumper Location

PROTECT SELECT   SPEED SELECT   MODULATION SELECT   TRACK SELECT   MODE SELECT
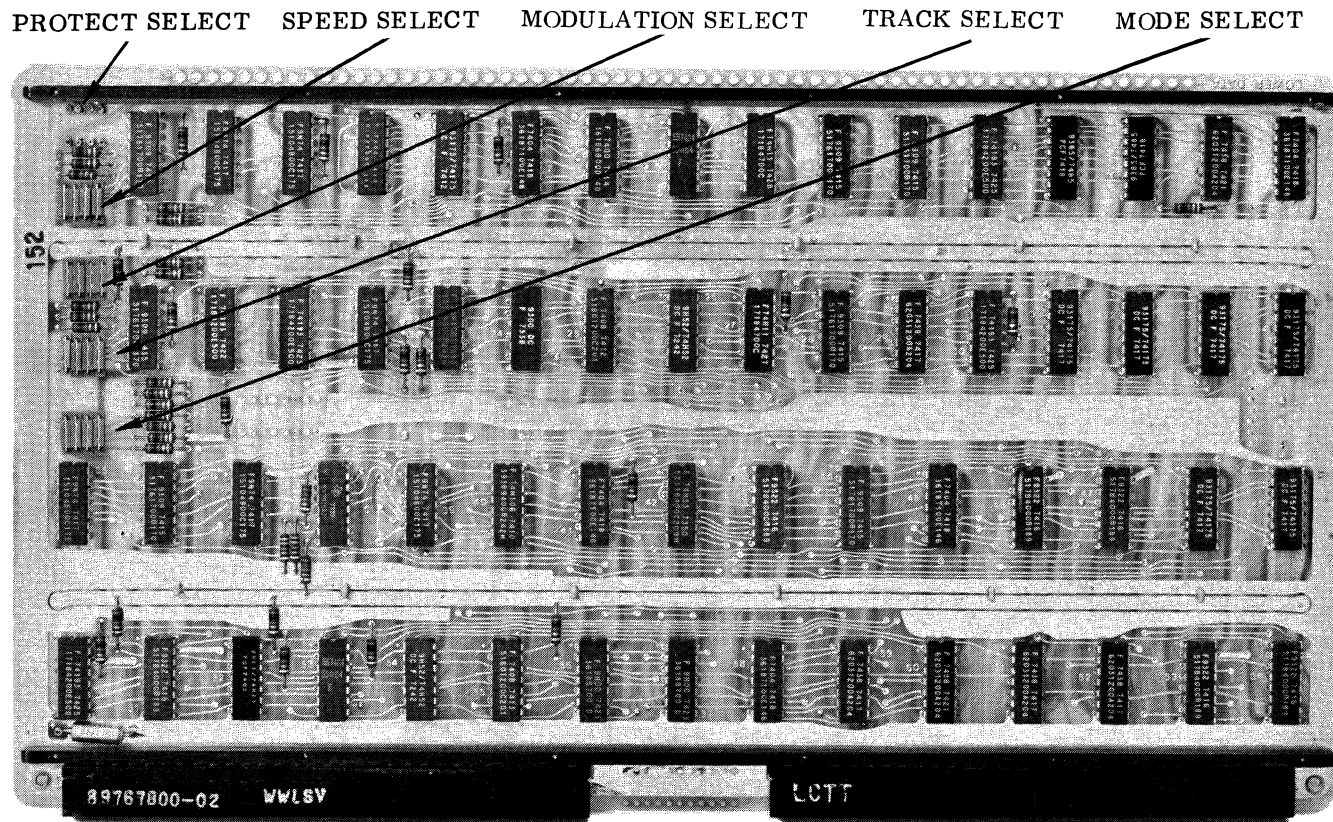
NOTES: 1. JUMPER POSITIONS APPLY TO INDIVIDUAL UNITS 0 THROUGH 3.
2. PROTECT JUMPER IN = UNIT IS PROTECTED.
3. SPEED JUMPER IN SELECTS 50 IPS; SPEED JUMPER OUT SELECTS 25 IPS.
4. TRACK JUMPER IN = 9-TRACK; TRACK JUMPER OUT = 7-TRACK.
5. MODULATION JUMPER IN = P. E; MODULATION JUMPER OUT = NRZI.
6. MODE JUMPER IN = DUAL MODE (800/1600 BPI); MODE JUMPER OUT = SINGLE MODE.

Figure 12-7.   Protect, Speed, Mode, Track, and Modulation Jumper Locations

12.3.8 INTERNAL CABLES

Remove the back cover of the CPU. If a battery pack is part of the system, record where the battery leads connect to the CPU before removal. Install an internal cable assembly between J14 P2 and the chassis I/O connector panel. Use four No. 4-40 screws and nuts to mount the 66-pin continental connector to a convenient location on the CPU I/O connector panel. Repeat the procedure for a second internal cable assembly between J11 P2 and the CPU I/O connector panel. Record these positions on the card position assignment sheet.

12.3.9 INTERRUPT CABLE

Install the interrupt jumper between J12 P2 A16 and the desired interrupt level on slots J25/J26 of the CPU. Interrupt No. 7 is normally assigned to the MTT; thus the jumper should go to J25 P1 B05 for most systems. See Section 1.3.1 for alternate interrupt assignments. The magnetic tape controller provides only a common interrupt output.

12.3.10 EXTERNAL CABLE

The external cable is constructed as a double cable assembly with two continental connectors on one end and three Elco connectors on the MTT end. Connect the continental connector labeled Tape Interface to the I/O connector going to J11 P2. Connect the connector labeled Upper Data to the I/O connector going to J14 P2. Route the MTT end of the external cable assembly to the universal translator board mounted on the power supply of the nearest MTT. The three connectors on the MTT end are labeled J1, J2, and J3. Install the connectors on the corresponding J1, J2, and J3 card edge connector on the universal translator board. See Figure 12-8.

NOTE

The connectors do not contain a key; thus it is possible
to mount the connectors incorrectly. Ensure that the
letter side of the connectors mates with the pins on the
logic side of the boards. The numerical side of the
connectors mates with the pins on the clad side of the
board.

Install one of the two-foot ribbon cable assemblies from J4 of the universal translator board to the upper set of 14 pins of XA1 on the backplane of the first MTT (see Figure 12-8). If the first MTT is a 7-track NRZI unit, install the second two-foot cable from J5 of the UTB to the upper pins of XA10 of the MTT. If the first MTT is a 9-track, dual-mode unit, install the second cable from J5 of the UTB to the upper pins of XA6 on the MTT. XA6 may require keying to mount the connector. If not keyed, carefully cut off half of XA6 pin A1 and XA6 pin A14 and mount the connector. For subsequent transports, install the ribbon cable assemblies from J1 and J2 of the first transport to XA1 and XA10 (for the 7-track NRZI MTT) or to XA6 (for the 9-track dual-mode MTTs), respectively, of the second transport. Follow the same procedure for the third and fourth units, if required.
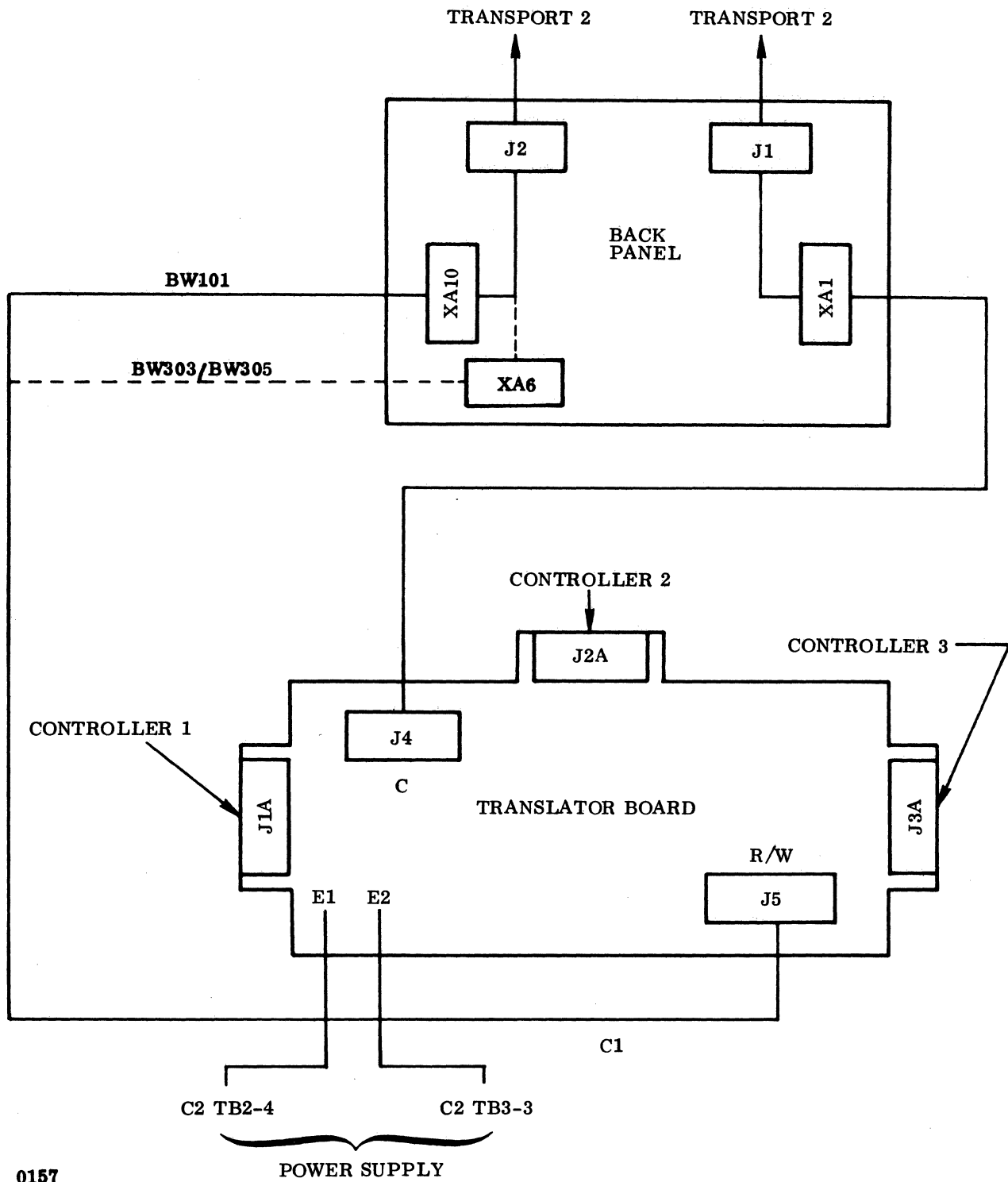
Figure 12-8. Magnetic Tape Transport Translator Intercabling

12.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Apply power to the CPU. Apply power to the expansion enclosure (if it is part of the system) after the CPU has been powered up. Use a VOM or DVM to measure the presence of +5V ± 0.2 vdc on test point 63 of each controller card.

The tape power on and local alignment checks should have been completed in accordance with the magnetic tape transport field service manual. If not, complete the tape alignment procedures before proceeding with the diagnostic checkout.

12.5 DIAGNOSTIC CHECKOUT

12.5.1 SMM TESTING

Load SMM17 Version 3.1-2 Monitor into the CPU. At BUILD TEST LIST, call up PETO4B (Magnetic Tape Test No. 4B). Set up the test parameters as in Table 12-5. Ensure that the MTTs to be tested have tapes with mounted write rings, have assigned unit numbers, and have been made ready. Refer to the SMM17 manual for further details on setting the SMM and test parameters and for a description of errors in the event of failures during test.

Table 12-5. Magnetic Tape Controller SMM17 Parameter Set-Up

TEST STOP	CONTENTS OF A	CONTENTS OF Q
1st	4B41 Test ID	STJP Typically 0241 or 024D
2nd	U0, U1, Unit select U2, U3	U4, U5, Unit select. Should be equal to 0000 U6, U7 since this system can have only units 0 through 3

3rd	03FF Test sections	0UVW Interrupt lines
		    U = Alarm interrupt
		    V = Data interrupt
		    W = EOP interrupt
		    0777 for interrupt 7 assignment

4th	WESF Equipment
	    address
	    (typically 0381)
		A/Q-DSA I/O select
		0000 A/Q
		0002 DSA

The following is the format for each four-bit character representing U0, U1, U2, and U3 of unit select. SMM will display these bits in accordance with the existing status of each MTT upon test initialization.

2^0 = Select this unit for test (unit is ready and has write enable set).

2^1 = Selected unit is protected.

2^2 = Selected unit is nine-track.

2^3 = Selected nine-track unit is to be tested in phase encode mode.

Example: Stop A2

A2 = 135D = Units 0 through 3 are to be tested.

Unit 0 = Seven-track and ready for test. (1)

Unit 1 = Seven-track and protected and ready for test. (3)

Unit 2 = Nine-track and ready for test. (5)

Unit 3 = Nine-track and phase encode mode and ready for test. (D)

If bit 0 of the respective unit select parameter character is not set, the test will not attempt to exercise that transport.

12.5.2 SCMM TESTING

To perform SCMM testing, MSOS must include the SCMM routines and the MSOS on-line monitor must be loaded into the CPU. The magnetic tape test may be requested through the MSOS monitor (see Table 12-6).

12.6 MULTIPLEX TESTING

The purpose of multiplex testing is to simulate system operation. Tests will be loaded sequentially, set into operation simultaneously, and run with status or interrupt synchronization.

12.6.1 SMM

The magnetic tape test may be multiplexed with the following tests:

● Command Test No. 1

● MDC Test No. 7A

● Magnetic Tape Test No. 15

- Magnetic Tape Test No. 4B

- Line Printer Test No. C

See Section 1.7.1 for multiple test loading information.

Table 12-6. Magnetic Tape SCMM Parameter Set-Up

OPERATOR ENTRY SCMM REPLY	COMMENTS

Press MANUAL INTERRUPT
 	
    MI
SCMM (CR)
 	
    SCMM IN
    CONTROL, TEST ID
SRT, MTT (CR)
 	
    BEGIN MAG TAPE TEST
    SECTIONS, NO OF RECORDS,
    RUNS
x, y, z (CR)
 	
    DLU, DENSITY
LU Tape 1, Density (CR)
LU Tape 2, Density (CR)
LU Tape 3, Density (CR)
LU Tape 4, Density (CR)
FFFF (CR)
 	
    SPECIAL PATTERN FOR
    TEST 2
xxxx (CR)
	For example, 3F, 200, 4
	
	LU tape 1 = MSOS assigned
	              logical unit for tape
	              0, etc.
	
	Density = 556, 800, or 1600,
	           depending on unit
	           under test

12.6.2 SCMM

SCMM multiplex testing may be performed utilizing all equipments on the system provided that there is an SCMM test for the respective device, the device is included in the MSOS logical unit table, and the interrupt priority is set up correctly. See Section 1.7.2 for multiple test loading examples. To multiplex SCMM tests, use the call-up procedure outlined in the sections pertaining to the equipment to be tested.

12.7 VOLTAGE MARGIN TESTING

This is an EPS requirement and will be utilized on all SYSTEM 17 systems.

Logic voltage margins on the MTT controller should be performed to fulfill the on-site EPS installation requirements. SCMM and SMM tests should be run satisfactorily at the various voltage settings noted in Section 2.7. Tests at all voltages, including Vss, should be run.

The magnetic tape transport dc supplies are not adjustable. It is recommended that measurements of the MTT logic voltages be made in accordance with Table 2-4 of the minimum performance standards test in the magnetic tape transport field service manual. It is recommended that voltage margins not be run on the MTT units.

12.8 TEST/MAINTENANCE AIDS

The following tests and maintenance aids are intended to assist in the initial alignment of the tape units in conjunction with the alignment procedures outlined in the MTT Maintenance Manual.

12.8.1 SKEW ALIGNMENT

On the 7-track NRZI MTT no program is required. Load the standard alignment tape, use the FWD/REV in the transport to move the tape, and follow the procedure in the maintenance manual.

On the 9-track dual-mode MTT, the following program is required to set the unit to NRZI in the forward direction. Mount the alignment tape and make the unit ready. Initialize the program and follow the procedure in the maintenance manual. At the end of the tape or to change to reverse, depress the CLEAR switch and create a reverse drive condition with the switch provided in the card cage of the unit. Adjust FWD/REV read skew potentiometers for each channel. Fine tuning may be obtained by using TP13 on XA7 of the 7-track NRZI unit or TP19 on XA7 of the 9-track dual-mode unit and adjusting late/early data channels to produce the smallest possible pulse width. A pulse width of two microseconds or less is ideal. Note the acceptable tolerance in the maintenance manual.

The program to do the dual-mode alignment using alignment tape is as follows:

XXX0	0B00	
XXX1	E000	
XXX2	(WESF)	Typically 0382
XXX3	C000	
XXX4	040D	Unit select (unit 0, 800 bpi, binary character)
XXX5	0B00	
XXX6	03FE	
XXX7	0DFE	

XXX8	C000	
XXX9	0100	
XXXA	0B00	
XXXB	03FE	
XXXC	0000	Run with SELECTIVE STOP switch on
	FFFF	

12.8.2 NRZI READ—AFTER—WRITE SKEW/GAIN ALIGNMENT

Load the following program and mount the scratch tape on the unit. Initialize and follow the procedures in the maintenance manual for write skew alignment and gain alignment.

XXX0	0B00	
XXX1	E000	
XXX2	(WESF)	Typically 0382
XXX3	C000	
XXX4	040D	Unit select change for desired unit
XXX5	0B00	
XXX6	03FE	
XXX7	0DFE	
XXX8	C000 ·	
XXX9	0080	
XXXA	0B00	
XXXB	03FE	
XXXC	0DFE	
XXXD	0AFF	
XXXE	0B00	
XXXF	03FE	
XX10	0000	SELECTIVE STOP switch is down to test; up to terminate
XX11	18FC	

12.8.3 START/STOP TIME ADJUST

Use the following program for adjusting start/stop time. Using the switch as described in the MTT maintenance manual does not produce the best results. This program allows more accurate adjustment. Use the procedure as outlined in the maintenance manual, except the program will exercise the start/stop circuits instead of the switch.

XXX0	0E00	
XXX1	E000	
XXX2	(WESF)	Typically 0382
XXX3	C000	
XXX4	040D	Unit select — Change to desired unit
XXX5	0B00	
XXX6	03FE	
XXX7	0DFE	
XXX8	C000	
XXX9	0100	
XXXA	0B00	
XXXB	03FE	
XXXC	C000	
XXXD	2000	
XXXE	09FE	
XXXF	0101	
XX10	18FD	
XX11	0A01	
XX12	0B00	
XX13	03FE	
XX14	C000	
XX15	2000	
XX16	09FE	
XX17	0101	
XX18	18FD	
XX19	18E7	

Use the program in Section 12.8.2 to create a tape of all ones for several feet of tape (200 to 300 feet). Rewind the tape and initialize the above program. Sync on XA4-TP3 and observe the test point as outlined in test reference 4b in the MTT maintenance manual. (Any data bit position will produce the desired picture on the analog test point of the data channel.)

Adjust the potentiometers as outlined in test references 4a and 4b in the MTT maintenance manual.

12.8.4 PHASE ENCODE GAIN ADJUST

Use the following program to establish phase encode and adjust gains according to maintenance manual procedures. First do the following:

1. Load cells 2000 through 4000 with FFFF.

2. Load cell 1FFF with 4000.

The program is as follows:

XXX0	0B00	
XXX1	E000	
XXX2	(WESF)	Typically 0382
XXX3	C000	
XXX4	0464	Unit select — 1600 bpi, unit 0, analog/digital mode
XXX5	0B00	
XXX6	03FE	
XXX7	0D01	
XXX8	C000	
XXX9	1FFF	
XXXA	0B00	
XXXB	03FE	
XXXC	0DFD	

The A/Q-DSA channel adapters provide the CPU with the capability of communicating with the CDC standard 1700 product line.

The A/Q channel adapter is a two-card device that requires any two A/Q card positions of the CPU or the expansion enclosure. It includes an integral 61-pin A/Q cable interface, an interrupt interface for 15 external interrupts, and a power supply assembly, all of which are located in a cabinet-mounted enclosure.

The DSA channel adapter is a two-card device that requires any two DSA slots of the CPU or expansion enclosure and is used in conjunction with the A/Q channel adapter. It includes a 61-pin cable interface that is mounted in the A/Q channel adapter panel assembly.

A block diagram of the A/Q-DSA channel adapter is shown in Figure 13-1.
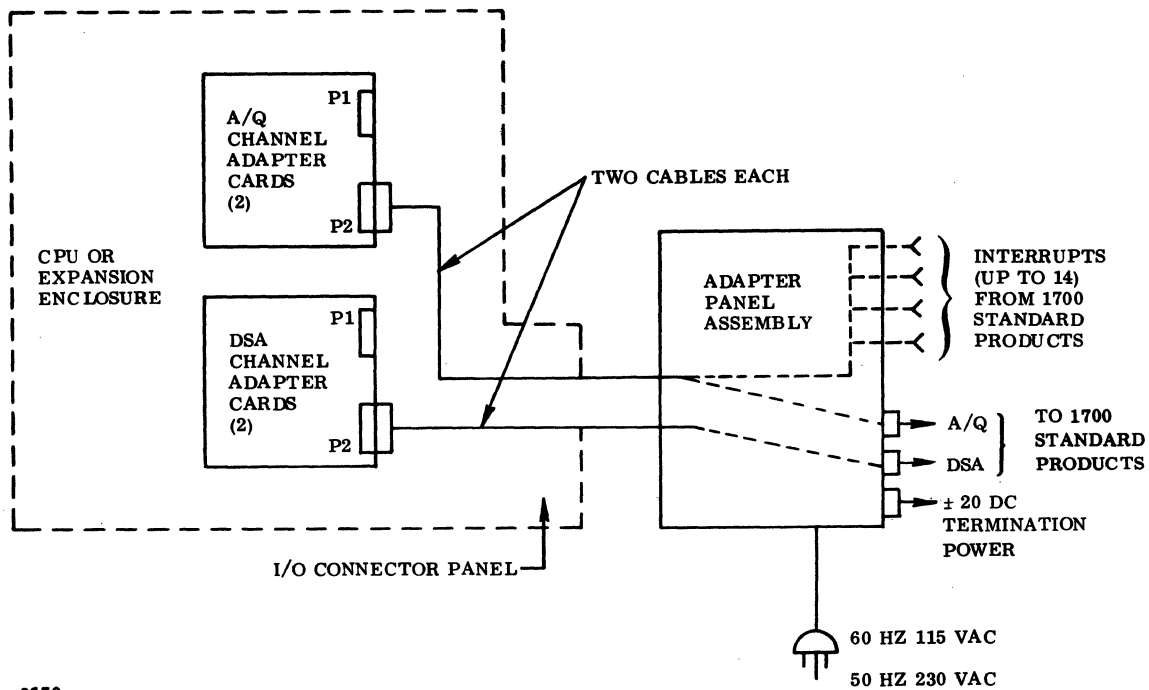
0150

Figure 13-1. Block Diagram of A/Q-DSA Channel Adapter

13.1 APPLICABLE DOCUMENTS

The following list of publications relates to the A/Q-DSA channel adapter. Documents with asterisks (*) are required for installation and maintenance of the A/Q-DSA channel adapters.

Title	Publication No.
1700 A/Q-DSA Adapters Hardware Reference/ Customer Engineering Manual (*)	39392700
Installation Instructions for Pedestal Cabinet	88947700

13.2 REQUIRED PARTS

The following parts are included in the basic CPU:

	Product No.	Equipment No.
A/Q channel adapter	1785-3	DC220-B/C
A/Q channel adapter card assembly (3SUT)		
A/Q channel adapter card assembly (3SVT)		
Jumpers, interrupt (20)	88868900	
Terminator assemblies (two)	30001201	
Terminator cable assembly	38927912	
Terminator power supply, Acopian 50/60 Hz, 115 vac	39397000	
Terminator power supply, Acopian 50 Hz, 230 vac	39396900	

The DSA channel adapter requires the following parts:

	Product No.	Equipment No.
DSA channel adapter	1785-4	DC221-B/C
DSA channel adapter card assembly (3SWT)		
DSA channel adapter card assembly (3SXT)		
Interface harness cable assembly	88944300A	
Terminator assemblies (two)	30001201	

Miscellaneous equipment required for installation and checkout of the A/Q DSA channel adapters is as follows:

<table>
<tr><td></td><td>Part No.</td></tr>
<tr><td>Mounting hardware, cabinet enclosure (see installation instruction for this enclosure)</td><td>88947700</td></tr>
<tr><td>Mounting hardware for desk/table top enclosure (see installation instructions for this enclosure)</td><td>88947700</td></tr>
<tr><td>Cable assembly, 61-pin†</td><td>103539xx</td></tr>
<tr><td>Cable assembly, interrupt†</td><td>38808812</td></tr>
</table>

13.3   INSTALLATION

13.3.1   A/Q-DSA CHANNEL ADAPTER

1. UNPACKING AND CHECKOUT. Remove the A/Q-DSA channel adapter from its shipping package. Inspect for and record any damage and/or missing parts. Order missing parts from the responsible division.

2. INSTALLATION. Turn the power off on the expansion enclosure first, if it is part of the system. Then turn the power off on the CPU. Install the two A/Q channel adapter boards into customer-specified A/Q slots of the CPU or the expansion enclosure. Install the DSA channel adapter boards in designated DSA slot positions adjacent to the A/Q channel adapter boards. Record these positions on the card placement assignment sheet in the site log.

13.3.2   A/Q CHANNEL ADAPTER PANEL ASSEMBLY

The adapter panel assembly is designed to be installed in the below-table CPU enclosure. However, the unit may also be mounted in a cabinet, mini cabinet, or table/desk top enclosure.

13.3.2.1   IN CABINET/MINI CABINET

Install a short horizontal strut between the rear strut mounting rail of the cabinet and the vertical mounting rail at the front of the cabinet. See Figure 13-2 for the proper dimensions. The adapter panel assembly is then installed on the horizontal struts as in Figure 13-2. Ensure that the logic cables from the power supply assembly will reach the backplane of the CPU or the expansion enclosure with enough slack to allow the adapter panel assembly to swing outward to the rear of the rack.

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† These assemblies are supplied with 1700 peripherals.

EXPANSION ENCLOSURE
OPTIONAL LOCATION

A/Q ADAPTER
PANEL ASSEMBLY

NEW SHORT STRUT

32-1/2 IN.

Y

CPU

A/Q

X

X

EXISTING STRUT

NEW SHORT STRUT
(OPTIONAL MOUNTING)

EXPANSION ENCLOSURE
NORMAL LOCATION

OPTIONAL
CABLE
ROUTING

OPTIONAL PANEL
ASSEMBLY MOUNTING

EXISTING MOUNTING RAIL
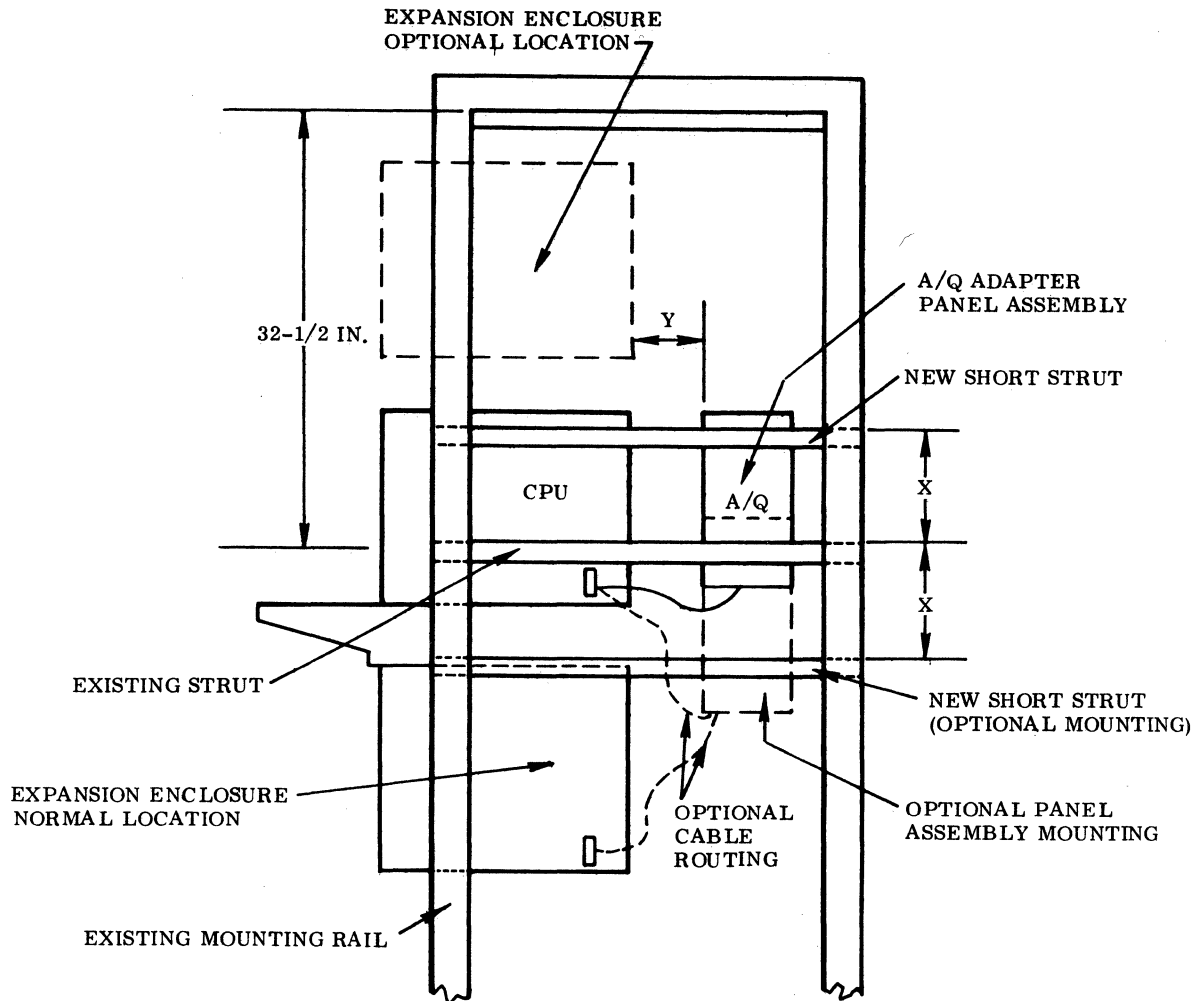
NOTES: 1. DIMENSION X IS REQUIRED TO MOUNT THE ADAPTER PANEL ASSEMBLY SO THAT IT SWINGS FREELY.

2. DIMENSION Y IS DEPENDENT UPON THE LENGTH OF THE CABLE FROM THE ADAPTER PANEL ASSEMBLY TO THE CPU OR EXPANSION ENCLOSURE BACKPLANE. ALLOW SUFFICIENT CLEARANCE BETWEEN THE CPU OR EXPANSION ENCLOSURE AND THE PANEL ASSEMBLY FOR REMOVAL OF THE CPU OR EXPANSION ENCLOSURE.

3. USE THE SAME TECHNIQUE WHEN INSTALLING THE ADAPTER PANEL ASSEMBLY IN THE MINI CABINET. IF THERE IS NO MIDDLE STRUT, THE X-DIMENSION MUST BE MEASURED DOWN FROM THE TOP EXISTING STRUT OF THE MINI CABINET.

Figure 13-2. A/Q-DSA Channel Adapter Installation in Cabinet/Mini Cabinet

13.3.2.2 IN BELOW-TABLE ENCLOSURE

The A/Q channel adapter panel assembly is mounted in the below-table enclosure according to the installation instruction for the below-table enclosure.

13.3.2.3 IN TABLE/DESK-TOP ENCLOSURE

The A/Q adapter panel assembly is mounted in the table/desk top enclosure according to the installation instruction for this enclosure.

13.3.3 A/Q-DSA CHANNEL ADAPTER CABLE

Route the 62-pin backplane cable assemblies from the A/Q channel adapter panel assembly to the backplane of the CPU or the expansion enclosure. The cables may be routed through openings in the I/O connector panel or through a cable access port between the back cover of the CPU, the expansion enclosure, and the unit itself. Connect the cables according to Table 13-1. If a DSA channel adapter is included, its cable assembly will have to be installed in the adapter panel assembly.

Table 13-1. A/Q-DSA Channel Adapter Intercabling

CABLE	CONNECTION	CARD POSITIONS	PART OF
J01 J02	Routes 1700 A/Q channel to CPU A/Q bus	JUP2 (3SUT slot) JVP2 (2SVT slot)	A/Q channel adapter
J03 J04	Routes 1700 DSA channel to CPU bus	JWP2 (3SWT slot) JXP2 (3SXT slot)	DSA channel adapter
NOTE: JU, V, W, and X are assigned card positions for the A/Q-DSA boards			

13.3.4 50 Hz/60 Hz MODIFICATION

The A/Q channel adapter is normally configured as a 60 Hz unit. To configure the A/Q channel adapter for 50 Hz 230 vac operation, it is necessary to remove the cover from the adapter panel assembly. Reconfigure the inputs to the power supply regulator assembly as in Figure 13-3. Remove the red wire from the spade connector and install it on the adjacent empty spade connector. Remove the orange wire and install it on the adjacent empty spade connector. The red and orange wires should now share a common connection on the regulator assembly.

13.3.5 PRIMARY POWER INSTALLATION

The A/Q channel adapter requires 50 Hz/60 Hz 120 vac. The primary power is obtained from the power distribution assembly of the CPU enclosure. If a power distribution assembly is used, ensure

that the line, neutral, and ground leads are installed in the respective output terminals of TB01. The terminals used should be the same as those used to supply power to the chassis (CPU or expansion enclosure) that houses the adapter assembly.
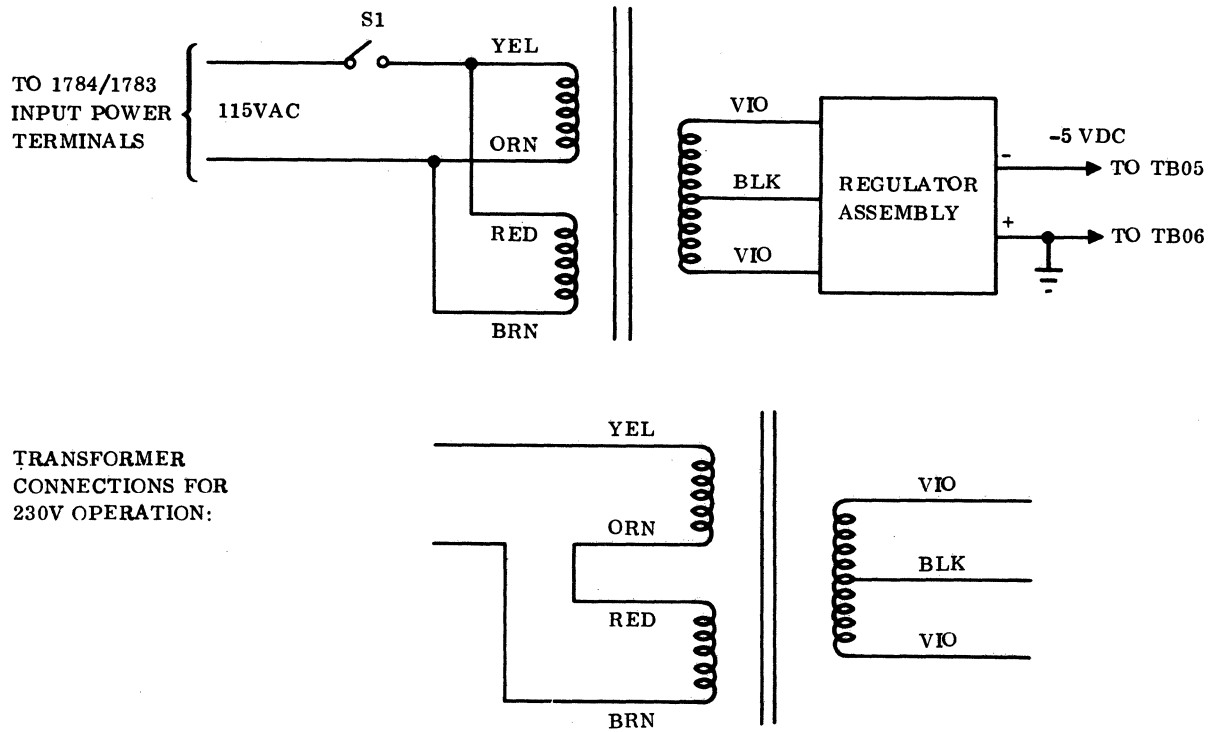
Figure 13-3. A/Q Channel Adapter 50 Hz/60 Hz Conversion Schematic

13.3.6 TERMINATION POWER SUPPLY

A termination power supply is required when the A/Q-DSA channel adapter is installed in the system. Two types of power supply assemblies are available. The first type (Part No. 39397000) is a 50 Hz/ 60 Hz 115 vac cabinet-mounted supply. The other power supply assembly (Part No. 39396900) is identical to the previous supply but requires 230 vac 50 Hz. The male connector of the primary power cord of these units may have to be changed to mate with the customer power source.

There are two CDC corporate standard termination power supplies (Part No. 52397700 60 Hz, and Part No. 52397700 50 Hz). These are floor, shelf, or wall mounted units. These units do not have primary power cords and must be connected to the customer power source via a three-conductor power cord capable of handling 15 amps.

In some cases a terminator power supply may already exist at the site. The terminator power should be routed to the power distribution panel input terminals TB01-18(+) and TB01-19(-). Install the terminator cable assembly from TB01-21(+) and TB01-20(-) to J52 of the A/Q channel adapter panel assembly.

13.3.7 EXTERNAL CABLE

Install the 61-pin cables from the standard 1700 product line equipment(s) to the respective A/Q or DSA connectors on the A/Q-DSA channel adapter panel in the following manner:

A/Q data - J40

A/Q add - J41

DSA data - J54

DSA add - J55

The A/Q-DSA channel adapters will accept 14 external interrupts from external equipments. These interrupts connect to the A/Q channel adapter power supply assembly as shown in Table 13-2. The interrupts are routed through the J01/J02 cables to the A/Q channel adapter boards. The interrupts are then routed from P1 of the assigned A/Q card positions to the CPU interrupt inputs as shown in Table 13-2. Figure 13-4 shows the routing of a typical interrupt configuration.

Table 13-2. A/Q Channel Adapter Interrupt Cable Assignment

A/Q CHANNEL ADAPTER INPUT	INTERRUPT NO.	Jx/y ASSIGNMENT	CPU INPUT
J42	2	Jx P1 B24	J25 P1 A07
J43	3	Jy P1 B24	J25 P1 B07
J44	4	Jx P1 B25	J25 P1 A05
J45	5	Jy P1 B25	J25 P1 A06
J46	6	Jx P1 B26	J25 P1 B06
J47	7	Jy P1 B26	J25 P1 B05
J48	8	Jx P1 B27	J26 P1 A10
J49	9	Jy P1 B27	J26 P1 B10
J50	10	Jx P1 B28	J26 P1 A07
J51	11	Jy P1 B28	J26 P1 B07
J56	12	Jx P1 B30	J26 P1 A05
J57	13	Jy P1 B30	J26 P1 A06
J58	14	Jx P1 B31	J26 P1 B06
J59	15	Jy P1 B31	J26 P1 B05

NOTES: 1. Jx nn nnn = 3SUT card position

2. Jy nn nnn = 3SVT card position
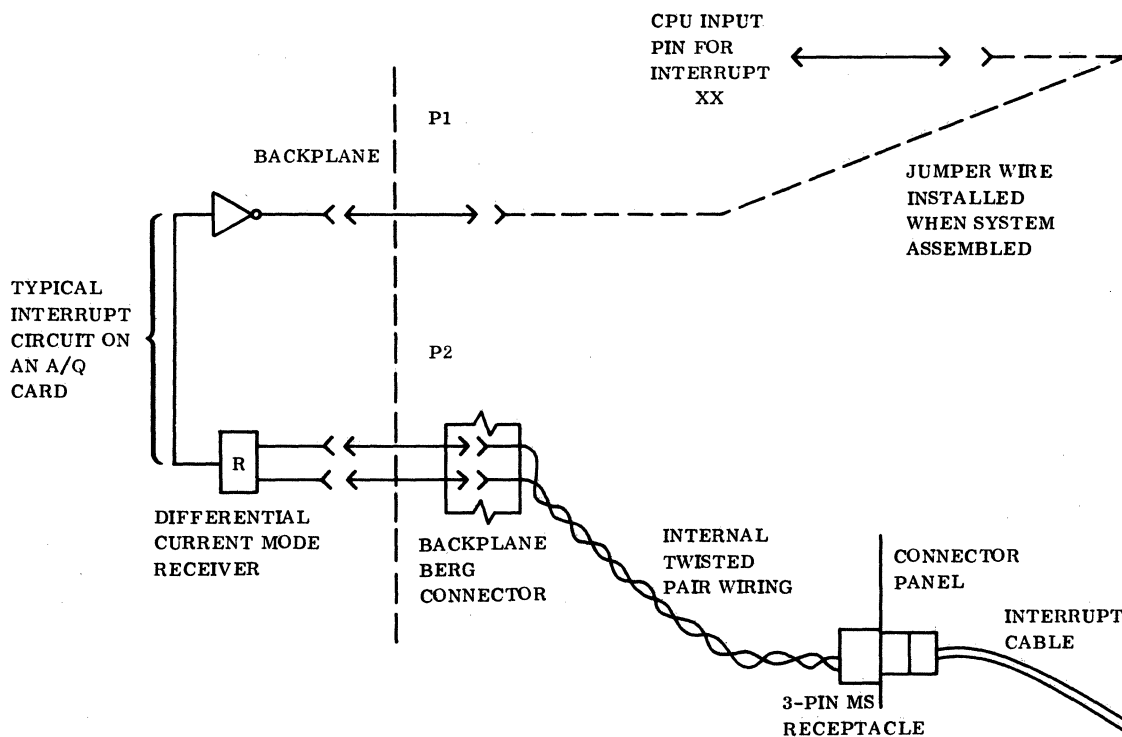
Figure 13-4. A/Q Channel Adapter Interrupt Routing

13.3.8 DSA SCANNER CONSIDERATION

The DSA channel adapter does not occupy a position on the DSA scanner but only passes it through the device to service external equipments on the DSA channel.

Ensure that Jx P1 B19 (3SWT card position) is jumpered to Scan Forward Out from the previous DSA device. Jx P1 B16 must be jumpered to the Scan Return In of the previous device. Refer to Section 1.6 for more details on installing SYSTEM 17 scanner jumpers.

13.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Power up the CPU first and then the expansion enclosure, if it is part of the system. Apply power to the terminator power supply. Apply power to the -5 vdc power supply in the A/Q channel adapter power supply assembly.

To ensure that all voltages are correct, measure these voltages at the points designated in Table 13-3 and adjust if necessary.

Table 13-3. A/Q-DSA Channel Adapter Volt TP/ADJ

VOLTAGE	TEST POINT	ADJUSTMENT
+5 vdc	TP63 of both A/Q and DSA channel adapter cards	CPU/expansion enclosure power supply (on door assembly)
-5 vdc	TP39 - 3SVT, 3SUT TP58 - 3SWT, 3SXT	A/Q channel adapter power supply assembly
+20 vdc	P2 B3 of the A/Q-DSA channel adapter card position	Terminator power supply
-20 vdc	P2 B31 of the A/Q-DSA channel adapter card positions	Terminator power supply

A self check of the A/Q-DSA channel adapter may be accomplished by use of the procedure outlined in the A/Q-DSA channel adapter customer engineering manual.

13.5 DIAGNOSTIC CHECKOUT

The A/Q channel adapter is a passive device and serves as an extension of the internal CPU A/Q-DSA bus to the 1700 standard product line A/Q-DSA channels. No specific test is applicable to the device. Therefore the device may be most effectively checked out by use of existing SMM17 or SCMM tests. Load and run SMM17 or SCMM tests on the standard 1700 equipments that interface with the A/Q-DSA channel adapter. Refer to the respective manuals for details in setting parameters and running the specific tests.

13.6 VOLTAGE MARGIN TESTING

This is an EPS requirement for on-site installations and may be utilized if problems occur that cannot be isolated via standard diagnostics. Perform voltage margin testing per the procedure outlined in Section 2.7. If both A/Q and DSA adapters are installed, both Vcc and Vss should be varied while running diagnostics on the devices that interface to the adapter.

The PROM boostrap loader is a one-card device that loads its contents into the CPU memory. It can be installed in a CPU or expansion enclosure DSA card position. The 50-PAK board assembly contains 256 words by four-bit bipolar programmable read only memory arrayed in a four-by-four matrix. The board assembly also contains the necessary supporting control logic circuitry.

The standard PROM contains a total of eight standard bootstrap programs and one set protect bit (SPB) program. The SPB program consists of three subprograms. The first subprogram sets protect bits throughout memory, the second checks the checksum of itself and of the selected bootstrap program, and the third initializes the selected bootstrap program.

The eight standard bootstrap programs include six SMM17 bootstrap loaders (1731/32 and 601/608, 1732/609, 1712/13, 1721/1777, 1726/405, and 1728/430) and two 1733-2/856 service routines (write address tags and write data).

14.1 APPLICABLE DOCUMENTS

The following document is required for installation and maintenance of the PROM bootstrap loader.

CDC Publication	Publication No.
PROM Bootstrap Loader Customer Engineering Manual	88943600

14.2 REQUIRED PARTS

	Product No.	Equipment No.
PROM Bootstrap Loader	10337-1	BU162-A

14.3 INSTALLATION

1. UNPACKING AND CHECKOUT. Remove the PROM from its shipping package. Inspect for and record any damage.

2. PRELIMINARY SET-UP. The PROM is capable of providing various functions for the user. To select these functions, optional jumpers must be installed or removed on the board assembly and on the CPU or expansion enclosure backplane. Refer to Figure 14-1 for the board jumper locations. The PROM utilizes hardwire jumpers that must be soldered when installed. Consider these configurations carefully to make sure they will not conflict with the system operation. See Table 14-1 for PROM general jumper assignments.

Table 14-1. PROM General Jumper Assignment

JUMPER	PLACEMENT	FUNCTION
512F	In	Indicates that PROM contains up to 512 words
1024F	In	Indicates that PROM contains up to 1024 words
Jx P2 A05 (Signal) Jx P2 A03 (Ret)	The signal is routed via twisted pair wiring to the remote station.	Enables remote loading of PROM if all other jumpers are configured correctly. Shorting these signals via a switch or control with a gate at the source activates this signal.
NOTE: Jx = The assigned card slot		

3. JUMPER CONFIGURATION FOR AUTOMATIC LOADING WHEN POWER IS APPLIED TO THE SYSTEM. This function will be initiated when either the console power switch is turned on or the main power switch is turned on. (The console switch is already on.) As such, it will override the CPU memory hold and auto-restart feature and will destroy any existing auto-restart program. See Table 14-2 for jumper assignments for automatic loading when power is applied.

JUMPER OUT ENABLES
LOADING OF SPB PROGRAM

SELECTS CONSOLE
OR LOCAL/MANUAL
AUTOLOAD

MANUAL/LOCAL
AUTOLOAD

SELECTS SPECIFIC PROGRAM
FROM CONTENTS

JUMPER OUT
ENABLES
CLEAR CORE
SEQUENCE

JUMPER OUT ENABLES
POWER UP START MODE

JUMPER IN INDICATES PROM
CONTAINS UP TO 1024 WORDS

JUMPER IN INDICATES PROM
CONTAINS UP TO 512 WORDS

DETERMINES WHERE SELECTED
PROGRAM LOADS INTO CORE
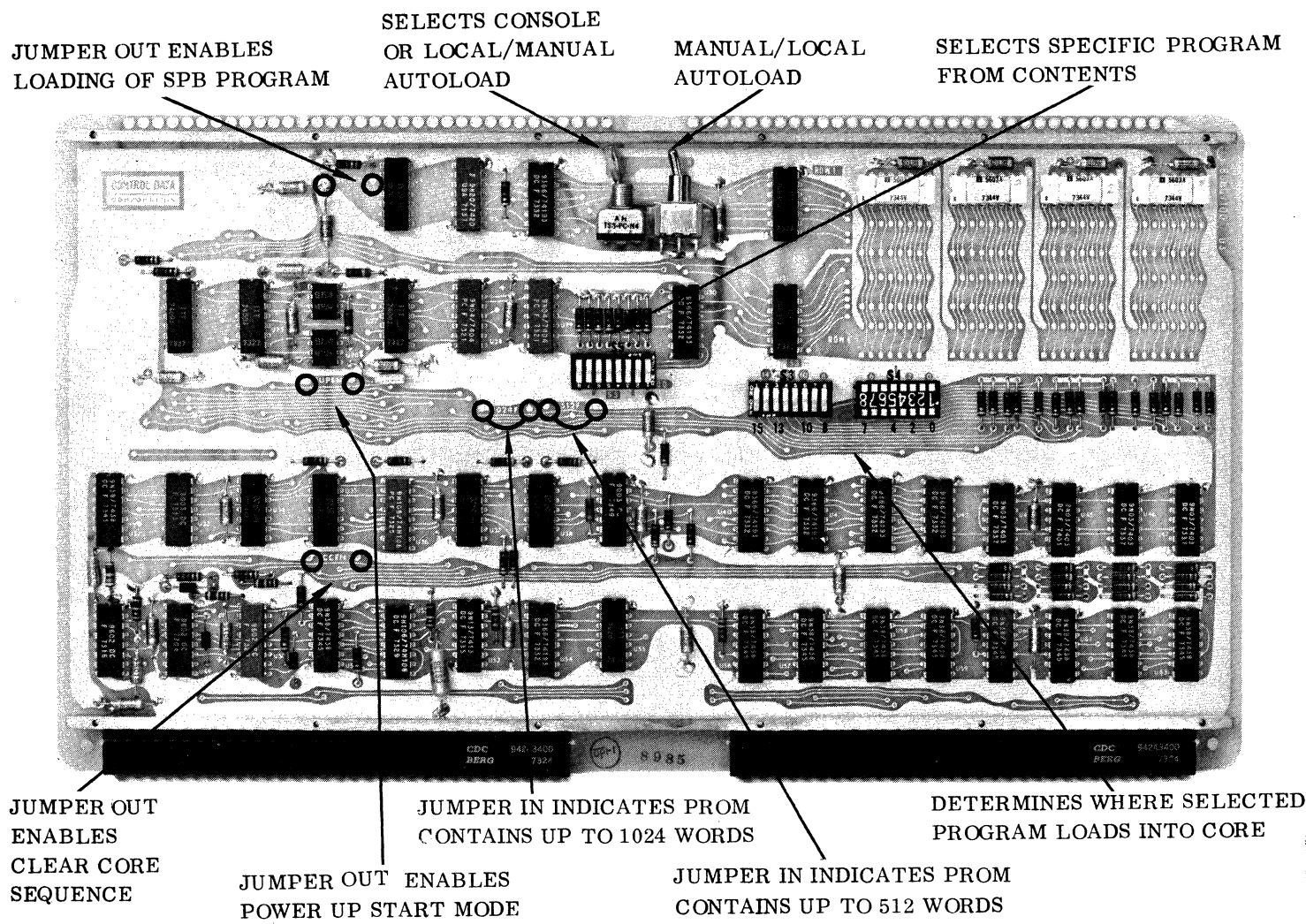
Figure 14-1. PROM Jumper and Switch Locations

Table 14-2. PROM Jumper Assignment for Automatic Loading when Power
is Applied to the System

PROM JUMPER	PLACEMENT	FUNCTION
CCEN	Out	Enables clear core sequence
PUPEN	Out	Enables power up start mode
SPBEN	Out	Enables loading of the SPB program which sets the program bit, performs checksum check when reading bootstrap from PROM, and executes the bootstrap and the follow-up program

Since the device in this configuration works off the console power switch, it provides a valuable maintenance capability. It clears the memory of parity errors and automatically loads a bootstrap that in turn loads a routine (such as SMM) from a device and then executes that routine. The operation may be accomplished by use of the console power switch or one of the autoload procedures.

4. AUTOLOAD CONFIGURATION FOR THE PROM. The PROM has three autoload capabilities:

- Remote autoload from remote station
- Autoload from the CPU console
- Local autoload from the PROM

All autoload features will work with the jumper configuration given in Table 14-3. The autoload features will also work if the board jumpers are reconfigured. Install PUPEN and CCEN jumpers (see Figure 14-1 for jumper locations). In this configuration, the contents of the PROM will load into specified memory and will be executed without clearing core whenever the selected (i.e., local, console, or remote) autoload signal is received.

Table 14-3. PROM Automatic Loading Jumper Assignment

BACKPLANE JUMPER	PLACEMENT	FUNCTION
Jx P2 A6–J21 P2 B27	In	PRMC provides power on master clear when power is applied or when an autoload is initiated.
Jx P2 A08–J21 P2 A04	In	PRGO provides go signal to initiate the loaded bootstrap program when the power-on feature is used or when any of the three autoloads are executed.
Jx P2 A07–J21 P2 A14	In	PRPU overrides the CPU program protect system. It eliminates program faults if the console PROGRAM PROTECT switch is set when PRMC and PRGO conditions are enabled.
NOTE: Jx = DSA card position of PROM		

5. CONSOLE AUTOLOAD. When using the console autoload, make sure that this autoload feature does not conflict with other devices such as the disk controllers.

Set the S1 autoload switch to the up position to enable the console autoload. See Figure 14-1 for the switch location. When the console autoload button is depressed, , the specified contents in the PROM will be loaded into the designated memory locations and will be set into execution.

6. LOCAL AUTOLOAD. Set S1 to the down position to disable the console autoload capability of the PROM. Depress S2 on the PROM (see Figure 14-1 for the switch location). The specified contents of the PROM will be loaded into designated memory locations and will be put into execution. The local autoload feature will also function if the console autoload is enabled.

7. REMOTE AUTOLOAD. Activating the remote autoload by shorting the remote autoload lines through a switch or by controlling with an active low signal causes the PROM to load specific contents into selected memory. The remote autoload operates independently of the auto enable switch S1. The remote autoload may be activated through a twisted pair of wires from distances up to 2000 ft.

8. ADDRESS SWITCH CONFIGURATIONS. Two sets of 8-bit DIP switches (S3 and S4) are used to establish the memory address into which data is to be stored. One set of DIP switches (S5) determines which PROM bootstrap will be loaded into memory.

9. S3 AND S4 MEMORY ADDRESS CONFIGURATION. S3 and S4 are labeled 0 through 15 to correspond to memory address bit assignments bit 0 through 15. To select a particular memory address, depress the switch(es) corresponding to the bits used to establish that address. For example, to select $1800, depress the switch corresponding to bits 11 and 12.

Memory addresses greater than $001C must be selected if the SPB program is to be used, since this program resides below $001C.

10. S5 PROM BOOTSTRAP ADDRESS CONFIGURATION. Two methods are utilized to determine the S5 PROM bootstrap address. Both methods require use of the firmware specification to determine the address of the required bootstrap.

To use the first method, obtain the decimal address of the required bootstrap from the firmware specification (see Figure 14-2). Divide this address by four, and convert this result to hexadecimal. Configure the S5 switch assembly to correspond to this hexadecimal address. Each hexadecimal bit corresponds to one bit position of the S5 switch assembly (see Figure 14-1).

Example:

Find the address to set on S5 of a program starting at 68 of the firmware specification.

Divide: 68_{10} by $4_{10} = 17_{10}$

Convert: $17_{10} = 11_{16}$

$11_{16} = 00010001$. These bits correspond to S5 bit positions 8 through 1 respectively. Therefore, S5 bits 5 and 1 must be set to select the required program at 68_{10}.

To use the second method to determine the S5 PROM bootstrap address, refer to Figure 14-2. Locate the starting address of the required program in the Word column. Follow the row associated with this address to the left. In the left column (PROM SW) is the bit assignment of S5 for the first three digits. Follow the Word column from the start of the required program to the bottom of the page. The bottom row (PROM SW) contains the bit assignment of S5 for bits 4 through 7. Set S5 to the proper configuration to load the specified bootstrap.

Example:

Find the S5 setting for a program starting at 68_{10}. The PROM SW column on the left contains 001. This corresponds to S5 bit assignments of 3, 2, and 1 respectively. Follow the Word column to the bottom of the page. The PROM SW row should contain ---10, which corresponds to S5 switch positions 8, 7, 6, 5, and 4 respectively. Thus, S5 bit positions 1 and 5 should be set to select the requested program at 68_{10}.

11. INSTALLATION OF PROM BOOTSTRAP LOADER. Power down the expansion enclosure first if it is part of the system. Then power down the CPU.

Install jumpers according to customer requirements. Install the PROM into the customer specified slot or any convenient DSA slot of either the CPU or the expansion enclosure. Record its position on the card placement assignment sheet. If the PROM is to be used in the expansion enclosure, a DSA channel expansion will be required. The PROM does not require a position on the DSA scanner, and, as such, always acts as a one only device.

CDC PART NUMBER:											COLUMN NUMBER:									
	WORD	OUTPUT				WORD	OUTPUT				WORD	OUTPUT				WORD	OUTPUT			
		O_4	O_3	O_2	O_1		O_4	O_3	O_2	O_1		O_4	O_3	O_2	O_1		O_4	O_3	O_2	O_1
000	0					32					64									
001						36					68									
010																				
011																				
100																				
101																				
110																				
111																				
321	31					62														
PROM SW	$\bar{8}\bar{7}\bar{6}5\,4^{0\,0}$					$\bar{8}\bar{7}\bar{6}5\,4^{0\,1}$					$\bar{8}\bar{7}\bar{6}5\,4^{1\,0}$					$\bar{8}\bar{7}\bar{6}5\,4^{1\,1}$				

NOTE: WORD COLUMN CONTAINS DECIMAL ADDRESS.

Figure 14-2. Firmware Specification Example

14.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

14.4.1 POWER APPLICATION

The PROM derives its power, +5 vdc, from the CPU or the expansion enclosure.

There are four ways of loading the contents of the PROM into memory: power on autoloading, console autoload, local autoload, and remote autoload. The contents may be checked by actual execution of the program, or execution may be inhibited and the designated memory may be swept to ascertain correct loading.

14.4.2 PRELIMINARY CHECKOUT

Power up the CPU first and then the expansion enclosure (if it is part of the system). If the PROM is configured for automatic loading when power is applied to the system (see Section 14.3.1), the first check will be initiated. With the proper program address set on S5, the program will load into the memory locations specified by S3 and S4, and the program will go into execution. (It is assumed that the end device; i.e. MTT, card reader, etc., has been made ready and functions correctly.)

Activating any of the three other autoload conditions will accomplish the load and execution of the selected program also.

The alternate method of checking the contents loaded into memory from the PROM is to disable the automatic go condition of the PROM by removing backplane jumpers Jx P2 A08 through J21 P2 A04. The contents of the PROM will load by any of the four methods of loading, but the program will not go into execution. Set the P register to the address specified by S3 and S4. Select Sweep and Cycle mode on the CPU. Step through the program in memory and compare it with the program as listed in the firmware specification.

14.5 DIAGNOSTIC CHECKOUT

SMM17 or SCMM tests do not exist for this device.

14.6 VOLTAGE MARGIN TESTING

This is an optional requirement and may be utilized if problems are encountered that cannot be isolated readily at nominal conditions. Refer to Section 2.7 for voltage margin procedures.

88996000 A

The real-time clock (RTC) is used in SYSTEM 17 to generate interrupts after selected time intervals and/or to measure elapsed time. It consists of a single card that occupies one A/Q slot in either the CPU or the expansion enclosure. If the RTC is mounted in the expansion enclosure, an A/Q channel expansion is required. The RTC contains equipment select and clock rate select of one microsecond through one second intervals.

15.1 APPLICABLE DOCUMENTS

The following list includes pertinent documents associated with the RTC. The documents with asterisks are required for installation and maintenance of the real-time clock.

Title	Publication No.
AT229-A Real-Time Clock Customer Engineering Manual (*)	89638900
Real-Time Clock Reference Manual (*)	89638800
AT229-A Real-Time Clock Spare Parts List	89638900

15.2 REQUIRED PARTS

The following list includes hardware required for installation and checkout of the real-time clock:

	Product No.	Equipment No.
Real-time clock	10336-1	AT229-A
Interrupt cable assembly	89724700	
Jumper plug	89684100	

15.3 INSTALLATION

1. UNPACKING AND CHECKOUT. Remove the RTC from its shipping package. Inspect for and record any damage.

2. INSTALLATION. Install the equipment number jumpers and time interval jumpers (see Figure 15-1 for jumper locations). A jumper inserted selects the equipment Q-bit and the selected interval rate.

CLOCK RATE SELECT

1 SEC 100 MS |10 MS |1 MS |100 μS |10 μS 1 μS

EQUIPMENT
NUMBER
SELECT —
{ Q07
  Q08
  Q09
  Q10
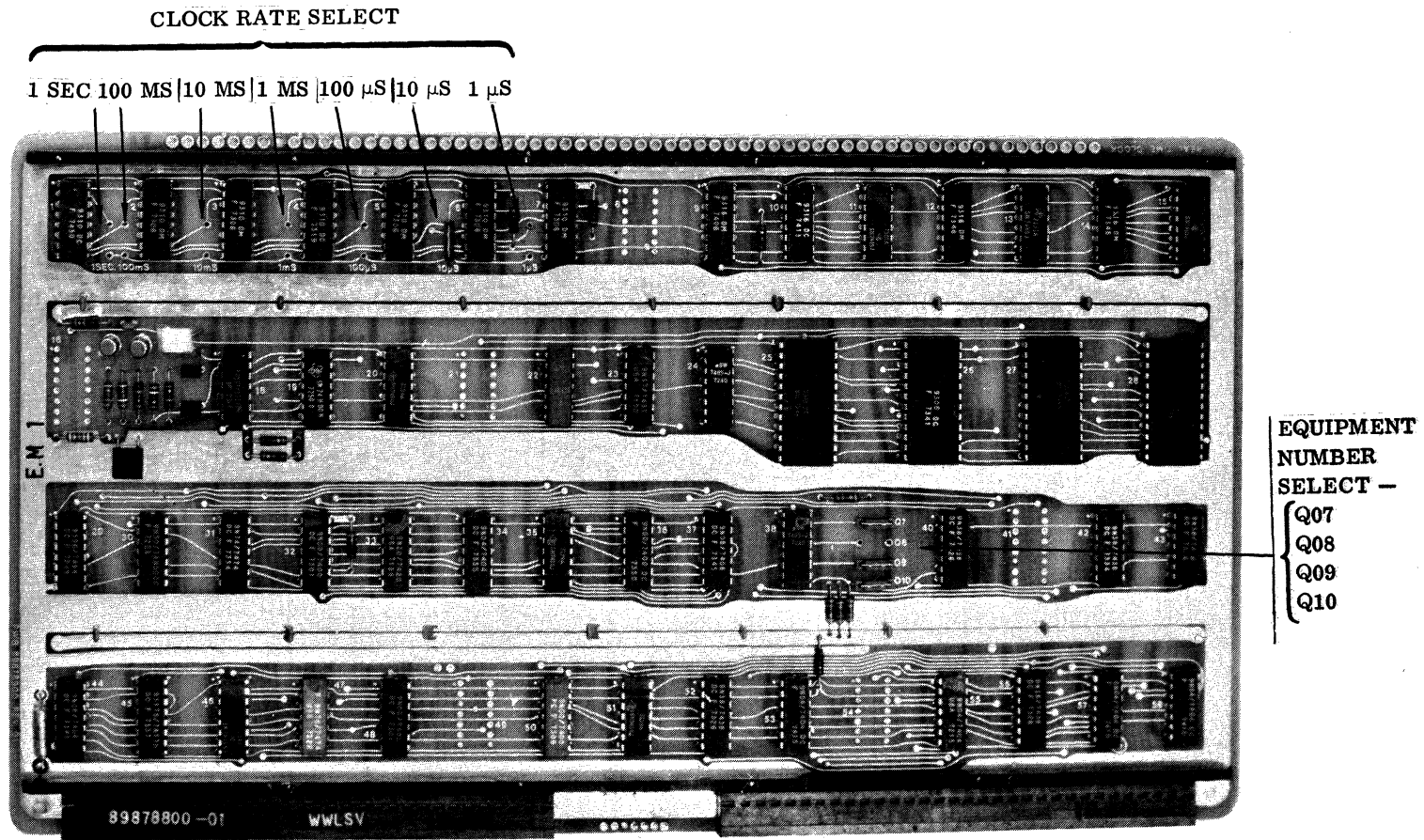
NOTES: 1. Q-BIT JUMPER IN SELECTS THE BIT.
        2. CLOCK RATE SELECT JUMPER IN SELECTS THE CLOCK RATE.

Figure 15-1. Real-Time Clock Equipment Number and Clock Rate Jumper Locations

Turn the power off on the system. Turn off the power on the expansion enclosure first if it is part of the system. Install the RTC in a specified A/Q slot in the CPU (or expansion enclosure). Record the card slot assignment on the system card placement sheet. Remove the back cover of the CPU or expansion chassis. If a battery pack is part of the system, pay particular attention to the way the battery leads are connected to the CPU or expansion enclosure. Install the RTC interrupt cable between P1 B08 of the assigned card slot and the assigned interrupt level in J25 or J26 (see Table 1-2 for interrupt assignments).

Reinstall the back cover of the CPU or expansion enclosure. Make sure that the battery leads are installed correctly. Ensure that any other cables are not disturbed or pulled off during removal and replacement of the back cover.

15.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Apply power to the system, applying power to the CPU first if an expansion enclosure is part of the system. Check test point 63 of the RTC for +5, ±0.2 vdc. If necessary, adjust the +5 vdc Vcc voltage at the power supply located on the console door.

15.5 DIAGNOSTIC CHECKOUT

15.5.1 SMM TESTING

Load SMM17 Version 3.1-2 Monitor into the CPU. Set up the SMM parameters as shown in Section 1.7.1. When BUILD TEST LIST is typed out, call up RTC091 (Real Time Clock Test No. 91). Set up test parameters as in Table 15-1.

Table 15-1. Real-Time Clock SMM17 Parameter Set-Up

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	9141	Test ID	STJP	Typically 0241 or 024D
2nd	000F	Test sections	2000	Interrupt, prestored as No. 13
3rd	0005	Basic clock cycle – Ensure that the test clock rate matches the RTC-selected clock rate.	0005	Time limit in minutes for testing free-running clock
4th	000F	Selected interval for section 2.	0100	Number of times selected interval is tested

The parameters in Table 15-1 reflect those normally used for acceptance testing. Refer to the SMM17 Manual for further details on setting up SMM and test parameters and for a description of errors in case the test does not run.

15.5.2 SCMM TESTING

No SCMM tests exist for this device.

15.6 MULTIPLEX TESTING

The purpose of multiplex testing is to simulate system operation. Tests will be loaded sequentially, set into operation simultaneously, and run with either status or interrupt synchronization.

15.6.1 SMM

The RTC test may be multiplexed with the following tests:

- Teletypewriter Test No. 5
- Command Test No. 1
- MDC Test No. 7A
- Magnetic Tape Test No. 4B

Other SMM tests have no multiplex testing restrictions.

NOTE

If RTC test section 1 is selected, the test must be run as a stand-alone test.

15.6.2 SCMM

No SCMM testing is possible.

15.7 VOLTAGE MARGIN TESTING

This is an EPS requirement for on-site installations and may be utilized if problems occur within SYSTEM 17 that cannot be isolated via standard diagnostics.

Logic voltage margins on the RTC may be performed by following the procedure outlined in Section 2.7. Real-time clock SMM tests should run at each setting. Vss margins need not be run.

88996000 B

The synchronous communications controller consists of one controller and the necessary hardware to interface with two RS232C-compatible synchronous data channels.

The synchronous communications controller is a one-card device that may be inserted into any A/Q slot of the CPU or the expansion enclosure. The controller has jumper-selectable equipment number, protect, full/half duplex, parity, bits per word, sync pattern, and interrupt cycle rate.

Hardware items that are included with the synchronous communications controller consist of one internal cable assembly, one external cable assembly, one interrupt cable assembly, and one rack-mountable distribution panel. The controller also requires an external ±12 vdc power supply.

A block diagram of the synchronous communications controller is shown in Figure 16-1.

16.1 APPLICABLE DOCUMENTS

The following list includes those documents associated with the synchronous communications controller. The documents with asterisks (*) are required for installation and maintenance of the synchronous communications controller.
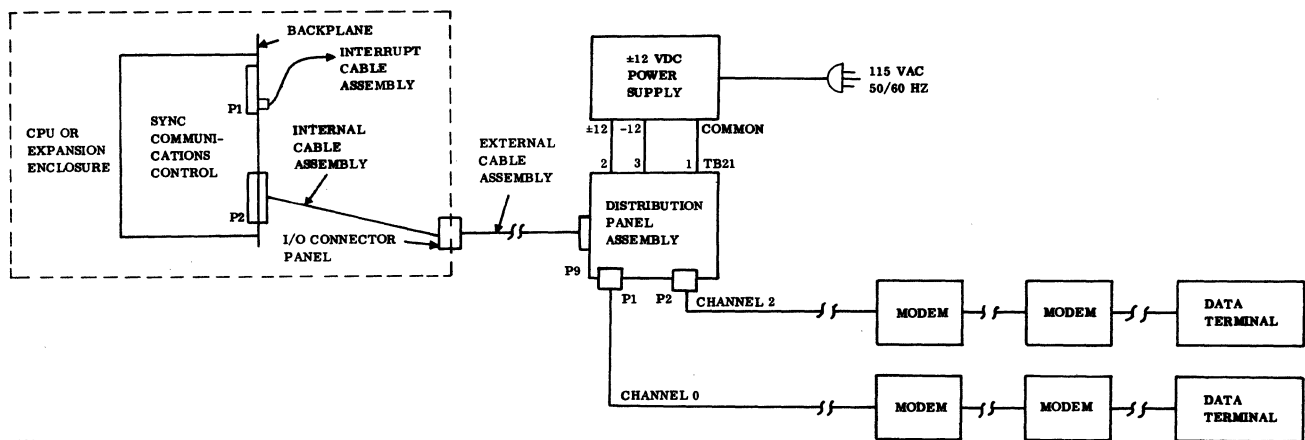
Figure 16-1. Block Diagram of Synchronous Communications Controller

Title	Publication No.
Synchronous Communication Controller and Distribution Panel Reference Manual (*)	89638400
Synchronous Communications Controller and Distribution Panel Customer Engineering Manual	89638500
Internal Cable Assembly Wire List (Part of Customer Engineering Manual)	89638500
External Cable Assembly Wire List (Part of Customer Engineering Manual)	89638500
Distribution Panel Assembly Wire List (Part of Customer Engineering Manual)	89638500
Synchronous Communications Controller Spare Parts List	89631000

16.2 REQUIRED PARTS

The following parts are required for installation and checkout of the synchronous communications controller:

	Product No.	Equipment No.
Sync communications controller	1743-1	FJ606-A
Select jumpers	89684100	
Cable assembly, internal	89641800	
Cable assembly, external	89779602	
Cable assembly, interrupt	89724702	
Distribution panel assembly	89778100	
Communications controller mounting kit	38981200	
Power supply assembly, ±12 vdc	10343-1 (88977800)	

Customer-provided modems and data terminals

19-inch type rack/cabinet enclosure

16.3 CONTROLLER

Remove the controller, cable assemblies, and distribution panel from the shipping carton. Unpack the 12 vdc power supply.

Remove all packing material from the parts and inspect for missing and damaged parts. Record all discrepancies.

16.3.1 DISTRIBUTION PANEL ASSEMBLY/POWER SUPPLY

Install the distribution panel assembly and the power supply. These items fit standard 19-inch type racks. Each device requires a minimum of 3-1/2 inches of vertical space. The power supply requires 5-1/2 inches of horizontal space. These units will be mounted on the same rails that the CPU is mounted on when the CPU is installed in an equipment cabinet. The units will be mounted immediately below the CPU. If sufficient room for mounting is not available the units must be installed in adjacent cabinets. When the CPU is installed in a table-top, desk-top, or pedestal-cabinet-top enclosure, additional rack space will be required to mount the distribution panel and power supply assemblies.

Connect the power supply to TB01 on the distribution panel assembly. +12 vdc connects to TB01-2, -12 vdc connects to TB01-3, and common connects to TB01-1.

16.3.2 SYNC COMMUNICATIONS CONTROLLER

Ensure that all jumpers on the controller board are properly installed according to customer requirements. See Figure 16-2 for board jumper locations, and see Table 16-1 for jumper assignment information.

Make sure that the CPU and/or expansion enclosure power is off. If the expansion enclosure is present, power it down first.

Install the controller board in the customer-designated A/Q slot of the CPU or expansion enclosure. Record this position on the card position assignment sheet.

16.3.3 CABLE ASSEMBLY

Remove the back cover and battery pack (if present) from the CPU or expansion enclosure. Pay particular attention to where the battery leads connect to the CPU/expansion enclosure.

Install the interrupt cable assembly between the assigned card slot position P1 B24 and the specified interrupt input on J25 or J26.

If the expansion enclosure is utilized, the interrupt cable will have to be routed through the A/Q channel expansion. See Section 1.3.1 for interrupt routing information.

Install the internal cable assembly between P2 on the backplane of the assigned card position and the CPU/expansion enclosure I/O connector panel. Record this jack position on the card assignment sheet.

Install the external cable assembly between the I/O connector just installed and P9 on the distribution panel assembly. Replace the back cover of the CPU/expansion enclosure. Ensure that the battery leads are installed properly.

Modem cables may be connected to P1 (channel 0) or P2 (channel 1) at this time, or they may be left off until part of the checkout is completed (i.e., the sections of SMM testing that utilize special connections on P1 and P2).

INTERRUPT CYCLE
RATE SELECT
.39 → 6.26

MODE   PROTECT SELECT (PROT)

EQUIPMENT
NUMBER
SELECT —
Q10
Q09
Q08
Q07
Q06

SYNC
PATTERN
SELECT —
07
06
05
04
03
02
01
00

BITS PER CHARACTER   PARITY
SELECT   SELECT
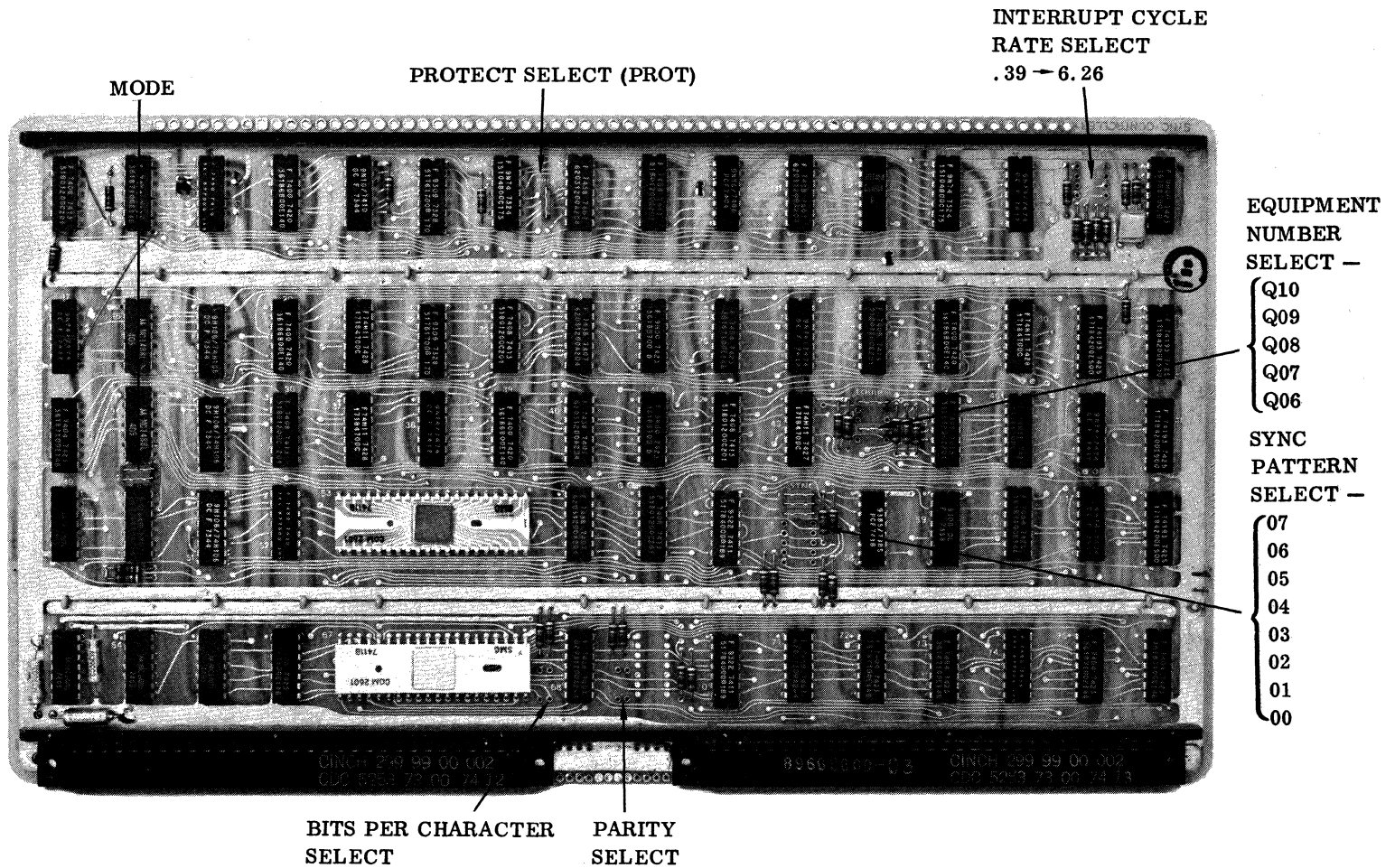
NOTES: 1. PROTECT, EQUIPMENT NUMBER JUMPERS IN SELECT BIT OR CONDITION.
2. SYNC PATTERN JUMPER OUT SELECTS THE BIT.
3. INTERRUPT RATE CYCLE, PARITY, AND BITS PER CHARACTER SELECTION IS
DEPENDENT ON THE COMBINATION OF JUMPERS SELECTED.
4. MODE JUMPER IN SELECTS FULL DUPLEX.

Figure 16-2. Sync Communications Controller Jumper Locations

Table 16-1. Sync Communications Controller Jumper Select Information

JUMPER	PLACEMENT	FUNCTION
Protect select	Jumper in	Indicates controller is unprotected
Mode select	Jumper in	Selects full duplex for specific channel
	Jumper out	Selects half duplex for specific channel
Data bits/ character select	Both jumpers out	Selects eight data bits per character
	Left jumper in	Selects seven data bits per character†
	Right jumper in	Selects six data bits per character†
	Both jumpers in	Selects five data bits per character†
Parity select	No jumper in	Selects no parity (mark)
	Right jumper in	Selects even parity
	Both jumpers in	Selects odd parity
Sync pattern select	Jumper in	Selects 0
	Jumper out	Selects bit†
Equipment code select	Q-bit jumper in	Selects appropriate Q bit
	Q06-bit jumper in	Selects the second controller, utilizing the same equipment number as the first controller
Interrupt cycle select	Jumper in	Selects the desired cycle rate to be used in conjunction with the selected baud rate. The interrupt rate is common to both channels; select one of 0.39, 0.78, 1.57, 3.13, or 6.26 microseconds.

† When less than eight data bits per character are used, the unused bits (bits 07; 07 and 06; or 07, 06, and 05), must be set to 1 in each character transmitted. This is accomplished via software.

††When set up for less than eight bits per character, the upper sync pattern jumper corresponding to the unused data bit must be removed; i.e., six bits/character. In addition, the sync bit corresponding to bit 7 and bit 6 must be removed.

16.3.4 60 HZ/50 HZ MODIFICATION

The controller board derives its power from the CPU/expansion enclosure and therefore requires no modification.

The ±12 vdc power supply will operate at 50/60 Hz 115 vac. The power cord connector will have to be changed to mate with the customer 50 Hz power source.

16.4 POWER APPLICATION

Apply power to the CPU first, and then apply power to the expansion enclosure.

Connect the ±12 vdc power supply to the customer primary power source. +12 vdc may be measured on P2 A30 of the assigned card slot; -12 vdc may be measured on P2 B30, and +5 vdc can be measured at P2 A31. ±12 vdc may also be measured at TB01-2/3 on the distribution panel assembly.

16.5 DIAGNOSTIC CHECKOUT

16.5.1 SMM TESTING

Load SMM17 Version 3.1-2 Monitor into the CPU. Set up the SMM parameters as shown in Section 4.1.

When BUILD TEST LIST is typed out, call up the Synchronous Communication Controller Test (Test No. 87). Set up the test parameters as in Table 16-2. Ensure that the parameters used agree with the configuration of cables or connections made at P1 and P2 of the distribution panel assembly. Refer to the SMM17 Reference Manual for further details on setting up SMM and test parameters and for a description of errors in case the test does not run properly.

16.5.2 SCMM TESTING

No SCMM tests exist for this device.

16.6 MULTIPLEX TESTING

The purpose of this type of testing is to simulate system operation. Tests will be loaded sequentially, set into operation simultaneously, and run with either status or interrupt synchronization.

Table 16-2. Synchronous Communications Controller SMM17 Parameter Set-Up

TEST STOP	A		Q	
	CONTENTS	TYPICAL VALUE	CONTENTS	TYPICAL VALUE
1st	Test ID	8761	STJP	0201 or 0240
2nd	Sections	00BF	Interrupt select	Interrupt number
3rd	Channel 0 select	00xy[†] x = Bits 4 through 7; selects bits per character[††] y = Bits 0 through 3; selects type of test[††]	Channel 1 select	00xy[†] x = Bits 4 through 7; selects bits per character[††] y = Bits 0 through 3; selects type of test[††]
4th	Test mode pattern for section 4	00xx xx = Data	Special pattern for section 5	y0xx y = Set to run section continuously xx = Data
5th	Section repeat flags	0uv0 u = Bit 8 set; repeat section 8 v = Bit 7 set; repeat section 7 = Bit 6 set; repeat section 6	Controller/ mode flag	000w w = Bit 0 set = controller 1 Bit 0 not set = controller 2 Bit 1 set = full duplex Bit 1 not set = half duplex
6th	Sync character select[†††]	00xx xx = Sync pattern	Special character for sections 1 and 3	0020

[†] Section 16.8.1 for the required jumper configuration.
[††] 0 = No test
   1 = Channel-to-channel loop test
   2 = Single-channel loop test
   3 = Internal test mode (connected to modem)
   4 = No terminal connected; no jumper. Test mode if clock pulses are applied.
   5 = Jumpered for Section 8.
   6 = Not used
[†††] Use filler bits in the MSB positions if less than eight data bits per character are used.

16.6.1 SMM

Test 87 may be multiplexed with the following tests:

- Teletypewriter Test No. 5

- Command Test No. 1

- MDC Test No. 7A

- Magnetic Tape Test No. 4B

NOTE

At higher baud rates (4800, 9600, and 19,200 baud)
lost data may occur within Test 87 due to the inability
to get back to the controller to accept incoming data.

16.6.2 SCMM

No SCMM multiplex testing is possible for this device.

16.7 VOLTAGE MARGIN TESTING

This is an EPS requirement for on-site installations and may be utilized if problems occur within the system that cannot be resolved via standard diagnostics.

Synchronous controller margin testing may be performed by following the procedure outlined in Section 2.7. SMM tests should run satisfactorily at each setting. Vss margins need not be run.

16.8 TEST MAINTENANCE AIDS

The following program sends one character continuously when used with the jumper configuration specified in Section 16.8.1. Enter the program, set P equal to X, and depress GO with the SELECTIVE STOP switch off. To view data, set SELECTIVE STOP and A register. De-select SELECTIVE STOP and depress GO to continue.

P=X	E000	
	0492	Equipment number, channel address (channel 0), enable request
	0A00	
	02FE	

```
C000

0100

03FE

E000

0480

02FE

0AXX        XX = data

03FE

0B00

02FE

0000

18FA
```

16.8.1 SPECIAL TEST JUMPERING OF CHANNEL 0 AND CHANNEL 1

16.8.1.1 SINGLE—CHANNEL LOOP TEST

Utilize the connector (part number 93609008) and make the following connections to allow for single channel testing.

```
Ground               1 ◄─────┐
Transmit Data        2 ─────┐ │
Receive Data         3 ◄────┘ │
Request to Send      4 ◄────┐ │
Clear to Send        5 ◄───●─┘ │
Data Set Ready       6 ◄───●───── A
Ground               7 ◄──────┘
Carrier On           8 ◄─────── B
Transmit Clock      15 ◄────┐
Receive Clock       17 ◄────┴──── Square wave input 10 Vpp
Data Terminal Ready 20              frequency determines
Ring Indicator      22 ◄─────       baud rate.
```

A and B must be shorted together where running SMM Section 8.
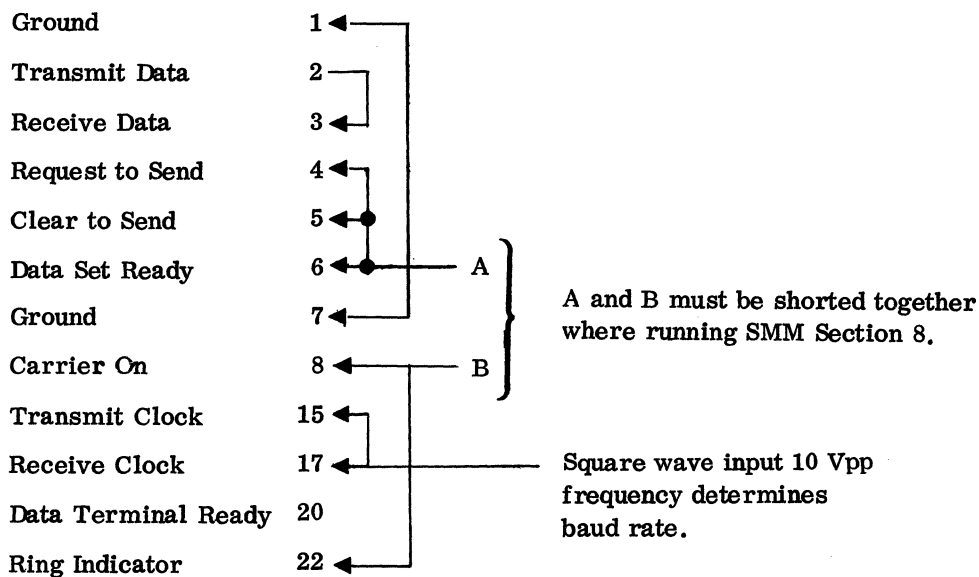
16.8.1.2 CHANNEL-TO-CHANNEL LOOP TEST

This test utilizes two connectors (part number 93609008) and makes the following connections to allow for channel-to-channel testing.

Transmit Channel			Receive Channel

```
        Transmit Channel                                    Receive Channel

    Ground              1                              1    Ground
    Transmit Data       2                         N.C.2    Transmit Data
    Receive Data        3 N.C.                         3    Receive Data
    Request to Send     4                              4    Request to Send
    Clear to Send       5                              5    Clear to Send
    Data Set Ready      6                              6    Data Set Ready
    Ground              7                              7    Ground
    Serial Transmit Clock   15                        17    Serial Receive Clock
    Data Terminal Ready     20                        20    Data Terminal Ready
```

See Section 16.8.1

Test mode testing may be accomplished by connecting the communications controller to a synchronous modem via the distribution panel assembly.

88996000 B

The asynchronous communications subsystem consists of one controller and the necessary hardware to interface eight RS232C data channels.

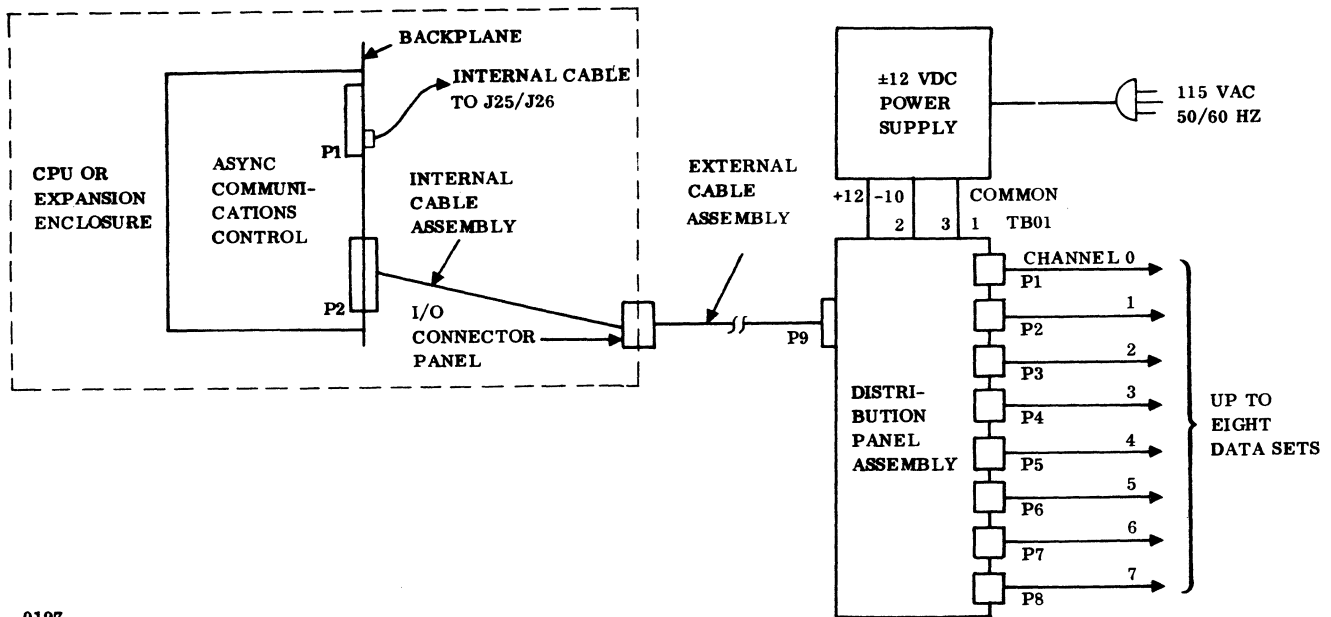The asynchronous communications controller is a one-card device that fits into any A/Q slot of the CPU or the expansion enclosure. The controller multiplexes up to eight RS232C asynchronous full/half duplex channels. The controller has jumper-selectable baud rate, interrupt clock cycle, protect, parity, data bits, and stop bits. Included with the controller are an internal cable assembly, an external cable assembly, an interrupt cable assembly, and a distribution panel. A power supply is required for use with this controller.

A block diagram of the asynchronous communications controller is shown in Figure 17-1.

17.1 APPLICABLE DOCUMENTS

The following list includes those documents associated with the synchronous communications controller. The documents with asterisks (*) are required for installation and maintenance of the async communications controller.

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Figure 17-1. Block Diagram of Asynchronous Communications Controller

Title	Publication No.
Asynchronous Communication Controller and Distribution Panel Reference Manual (*)	89638200
Asynchronous Communications Controller and Distribution Panel Customer Engineering Manual (*)	89638300
Internal Cable Assembly Wire List (Part of Customer Engineering Manual)	89638300
External Cable Assembly Wire List (Part of Customer Engineering Manual)	89638300
Distribution Panel Assembly Wire List (Part of Customer Engineering Manual)	89638300
Asynchronous Communications Controller Spare Parts List	89658800

17.2 REQUIRED PARTS

The following parts are required for installation and checkout of the asynchronous communications controller:

	Product No.	Equipment No.
Async communications controller	1743-2	DJ815
Select jumpers	89684100	
Cable assembly, internal	89641800	
Cable assembly, external	89779602	
Cable assembly, interrupt	89724702	
Distribution panel assembly	89778101	
Communications controller mounting kit	38981200	
Power supply assembly, ±12 vdc	10343-1 (88977800)	

Customer-provided modems and data terminals

19-inch type rack/cabinet enclosure

17.3 INSTALLATION

Remove the controller, cable assemblies, and distribution panel assembly from the shipping carton. Unpack the ±12 vdc power supply.

Remove all packing material from the parts and inspect for missing and damaged parts. Record all discrepancies.

17.3.1 DISTRIBUTION PANEL ASSEMBLY/POWER SUPPLY

Install the distribution panel assembly and the power supply assembly. These items fit standard 19-inch type racks. Each device requires a minimum of 3-1/2 inches of vertical space. The power supply requires 5-1/2 inches of horizontal space.† Connect the power supply to TB01 on the distribution panel assembly. +12 vdc connects to TB01-2, -12 vdc connects to TB01-3, and common connects to TB01-1.

17.3.2 ASYNC COMMUNICATIONS CONTROLLER

Ensure that all jumpers on the controller board assembly are properly installed according to customer requirements. See Figure 17-2 for board jumper locations. See Table 17-1 for jumper assignment information.

Ensure that the CPU/expansion enclosure power is off. If present, power down the expansion enclosure first.

Install the controller board in the customer-designated A/Q slot of the CPU/expansion chassis. Record this position on the card assignment sheet.

17.3.3 CABLE ASSEMBLY

Remove the back cover and battery pack (if present) from the CPU/expansion enclosure. Pay particular attention to where the battery leads connect to the CPU/expansion enclosure.

Install the interrupt cable assembly between the assigned card slot position P1 B24 and the specified interrupt input on J25 or J26.

---

†These units are mounted on the same rails that the CPU is mounted on when the CPU is installed in an equipment cabinet. The units will be mounted immediately below the CPU. If sufficient room for mounting is not available, the units must be installed in adjacent cabinets. When the CPU is installed in a table-top, desk-top, or pedestal-cabinet-top enclosure, additional rack space will be required to mount the distribution and power supply assemblies.

BAUD RATE,
PARITY, BITS
PER CHARACTER,
AND STOP BIT
SELECT —
CHANNELS 0 AND 1

BAUD RATE,
PARITY, BITS
PER CHARACTER,
AND STOP BIT
SELECT —
CHANNELS 2 AND 3

INTERRUPT CYCLE, TIME,
EQUIPMENT NUMBER, AND
PROTECT SELECT
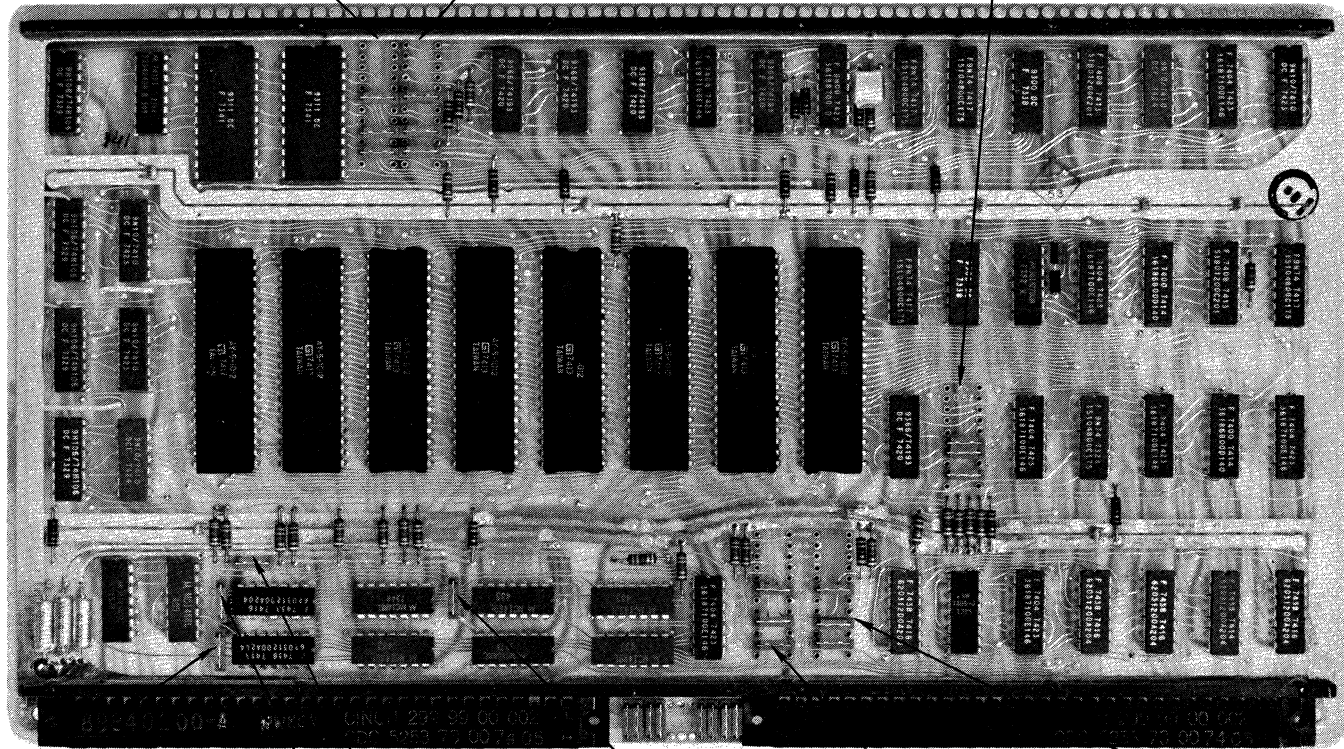
OPERATING MODE —
CHANNELS 0 AND 1

OPERATING MODE —
CHANNELS 2 AND 3

OPERATING MODE,—
CHANNELS 6 AND 7

OPERATING MODE,—
CHANNELS 4 AND 5

BAUD RATE,
PARITY, BITS
PER CHARACTER,
AND STOP BIT
SELECT —
CHANNELS 4 AND 5

BAUD RATE,
PARITY, BITS
PER CHARACTER,
AND STOP BIT
SELECT —
CHANNELS 6 AND 7

Figure 17-2. Async Communications Controller Jumper Locations

Table 17-1. Async Communications Controller Jumper Select Information

JUMPER	PLACEMENT	FUNCTION
Mode select	Jumper in	Selects full duplex for two specified channels
	Jumper out	Selects half duplex for two specified channels
Baud rate select	Jumper in	Selects baud rate of 110, 300, 600, 1200, 2400, 4800, or 9600 for two specified channels
Parity select	NP and EPS jumpers out	Selects no parity (mark) for two specified channels
	NP jumper in	Selects even parity for two specified channels
	NP and EPS jumpers in	Selects odd parity for two specified channels
Stop bit select (TBS)	Jumper out	Selects two stop bits for two specified channels
	Jumper in	Selects one stop bit for two specified channels
Data bit select	NB1 and NB2 jumpers out	Selects eight data bits for two specified channels
	NB1 jumper in	Selects seven data bits for two specified channels
	NB2 jumper in	Selects six data bits for two specified channels
	NB1 and NB2 jumpers in	Selects five data bits for two specified channels
Protect select	Jumper in	Indicates controller is unprotected
	Jumper out	Indicates controller is protected
Interrupt cycle time select	Jumper in	Selects interrupt cycle time to be used with selected baud rates. Interrupt rate is common to all eight channels. Selects 0.57, 0.83, 2.3, 9.16, or 18.3 microseconds.
Equipment code	Jumper in	Selects specified Q bit
NOTE: Channel jumpering is done on a paired basis. Channels 0 and 1; 2 and 3; 4 and 5; and 6 and 7 have a common jumper select position.		

If the expansion enclosure is utilized, the interrupt cable will have to be routed through the A/Q channel expansion. See Section 1.3.1 for interrupt routing information.

Install the internal cable assembly between P2 on the backplane of the assigned card position and the CPU/expansion enclosure I/O connector panel. Record this jack position on the card assignment sheet.

Install the external cable assembly between the I/O connector just installed and P9 on the distribution panel assembly. Replace the back cover of the CPU/expansion enclosure. Ensure that the battery leads are installed properly.

Modem/data set cables may be connected to P1 (channel 0) through P8 (channel 7) at this time, or they may be left off until part of the checkout is completed (i.e., those sections of SMM testing that utilize special connections on P1 through P8).

17.3.4 60 HZ/50 HZ MODIFICATION

The controller does not require 50 Hz since it derives its power from the CPU/expansion enclosure.

The ±12 vdc power supply will operate on 50/60 Hz 115 vac. The power cord connector will have to be changed to interface with the customer power source.

17.4 POWER APPLICATION

Apply power to the CPU first; then apply power to the expansion enclosure.

Connect the ±12 vdc power supply to the customer primary power source. +12 vdc may be measured on P2 A30 of the assigned card slot; -12 vdc may be measured on P2 B30; and +5 vdc can be measured at P2 A31. ±12 vdc may also be measured at TB01-2/3 on the distribution panel assembly.

17.5 DIAGNOSTIC CHECKOUT

17.5.1 SMM TESTING

Load SMM17 Version 3.1-2 Monitor into the CPU. Set up the SMM parameters as shown in Section 4.1. When BUILD TEST LIST is typed out, call up the Asynchronous Communications Controller Test (Test No. 86). Set up the test parameters as in Table 17-2. Ensure that the parameters used agree with the configuration of cables or connections made at P1 through P8 of the distribution panel assembly. Refer to the SMM17 Reference Manual for further details on setting up the SMM and test parameters and for a description of errors in case the test does not run properly.

Table 17-2. Asynchronous Communications Controller SMM17 Parameter Set-Up

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	8671	Test ID	STJP	Typically 0201, 024B, etc.
2nd	00FF	Sections	0200	Interrupt No. 10
3rd	0xxx	Channel 0 select†	1xxx	Channel 1 select†
4th	2xxx	Channel 2 select†	3xxx	Channel 3 select†
5th	4xxx	Channel 4 select†	5xxx	Channel 5 select†
6th	6xxx	Channel 6 select†	7xxx	Channel 7 select†
7th	Special data pattern if bit 15 is set. Pattern will repeat (section 5) continuously		Test mode pattern if 0 = random data is used in section 4.	

†Channel select parameters are formed as follows:

Bit 12 through 15 = Channel under test (0-7)
Bit 8 through 11 = Channel being tested (0-7) with channel under test
Bit 4 through 7 = Number of data bits (8, 7, 6, or 5)
Bit 0 through 3 = Type of channel connection

Where: 0 = No connection; no test
              1 = Modem connected to I/O device (use jumper information in Section 17.7.2.3)
              2 = Modem in test mode or channel self jumper (use jumper information in Section 17.7.2.1)
              3 = Channel jumpered to another channel (use jumper information in Section 17.7.1.1)

17.5.2 SCMM TESTING

No SCMM test exists for this device.

17.6 MULTIPLEX TESTING

The purpose of this type of testing is to simulate system type of operation. Tests will be loaded sequentially, set into operation simultaneously, and run with either status or interrupt synchronization.

17.6.1 SMM

Asynchronous Communications Controller Test No. 86 may be multiplexed with the following tests:

- Teletypewriter Test No. 1
- Command Test No. 1
- MDC Test No. 7A
- Magnetic Tape Test No. 4B

NOTE

At higher baud rates (9600 or 4800 baud), lost data
may occur when running Test 86 due to the inability
to get back to the controller to accept incoming data.

17.6.2 SCMM

No SCMM multiplex testing is possible.

17.7 VOLTAGE MARGIN TESTING

This is an EPS requirement for on-site installation and may be utilized if problems occur within the system that cannot be resolved via standard diagnostics.

Asynchronous controller margin testing may be performed by following the procedure outlined in Section 2.7. SMM tests should run satisfactorily at each setting. Vss margins need not be run.

17.8 TEST MAINTENANCE

17.8.1 SINGLE CHANNEL LOOP TEST

This routine requires the jumper configuration specified in Section 16.8.1.

XXX0	E000	
XXX1	0101	Equipment number, channel number (0)
XXX2	0A03	
XXX3	03FE	

XXX4	0DFE	
XXX5	0A41	
XXX6	03FE	Output Character: $41
XXX7	0A00	
XXX8	02FE	Input Character: $41
XXX9	0000	
XXXA	1400	
XXXB	0000	

17.8.2 P1—P2 JUMPERING INFORMATION FOR SPECIAL TESTING

17.8.2.1 SINGLE CHANNEL LOOP TESTING

Utilize the connector (part number 93609008) and jumper the following pins:

Transmit Data 2◄─┐
Receive Data 3◄─┘

Request to Send 4◄─┐
Clear to Send   5◄─┘
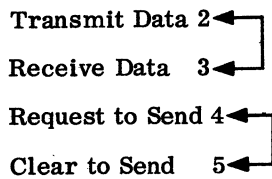
17.8.2.2 CHANNEL—TO—CHANNEL LOOP TESTING

Utilize two connectors (part number 93609008) and jumper the following pins. When using this configuration, ensure that the channels are set up identically (i.e., baud rate, parity, etc.)

Channel 1			Channel 2
Transmit Data	2	2	Transmit Data
Receive Data	3	3	Receive Data
Request to Send	4	4	Request to Send
Clear to Send	5	5	Clear to Send
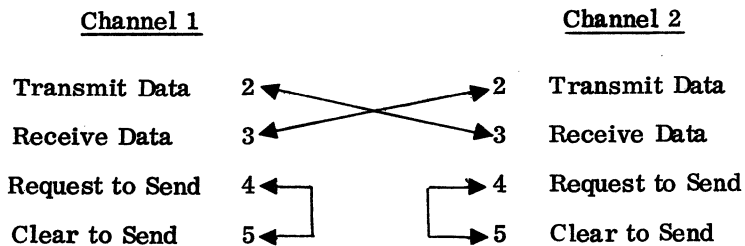
17.8.2.3 USE OF CDT FOR CHECKOUT

A CDT can be used for checkout purposes without the benefit of modems, if the following cable modifications are made.

Modify the distribution panel assembly end of cable number 41353504. Remove the wire from pins 4 and 5. Short these wires together and install a jumper between pins 4 and 5 on the connector. Remove the wire from pin 6 and install it in pin 20. Ensure that the respective channel and the CDT are set up identically (i.e., parity, baud rate).

The paper tape subsystem consists of one paper tape controller and a paper tape reader and/or a paper tape punch.

The paper tape controller is a one-card device designed to be inserted into any available A/Q card position of the CPU or the expansion enclosure. It communicates with the CPU via the A/Q channel and has selectable equipment number and program protect capability. It is provided with internal, external, and interrupt cable assemblies.

The paper tape controller is designed to communicate with the FACIT line of paper tape readers equipped with an SPI interface and/or the FACIT paper tape punch equipped with a FACIT SPI interface.

The FACIT paper tape readers are able to handle five-, six-, seven-, or eight-track tapes at reading speeds of 0 to 300 characters per second. The FACIT line of paper tape readers includes the following versions:

- FACIT 4021 — Top-loaded table-top version, with or without fan-folded tape handler

- FACIT 4022 — Front-loaded rack-mounted version with or without fan-folded tape handler

The FACIT paper tape punch is able to handle five- and eight-track tape or alternately six- and seven-track tape at an operation speed of up to 75 rows per second.

The paper tape controller communicates with the devices via standard SPI interface channels mounted in the devices. The controller performs the following functions:

- Decodes processor function codes

- Transmits processor function codes to the devices

- Transfers data between the CPU and the device in character mode

- Transmits device status messages to the CPU

- Detects operation and transmission errors

- Provide the CPU with device status information

A block diagram of the paper tape subsystem is shown in Figure 18-1.
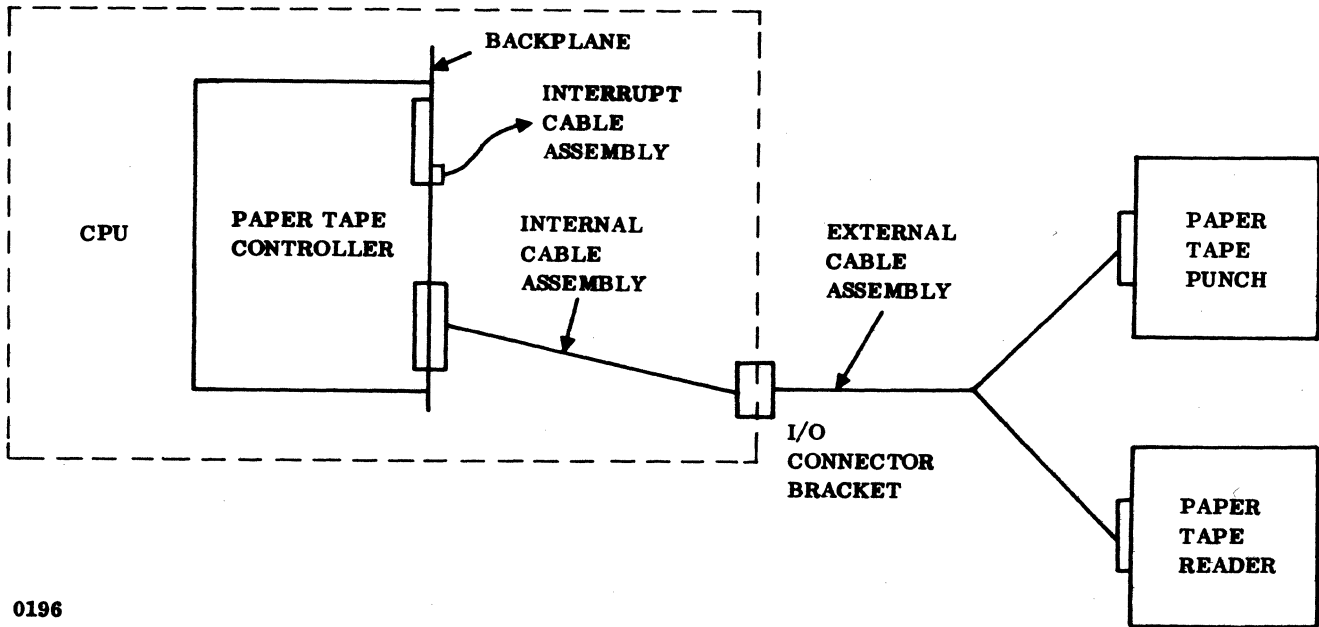
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Figure 18-1. Block Diagram of Paper Tape Subsystem

18.1 APPLICABLE DOCUMENTS

The following list includes the documents associated with the paper tape subsystem. The documents with asterisks (*) are required for installation. Documents relating to the paper tape controller are listed below:

Title	Publication No.
Paper Tape Controller Reference Manual (*)	89865300
AF108-A Paper Tape Controller Customer Engineering Manual (*)	89865200

The following documents related to the FACIT reader/punch devices may be obtained from FACIT:

Title	
FACIT 5117 Spare Parts List	5117.05.01.Eng.0.2M09.73
FACIT 5117 Tape Punch Adapter Service Manual	5117.08.01.Eng.0.2M08.73
FACIT 4070 Tape Punch Service Instructions	7031.Eng.
FACIT 4070 Tape Punch Spare Parts List	7261.Eng.
FACIT 4020 Tape Reader Service Instructions	7033.Eng.
FACIT 4020 Tape Reader Spare Parts List	7011.Eng.

18.2 REQUIRED PARTS

Required hardware for the paper tape subsystem is as follows:

	Product No.	Equipment No.
Paper tape controller	1720-1	AF108-A
Select jumpers	89684100	
Cable assembly, internal	89918200	
Cable assembly, external		
Reader	89918100	
Punch	89918000	
Cable assembly, interrupt	89724702	

	FACIT Product No.
Paper tape readers	
Table-top version	4021 with SPI interface
Rack-mounted version	4022 with SPI interface
Paper tape punch	
Table-top version	4070.0004
Rack-mounted version	4070.0005
SPI interface	5117/0005 SPI

NOTE

The subsystem requires either a punch or a reader
or both. The reader may be either a 4021 or a 4022
model. The punch may be either a 4070.0004 or a
4070.0005 model. Standard paper tape or mylar may
be used with the tape units.

18.3 INSTALLATION

18.3.1 PAPER TAPE READERS

Unpack and remove all packing materials. Refer to the FACIT Service Manual for initial inspection. Record all damage and/or missing parts and contact a local FACIT service representative for any problems encountered. The table-top model can be placed on a flat surface within five feet of the CPU.†

The rack-mounted model is designed to be mounted in a 19-inch Retma cabinet with a Retma mounting rack provided and may be mounted in the same cabinet with the CPU or an adjacent cabinet.

18.3.2 PAPER TAPE PUNCH

Unpack and remove all packing materials. Refer to the FACIT Service Manual for initial inspection and preparation for operation. Record all damage and/or missing parts and contact a local FACIT service representative for any problems encountered.†

The table-top model can be placed on a flat surface within five feet of the CPU.

The rack-mounted model is designed to be mounted with the standard 19-inch wide Retma mounting kit provided with the unit. It may be mounted in the same cabinet with the CPU (space permitting) or in an adjacent cabinet.
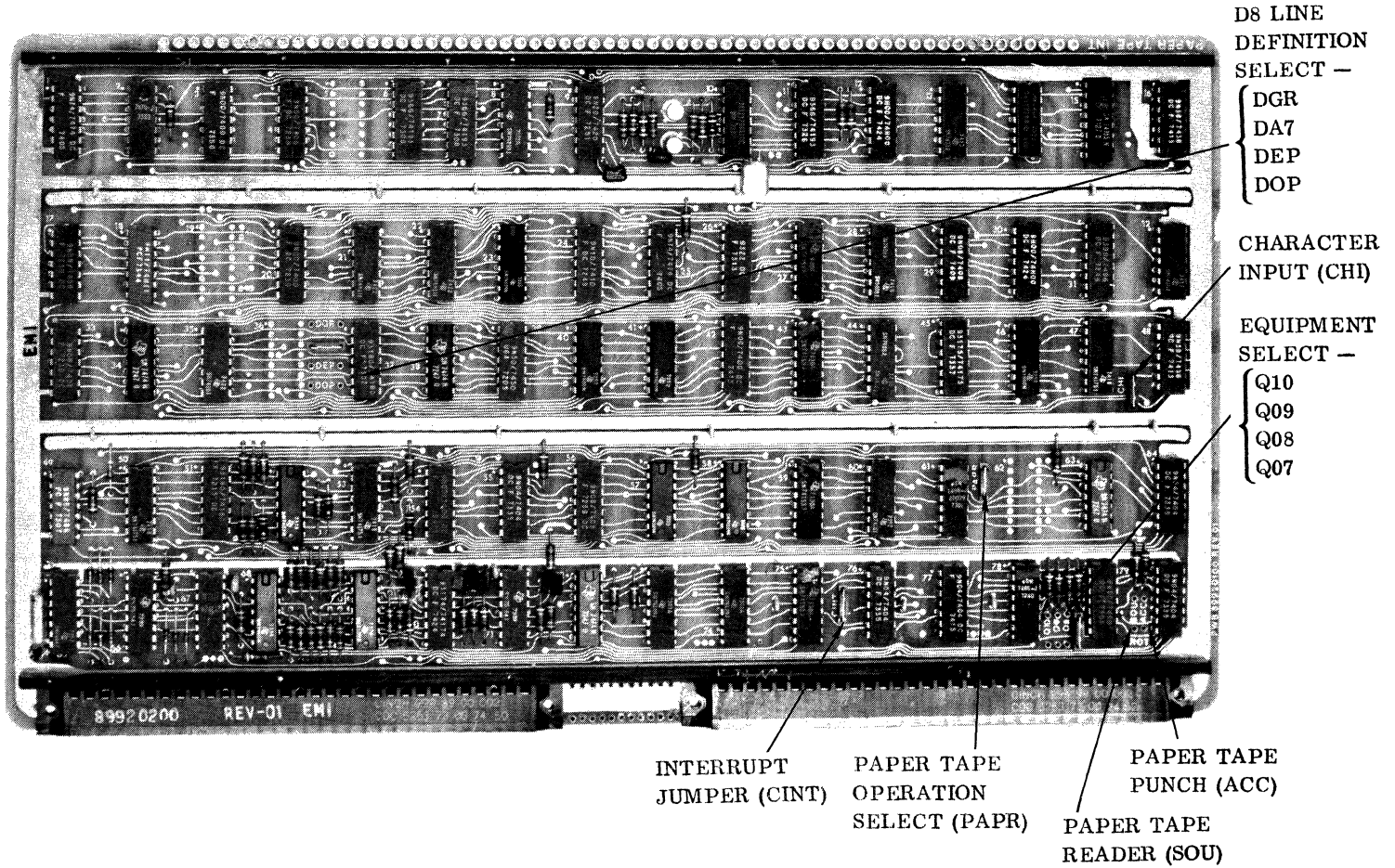
18.3.3 PRIMARY POWER PREPARATION

Both the reader and punch require single-phase ac power input. A selector switch is provided on the units that must be matched to the available input voltage. The settings available are 100 vac (+15% -10%), 115 vac (+15% -10%), 220 vac (+15% -10%), and 240 vac (+15% -10%). Determine the requirement at the site and set the dial to the specified value. The frequency may range from 49 Hz to 100 Hz. A power cord is provided with the unit to facilitate connection to a convenient outlet. Install the power cable.

18.3.4 PAPER TAPE CONTROLLER

Unpack the paper tape controller and cable assemblies. Inspect and record any damage and/or missing parts. Prepare the controller card for installation by placing the required jumpers on the card according to customer requirements. See Figure 18-2 and Table 18-1 for jumper locations.

---

†Installation and maintenance of the FACIT reader and punch units is the responsibility of the customer. For technical problems pertaining to these devices, contact the FACIT field service representative.

D8 LINE
DEFINITION
SELECT —
DGR
DA7
DEP
DOP

CHARACTER
INPUT (CHI)

EQUIPMENT
SELECT —
Q10
Q09
Q08
Q07

INTERRUPT
JUMPER (CINT)

PAPER TAPE
OPERATION
SELECT (PAPR)

PAPER TAPE
PUNCH (ACC)

PAPER TAPE
READER (SOU)

NOTE: JUMPER IN SELECTS THE BIT OR CONDITION.

Figure 18-2. Paper Tape Controller Jumper Locations

Table 18-1. Paper Tape Controller Jumper Select Information

JUMPER NAME	PAPER TAPE READER	PAPER TAPE PUNCH
Q07 Q08 Q09 Q10	Insert as required to determine system equipment number — typically Q7 (1)	Insert as required to determine system equipment number — typically Q7 (1)
PAPR	Install	Install
PROT-ACC	Does not apply	Install = Protected Out = Not Protected
PROT-SOU	Install = Protected Out = Not Protected	Does not apply
CHI	Install = Character input	Does not apply
CINT	Install = Common interrupt reader/punch	
DA7 DGR DEP DOP	Does not apply	Must be installed in one of the four positions to activate the D8 line†

†D8 line definition:
DA7 installed — Causes data punched in track 8 to be identical to A/Q bit A07. Typically in for punching 8-level tape.
DGR installed — Causes no data to be punched in track 8
DEP installed — Causes data punched in track 8 to be the even parity of tracks 1 through 7
DOP installed — Causes data punched in track 8 to be the odd parity of tracks 1 through 7
The installation of this jumper is to be determined by user.

Turn off power on the expansion enclosure if it is included in the system. Then turn off the CPU power. Install the paper tape controller card into the customer-specified A/Q card position. If the customer does not specify a particular card position and if no CDC system documents specify a card position, choose an A/Q position that will not interfere with the installation of other equipments (some equipments require two or more card positions that must be adjacent to each other). Record the assigned card position on the card position assignment sheet. This assignment sheet should be in the site log or located on the back of the door of the respective enclosure.

18.3.5 INTERNAL CABLES

Remove the back cover of the CPU or expansion enclosure. If a battery pack is part of the system, pay particular attention to where the battery leads connect to the CPU or expansion enclosure before removing them.

Install the internal cable assembly between P2 of the backplane of the selected A/Q position and the CPU/expansion enclosure connector panel. Locate the two labeled 66-pin Continental connectors adjacent to each other on the connector panel. Use eight 4-40 screws to mount the connectors to the chosen location on the CPU/expansion enclosure connector panel. Record the respective positions of the reader connector and punch connector on the card position assignment sheet.

18.3.6 EXTERNAL CABLE AND SPECIAL PLUG

Install the reader external cable to the reader SPI interface connector. Install the punch external cable to the punch interface connector.

For punch installation, the Cannon connector provided with the punch must be assembled and installed as follows to facilitate tape low detection and tape tight/ruptured error detection.

- Tape low — Install the jumper from pin 10 to pin 21 on the Cannon connector; solder into the pins.

- Error — Install the jumper from pin 18 to pin 20 on the Cannon connector; solder into the pins.

- Complete the assembly of the Cannon connector by placing the locking parts and plastic enclosure onto the connector.

- Install the connector onto P-1 of the punch and lock it in place.

Route the external cable assemblies from the reader and/or punch to the CPU/expansion enclosure and install the reader/punch external connectors to their respective I/O connectors.

18.3.7 INTERRUPT CABLE

Interrupt signals are available at two pins:

- Paper tape punch at P1 B25

- Paper tape reader at P1 B29

Insertion of the CINT jumper on the controller board causes both interrupts at either P1 B25 or P1 B29 to be common interrupt signals. Therefore, if CINT is installed, choose either pin. If the CINT jumper is out, choose the desired pin and install the interrupt cable assembly to the chosen pin and to J25 P1 or J26 P1. See Section 1.3.1 for optional interrupt assignment pins. Typically the paper tape subsystem is assigned to interrupt 1 and equipment 1.

If an expansion enclosure is used, refer to Table 5-2 for the appropriate pin for routing the interrupt signal to the CPU; i.e., for interrupt 1 in an expansion enclosure A/Q position, the paper tape controller CINT jumper is installed from P1 B29 of the selected A/Q position to the A/Q expander (JX P1 A24). Then in the CPU, another interrupt cable goes from A/Q expander JY P1 A24 to J25 P1 B10. (JX and JY are the assigned card positions of the A/Q channel expansion in the CPU and expansion enclosure, respectively.)

Reassemble the CPU/expansion enclosure.

18.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Apply power to the CPU. Apply power to the expansion enclosure (if it is part of the system) after the CPU has been powered up. Use a vom or dvm to measure the presence of +5v ±0.2 vdc on test point 63 of the controller card.

If the punch is part of the system, connect the power card to the primary source. Load the punch device with the supply reel of paper tape. Thread the paper tape through the punch to the output take-up reel. Turn on ac power. Depress DC ON and FORWARD switches. Check the tape tracking and reel operations. Depress FEED HOLE. Check to see that sprocket holes are being punched. Depress the CODE HOLE switch, which should punch all ones in the tape. Depress FEED HOLE a few inches to produce a leader. Note whether the ERROR light and TAPE LOW lights are out and READY is on at the end of the operation. If the ERROR light is on, check the threading of the tape. If the TAPE LOW light is on, check the switch on the TAPE LOW lever. If the READY light is not on, a fuse may be blown. Refer to the FACIT Service Manual for location and/or contact a FACIT service representative.

If a paper tape reader is included in the system, load the prepunched tape into the reader. Make sure the tape has a proper leader and that sprocket holes are punched. If there are no sprocket holes, there will be an alarm. Also, make sure the sprocket holes are correctly positioned. When loading the tape, align the sprocket holes so that they are between the third and fourth tracks from the front of the reader. If the tape is reversed or the sprockets are between the third and fourth holes from the rear, an alarm will be generated. Turn ac power on; turn dc power on. Set the thumbwheel switch to the appropriate setting (usually level 8). Position the guides for the desired tape width, usually level 8. Load the tape, making sure it moves freely in the guides. Then close and latch the lid. Press MASTER CLEAR on the CPU; then depress FEED FORWARD and FEED REVERSE to see if the tape movement is proper. Depress START. The tape should jog forward one sprocket and stop. The ERROR light should go off. If not, press MASTER CLEAR on the CPU two to three times. The tape should jog forward and the ERROR light should clear. If it does not clear, check the threading, the lid latch, and check to see if the dc light is on. If the ERROR light cannot be cleared, contact the FACIT service representative for a possible problem in the reader.

18.5 DIAGNOSTIC CHECKOUT

18.5.1 SMM TESTING

Load the SMM17 Version 3.1-2 Monitor into the CPU. Set up the SMM parameters as shown in Section 1.7.1. When BUILD TEST LIST is typed out, call up PT2092 (Paper Tape Punch Test No. 92) or PT2093 (Paper Tape Reader Test No. 93). Set up the respective test parameters according to Table 18-2 or Table 18-3. Ensure that the punch is loaded and ready or the reader is loaded and readied. Normally, the punch test is run first and then the reader test is run second, using the output tape of the punch test.

18.5.2 SCMM TESTING

To perform SCMM testing, MSOS must include the SCMM routines and the MSOS on-line monitor must be loaded into the CPU. The paper tape SCMM tests may be requested through the monitor (see Tables 18-4 and 18-5). Refer to Section 1.7.2 for details on loading the MSOS monitor and for more details on running SCMM. The test should begin to run after the paper tape punch test or the paper tape reader test has been requested. Ensure that the tape device is loaded and ready.

When running the Paper Tape Reader Test, use the output of the Paper Tape Punch Test and proceed as in Table 18-5.

18.6 MULTIPLEX TESTING

The purpose of multiplex testing is to simulate system operation. Tests will be loaded sequentially, set into operation simultaneously, and run with either status or interrupt synchronization.

18.6.1 SMM

The paper tape punch or paper tape reader may be multiplexed with the following tests:

- Teletypewriter Test No. 5
- Command Test No. 1
- MDC Test No. 7A
- Magnetic Tape Test No. 15
- Magnetic Tape Test No. 4B
- Line Printer Test No. OC

Table 18-2. Paper Tape Punch SMM17 Parameter Set-Up

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	9201	Test ID	STJP	Typically 0241 or 024D
2nd	LISS	Level, mode, sections　Typically 88FE	Number of times each pattern is to be repeated in each section	Typically 000B

$L^\dagger$ =
- Bit 15 = 8 level
- Bit 14 = 7 level
- Bit 13 = 6 level
- Bit 12 = 5 level

I =
- Bit 11 = 1 = Run test completely in interrupt mode
- 0 = Run test in both interrupt and character mode

SS =
- Bit 9 = Protect test
- Bit 8 = Backstepping test
- Bit 7 = $C9, $39 pattern
- Bit 6 = All ones, all zeros patterns
- Bit 5 = Complement pyramid pattern
- Bit 4 = Pyramid pattern
- Bit 3 = Complement zig-zag pattern
- Bit 2 = Zig-zag pattern
- Bit 1 = Static test

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
3rd	Delay constant		Interrupt line	Typically 0002
4th	Device protection	0000 = Device is not protected 0001 = Device is protected	Not used	

†Only one bit may be set in this group.

Table 18-3. Paper Tape Reader SMM17 Parameter Set-Up

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	9201	Test ID	STJP	Typically 0241 or 024D
2nd	LISS	Level, mode, sections	Interrupt line	Typically 0002
	$L^\dagger = \begin{cases} \text{Bit } 15 = 8 \text{ level} \\ \text{Bit } 14 = 7 \text{ level} \\ \text{Bit } 13 = 6 \text{ level} \\ \text{Bit } 12 = 5 \text{ level} \end{cases}$			
	$I = \begin{cases} \text{Bit } 11 = 1 = \text{Run test in} \\ \qquad\qquad \text{interrupt mode} \\ \qquad 0 = \text{Run test in} \\ \qquad\qquad \text{character mode} \end{cases}$			
	$SS = \begin{cases} \text{Bit } 9 = \text{Protect test} \\ \text{Bit } 8 = \text{Backstepping test} \\ \text{Bit } 7 = \$C9, \$39 \text{ pattern} \\ \text{Bit } 6 = \text{All ones, all zeros} \\ \qquad\quad \text{patterns} \\ \text{Bit } 5 = \text{Complement pyramid} \\ \qquad\quad \text{pattern} \\ \text{Bit } 4 = \text{Pyramid pattern} \\ \text{Bit } 3 = \text{Complement zig-zag} \\ \qquad\quad \text{pattern} \\ \text{Bit } 2 = \text{Zig-zag pattern} \\ \text{Bit } 1 = \text{Static test} \end{cases}$			
3rd	Delay constant		0000	Device not protected
			0001	Device protected

†Only one bit may be set in this group.

18.6.2 SCMM

SCMM multiplex testing may be performed utilizing all equipments on the system provided that there is an SCMM test for the device, the device is included in the MSOS logical unit table, and the interrupt priority is set up correctly. To run multiple tests, repeat the SCMM test loading procedure specified in the SCMM testing section of the applicable equipments.

Table 18-4. Paper Tape Punch SCMM Parameter Set-Up

OPERATOR ENTRY SCMM REPLY	COMMENTS

Press MANUAL INTERRUPT
 	
    MI
 	
SCMM (CR)
 	
    SCMM IN
    CONTROL, TEST ID
 	
SRT, PTP (CR)
 	
    BEGIN PAPER TAPE
    PUNCH TEST
    LU, TESTS, RUNS
 	
lu, x, y
	
	Start paper tape punch test.
	
	lu = Refer to MSOS for assigned
	       logical unit (see Section
	       1.7.2)
	x = Selected sections
	y = Number of runs

Table 18-5. Paper Tape Reader SCMM Parameter Set-Up

OPERATOR ENTRY SCMM REPLY	COMMENTS

Press MANUAL INTERRUPT
 	
    MI
 	
SCMM (CR)
 	
    SCMM IN
    CONTROL, TEST ID
 	
SRT, PTR (CR)
 	
    BEGIN PAPER TAPE
    READER TEST
    LU, TESTS, RUNS
 	
lu, x, y
	
	Start paper tape reader test
	
	lu = Refer to MSOS for assigned
	       logical unit (see Section
	       1.7.2)
	x = Selected sections
	y = Number of runs

18.7 VOLTAGE MARGIN TESTING

This is an EPS requirement for on-site installation and may be utilized if problems occur within the SYSTEM 17 that cannot be isolated via standard diagnostics.

Logic voltage margins on the paper tape controller may be performed by following the procedure outlined in Section 2.7. The paper tape devices do not contain a readily adjustable logic power supply. It is therefore recommended that margin testing not be performed on the paper tape devices.

18.8 TEST MAINTENANCE

18.8.1 PUNCH CHECK PATTERN

The following program may be used to punch a check pattern on paper tape. Visual observation of the information punched as well as operation should assist in isolation of problems.

Loc.			
$XXX0	0B00		
XXX1	E000	⎫	
XXX2	(WESF)		Typically 00C0
XXX3	C000		
XXX4	(0000)	⎬	Equipment code, write data
XXX5	0B00		
XXX6	03FE	⎭	
XXX7	0D01	⎫	
XXX8	02FE		Check status for not busy
XXX9	0FCE	⎬	
XXXA	0121	⎭	
XXXB	18FC		Repeat
XXXC	D8F7	⎫	
XXXD	C8F6		
XXXE	B000	⎬	Update data byte and check if completed section
XXXF	0100		
XX10	0101	⎭	
XX11	18EF		Repeat

XX12	0A00	⎫ Reset counter
XX13	68F0	⎭
XX14	0191	Skip stop to repeat section
XX15	0000	Stop — Terminate test
XX16	18EA	Repeat section

To use the program, make sure the paper tape punch is loaded and ready with several inches of feed holes punched. Initialize with the STOP switch set and the SKIP switch off. After initializing, the tape will begin punching a pattern. The pattern is repetitive, punching each binary character from 00_{16} through FF_{16}. After producing several feet of tape, raise the SKIP switch. The program will stop at the end of the last section at FF. Manually depress FEED HOLE to produce a trailer. Remove the tape and rewind. Examine the tape visually for the proper pattern or mount it in the paper tape reader and run the **read check pattern program** (see Section 18.8.2).

18.8.2 READ CHECK PATTERN

Loc.	$XXX0	0B00	
	XXX1	E000	⎫
	XXX2	(WESF)	Typically 00A1
	XXX3	0A00	
	XXX4	0B00	Load equipment code. Check status for not busy.
	XXX5	02FE	
	XXX6	0FCE	
	XXX7	0121	⎭
	XXX8	18FC	Repeat status
	XXX9	0DFE	⎫
	XXXA	0A00	
	XXXB	0B00	Input data
	XXXC	02FE	⎭
	XXXD	B000	⎫
	XXXE	0001	Search for 0001
	XXXF	0101	⎭
	XX10	18F1	Repeat

XX11	0D01	
XX12	0B00	
XX13	02FE	Check status for not busy
XX14	0FCE	
XX15	0121	
XX16	18FC	Repeat
XX17	0DFE	
XX18	0A00	
XX19	02FE	
XX20	6805	Search for hexadecimal and expected data byte
XX21	B000	
XX1B	(0002)	Initially set to 0002
XX1C	0103	
XX1D	C000	
XX1E	(0000)	Stop on error — Data in A-Register
XX1F	0000	
XX20	D804	Update section counter
XX21	C000	
XX22	0100	
XX23	B000	Check if section complete.
XX24	(0002)	Initially set to 0002
XX25	0102	
XX26	D8F4	D8F4 update expected data
XX27	18E8	Go for next data byte
XX28	0A00	
XX29	68F1	Reset expected data byte and section counter
XX2A	68F9	
XX2B	0191	Skip stop to terminate
XX2C	0000	Stop to terminate
XX2E	18E2	Repeat section

Initialize with the STOP switch set and the SKIP switch off. Raise the SKIP switch to terminate. If restarting at the beginning of the tape, reset cell XX1B and XX24 to 0002 and initialize. If a compare error is sensed, a stop will occur at XX1F and the contents of the last data transfer will display in the A register. Hit RUN to continue.

18.8.3 CREATE TEST TAPE

The following program may be used to create a test tape and to quickly examine the punch for data transfer:

Loc.		
$XXX0	0B00	
XXX1	E000	
XXX2	(WESF)	Typically 00C0
XXX3	0A00	
XXX4	0B00	
XXX5	03FE	
XXX6	0D01	
XXX7	02FE	
XXX8	0FCE	
XXX9	0121	
XXXA	18FC	
XXXB	0DFE	
XXXC	0AFF	
XXXD	0B00	
XXXE	03FE	
XXXF	0D01	
XX10	02FE	
XX11	0FCE	
XX12	0121	
XX13	18FC	
XX14	0000	
XX15	18EB	

Make sure the paper tape punch is loaded and ready. Initialize by turning the STOP switch off. The punch should produce a tape of alternate zeroes and ones. Allow about three feet to be punched and terminate by raising the STOP switch. Remove the tape and splice at each end to form a loop.

Mount the loop into the reader and use the following program to drive the tape loop. This allows observation of data lines in the reader in the second program and in the punch with the first program.

Loc. $XXX0   0B00

      XXX1   E000

      XXX2   (WESF)   Typically 00A1

      XXX3   0A00

      XXX4   02FE

      XXX5   0FCE

      XXX6   0121

      XXX7   18FC

      XXX8   0DFE

      XXX9   0B00

      XXXA   02FE

      XXXB   0000   SELECTIVE STOP switch up to terminate

      XXXC   18F4

This program can be operated in run mode or step mode.

18.8.4 TROUBLESHOOTING TIPS

18.8.4.1 PAPER TAPE READER

The error light should extinguish after the CPU has been master cleared and the STAND-BY switch has been depressed and released. If the light does not extinguish one or more of the following conditions is indicated:

1. The dc power is off.

2. The lid is not closed and latched.

3. The tape has no sprocket holes or the sprocket holes are aligned improperly.

4. The thumbwheel switch is set to the wrong level.

5. The tape is not properly loaded.

6. The tape moved in the wrong direction.

7. The tape did not move the correct distance.

8. There is a faulty diode in the reader or a misalignment of diodes.

9. The signal from the controller is missing saying the controller is on and operational.

A parity error after read indicates that transmission of data between the reader and controller is in error.

18.8.4.2 PAPER TAPE PUNCH

The READY light should come on after the CPU MASTER CLEAR button has been depressed and the dc POWER ON switch is depressed and released. If the READY light does not come on, one of the following conditions is indicated:

1. The dc power is off.

2. An error exists; if so, the ERROR light should be on indicating that the tape is too tight, ruptured, or improperly threaded.

3. A signal from the controller indicates that the controller is on and READY may be missing.

The remaining conditions indicate a device problem. Also the TAPE LOW light should be extinguished. If not, check the tape low indicating arm. Failure to become not busy after a punch operation may indicate one of three conditions in the punch device or interconnection:

1. Echo error — The coil drive in the punch is bad.

2. Tape low — A tape low condition is sensed by the punch.

3. Parity error — Transmission of data from the controller to the punch is in error.

These conditions may be established by performing a series of punch device queries. The following program may be used to make queries:

Loc.	$XXX0	0B00	
	XXX1	E000	
	XXX2	(WESF)	Typically 00C0
	XXX3	0AFF	
	XXX4	0B00	

XXX5	03FE
XXX6	0D01
XXX7	0A00
XXX8	0B00
XXX9	02FE
XXXA	0FCE
XXXB	0121
XXXC	18FC
XXXD	0D01
XXXE	0A11
XXXF	0B00
XX10	03FE
XX11	0DFE
XX12	0B00
XX13	02FE
XX14	0FC5
XX15	0121
XX16	0000	A stop here indicates a parity error
XX17	0D01
XX18	0A12
XX19	0B00
XX1A	03FE
XX1B	0DFE
XX1C	0B00
XX1D	02FE
XX1E	0FC5
XX1F	0121
XX20	0000	A stop here indicates the tape is low
XX21	0D01
XX22	0A14
XX23	0B00
XX24	03FE
XX25	0DFE

XX26	0B00	
XX27	02FE	
XX28	0FC5	
XX29	0121	
XX2A	0000	A stop here indicates an echo error
XX2B	18D5	

To initialize, make sure the tape is loaded and ready, raise the STOP switch, and run. The program will punch FFs down the tape. Any stop indicates one of three errors in the device as noted by the stop statements. If there are no problems, terminate by depressing STOP and MASTER CLEAR on the CPU.

The SYSTEM 17 Hardware Floating-Point Unit (HFPU) is to be used as an optional replacement for the SYSTEM 17 Software Floating Point Package (FLOT) when system requirements demand a higher operating speed for floating point calculations.

The HFPU is a seven-card device that requires one A/Q card position, one DSA card position, and five unwired card positions in an expansion enclosure. Included with the unit is an interconnecting mother board/cable assembly that plugs directly onto the expansion enclosure backplane.

Jumpers are included for equipment number and protect select, DSA scanner position select, and forced single-precision mode select. The HFPU uses the same calling sequences as the software FLOT package. It is initialized on the A/Q channel, and it retrieves its calling sequences and stores results via the DSA channel.

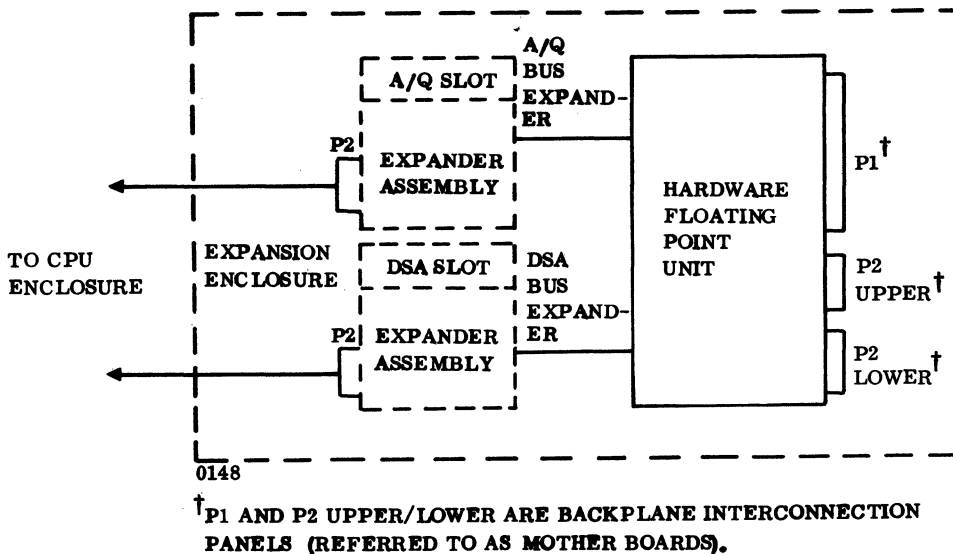See Figure 19-1 for a block diagram of the hardware floating point unit.

†P1 AND P2 UPPER/LOWER ARE BACKPLANE INTERCONNECTION
PANELS (REFERRED TO AS MOTHER BOARDS).

Figure 19-1. Block Diagram of Hardware Floating Point Unit

19.1 APPLICABLE DOCUMENTS

The following list of publications relates to the hardware floating point unit. Documents with asterisks (*) are required for installation and maintenance of the HFPU.

Title	Publication No.
BT221A Hardware Floating Point Unit Reference/Customer Engineering Manual (*)	88951000

19.2 REQUIRED PARTS

Required hardware for the HFPU includes the following:

	Product No.	Equipment No.
Hardware floating point unit	1781-1	BT221-A
EXP TIM Board		
FPHMP board		
SPALU board		
DPALU board		
A/Q board		
DSA board		
ADDALU board		
Mother Board Assembly, P1	88954400	
Mother Board Assembly, P2 top	88954500	
Mother Board Assembly, P2 bottom	88954600	
Tool, Extraction	88954700	
Shorting jumpers	89684100	

The following hardware must also be included in the system configuration:

	Product No.	Equipment No.
Expansion enclosure	1783-1	BT148-A
A/Q channel expansion	1785-1	AT310-A
DSA channel expansion	1785-2	AT310-A

19.3 INSTALLATION

Remove the HFPU logic boards and mother board assemblies from the shipping package. Inspect for and record any damage.

19.3.1 JUMPERS

Locate the A/Q board and install the HFPU equipment select and protect select jumpers as required. See Table 19-1 for the proper set-up of these jumpers and Figure 19-2 for the location of these jumpers.

Locate the DSA board and install a single jumper in one of the scanner select locations to determine the position of the HFPU in the DSA scanner chain. See Figure 19-3 for the location of these jumpers. See Section 1.5 for more details on establishing DSA scanner positions and jumper requirements to other devices.

Two jumper positions are located on the SPALU board. These are not used.

The component layout of the HFPU boards is different from other SYSTEM 17 boards. The components of the HFPU boards are laid out in coordinates. Each column is referenced by a letter, while each row is referenced by a number. Jumper and discrete component locations are referenced by the chip coordinate of the chip to the right of the jumper/component locations. (See Figure 19-4.)

Table 19-1. Hardware Floating Point Unit Equipment
Number Selection

| BIT	EQUIPMENT NUMBER SELECTION															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
07		X		X		X		X		X		X		X		X
08			X	X			X	X			X	X			X	X
09					X	X	X	X					X	X	X	X
10									X	X	X	X	X	X	X	X

NOTES:
1. X = A jumper is installed for this bit position.
2. Protect jumper installed = The controller is a protected device.
3. Equipment No. 15 (F) is the equipment number normally used for the HFPU.

PROTECT SELECT NOT USED

EQUIPMENT
NUMBER
SELECT
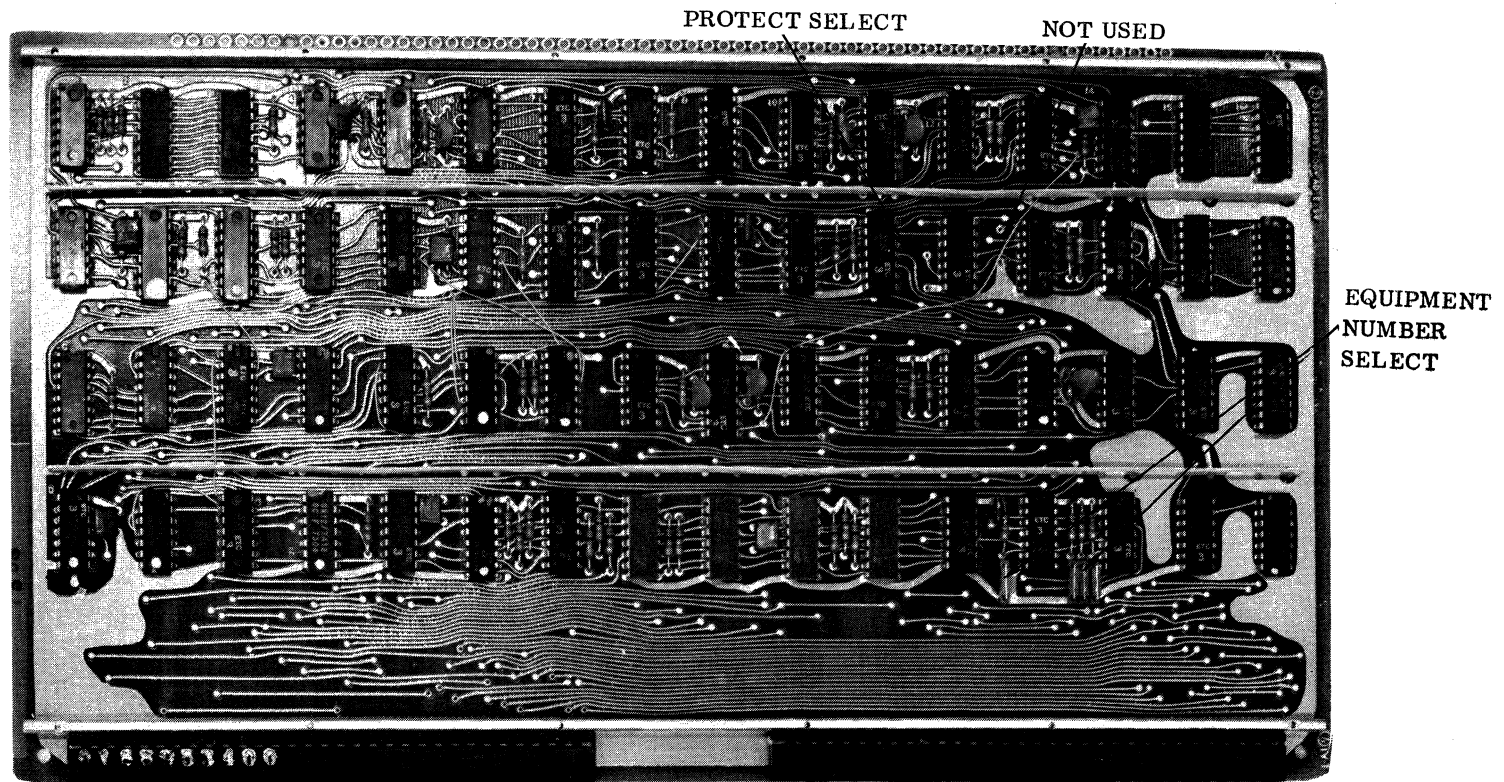
NOTES: 1. PROTECT JUMPER IN = DEVICE IS PROTECTED.
     2. JUMPER IN SELECTS Q-BIT AS FOLLOWS:
         E13S JUMPER IN = Q07
         E14S1 JUMPER IN = Q10
         E14S2 JUMPER IN = Q09
         E14S3 JUMPER IN = Q08

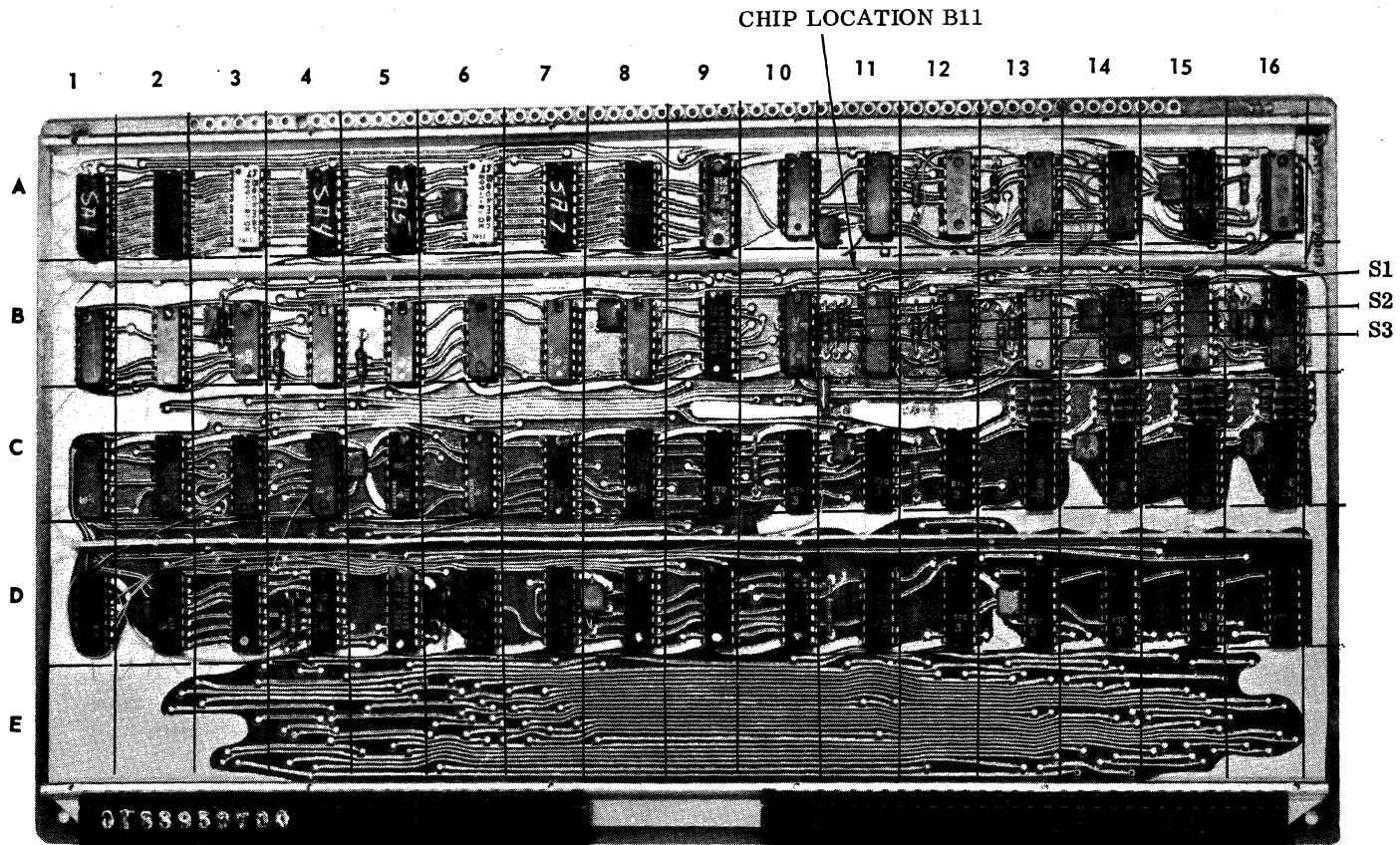Figure 19-2. HFPU Equipment Number and Protect Jumper Locations on A/Q Board

SCANNER SELECT
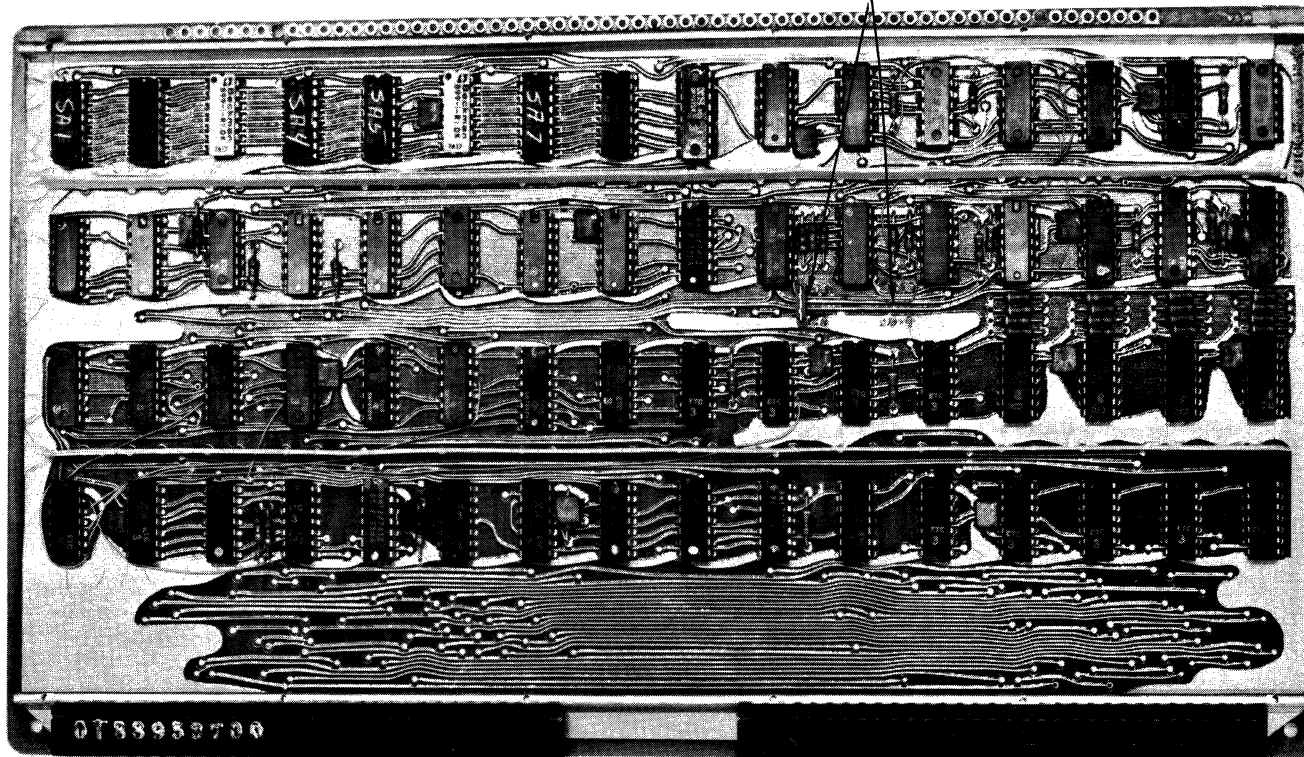
NOTE: JUMPER IN SELECTS SCANNER POSITION AS FOLLOWS:

      C11S1 JUMPER IN = LAST

      C11S2 JUMPER IN = MIDDLE

      C11S3 JUMPER IN = OUT

      C12S1 JUMPER IN = ONE ONLY

      C12S2 JUMPER IN = FIRST

Figure 19-3. HFPU Scanner Jumper Locations on DSA Board

CHIP LOCATION B11

NOTE: JUMPERS IN THE B11 COORDINATE ARE REFERRED TO AS B11S1, B11S2, AND B11S3.
COMPONENTS IN THIS COORDINATE ARE LABELED B11R1, B11R2 OR B11C1, B11C2
WITH THE LOWER-NUMBERED COMPONENTS TO THE LEFT.

Figure 19-4. HFPU Component/Jumper Orientation

19.3.2 LOGIC BOARDS

Turn off power on the expansion enclosure first; then turn off power on the CPU. Install the seven HFPU logic cards in the expansion enclosure chassis as shown in Figure 19-5.

NOTE

All cards must be in either the standard locations or the alternate locations. A mixing of standard and alternate locations is not allowable.

19.3.3 MOTHER BOARDS

1. PREPARATION. Visually inspect the area of the backplane opposite to the slots used for the HFPU logic cards for bent pins. A pin misalignment of approximately the width of the backplane pin itself (25 mils) can be tolerated by the vertical receptacles on the mother board.

Viewing each mother board from the side and top edge, sight down the rows of receptacles looking for ones that may have been bent out of alignment. A receptacle misalignment of approximately one-half the width of the opening at the top of the receptacle (25 mils) can be tolerated. The receptacles can be straightened using a needle-nosed pliers.

The examination and straightening (as required) should be carried out for all rows as viewed from both the side and the top edge of each mother-board card.

Slot	Label	Group
36		EIGHT MEMORY MODULES
35		EIGHT MEMORY MODULES
34		EIGHT MEMORY MODULES
33		EIGHT MEMORY MODULES
32		EIGHT MEMORY MODULES
31		EIGHT MEMORY MODULES
30		EIGHT MEMORY MODULES
29	MEMORY ADDRESS	
28	MEMORY CONTROL	
27		
26	RESTRICTED	
25		
24		OPEN
23	ADDALU (STANDARD)	
22	DSA (STANDARD)	
21	A/Q (STANDARD)	A/Q BUS
20	OPEN A/Q	A/Q BUS
19	OPEN A/Q	A/Q BUS
8	DPALU (STANDARD)	OPEN
17	SPALU (STANDARD)	OPEN
16	FPHMP (STANDARD)	OPEN
15	EXP/TIM (STANDARD), ADDALU (ALTERNATE)	
14	DSA (ALTERNATE)	
13	A/Q (ALTERNATE)	A/Q BUS
12	OPEN A/Q	A/Q BUS
11	OPEN A/Q	A/Q BUS
10	DPALU (ALTERNATE)	OPEN
9	SPALU (ALTERNATE)	OPEN
8	FPHMP (ALTERNATE)	OPEN
7	EXP/TIM (ALTERNATE)	OPEN
6	DSA BUS	
5		A/Q BUS
4		A/Q BUS
3	DSA BUS	
2	A/Q BUS	
1		

EXPANSION ENCLOSURE

Figure 19-5. HFPU Card Placement

2. INSTALLATION. Begin with the boards that cover the high-numbered pins on the P2 (bottom) row of connectors (see Figure 19-6). Orient each board with the lettering up and the receptacles pointing towards the backplane (away from you). Carefully align two corner receptacles with the backplane pins on the slot chosen for one of the outside logic cards (ADDR, slot 23; or EXP/TIM, slot 15 in the standard configuration). Start the receptacles onto the backplane pins along the chosen column to a depth of about 1/32 inch. Gently push against and oscillate the board until it drops down onto all of the pins.

Once the board has mated with all the pins (it will be parallel to the backplane and the pins will have entered approximately 1/16 inch into the receptacles), it needs to be pushed down onto the pins to make electrical contact. The fibre-glass epoxy board will flex slightly so that it is not necessary to overcome the insertion force of all the receptacles at once. Holding the board in place with one hand, force one corner down about 1/32 inch. Work around the board, forcing each corner down a little farther until the pins can just be seen through the holes in the bottom of the receptacles. Proper mating can be checked at this point by examining each receptacle to see the backplane pin within it.

After installing the bottom boards, proceed to the next pair of boards (P2 low-numbered pins) and then to the P1 boards.
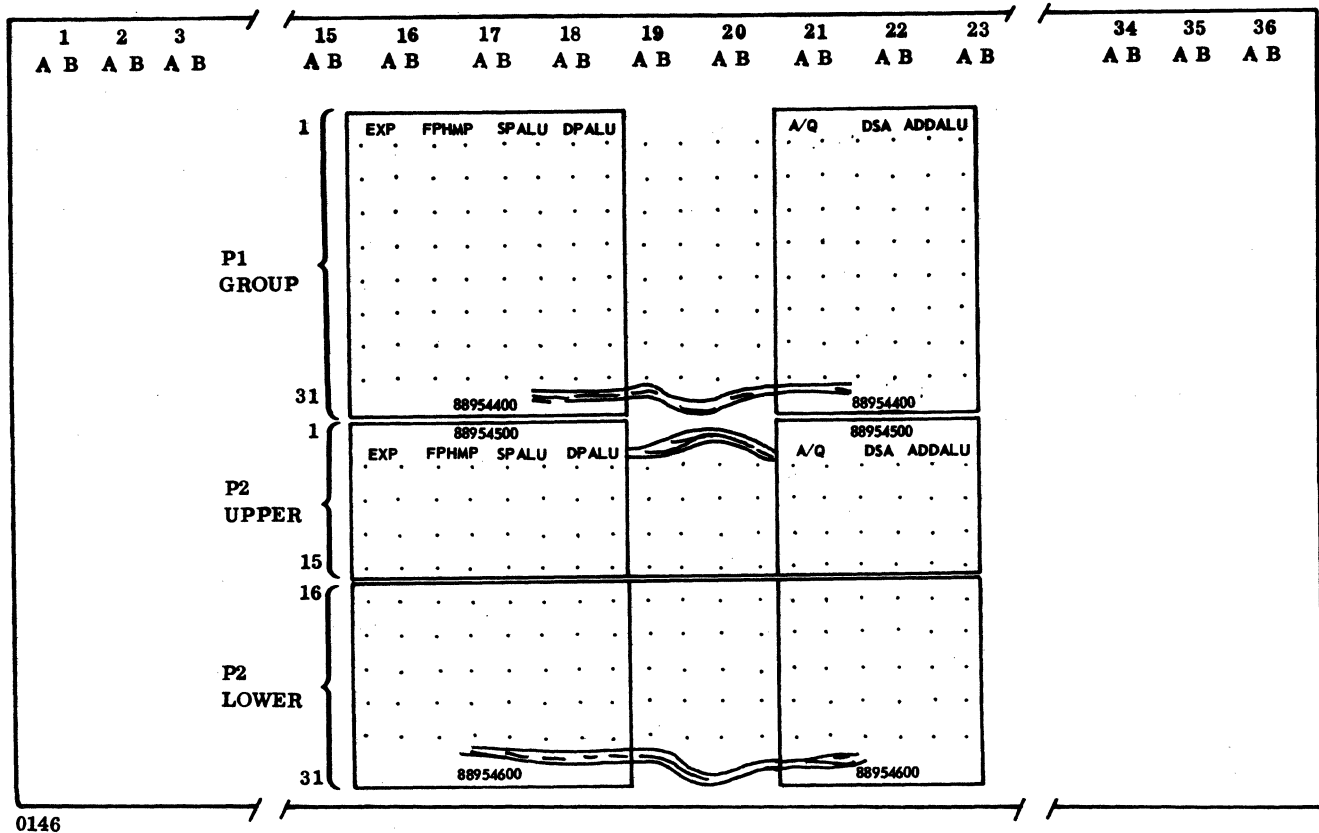

Figure 19-6. Mother Board Assemblies on Expansion Chassis

3. REMOVAL. Attach the removal tool to the vertical edges of the mother board. Alternately lift the right side and then the left side of the board and slowly walk the mother board off the backplane pins. The P1 boards may require some manual assistance in order to get the top and bottom rows of pins started moving.

CAUTION

Use one hand on the tool and the other hand to restrict
movement so that the last step does not result in an
abrupt, large movement, since this will sometimes
cause bent pins if one end (or side) releases before the
other.

19.3.4 DSA SCANNER CONFIGURATION

The scan forward signal is routed into the DSA board on P1 A19 and is designed SCFWDIN. It leaves the DSA board on P1 B19 and is designated SCFWDOUT. The scan reverse signal enters the DSA board on P1 B16 and is called SCREVOUT. It leaves the board on P1 B15 and is named SCREVIN. If the HFPU occupies the last position on the scanner, no connections are required at P1 B19 and P1 B16. Figure 19-7 shows a typical DSA scanner configuration.   Refer to Section 1.6 for more detailed SYSTEM 17 scanner configuration information.
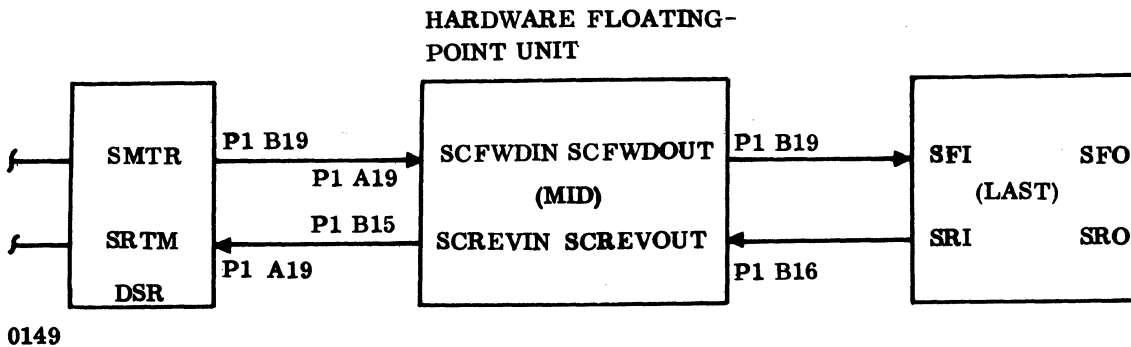

Figure 19-7. Typical DSA Scanner Connection

19.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

Apply power first to the CPU and then to the expansion enclosure. The HFPU derives its power from the expansion enclosure chassis.

To check the A/Q channel as well as the HFPU registers, use a simple hand routine to load and read each register. For a preliminary check of the DSA channel, use a simple hand routine to perform a floating load, floating store, and a floating end calling sequence. Ensure that the argument for the floating load is stored by the HFPU in the core location specified. See Section 19.8 and the following example:

(P)	FLDD	FLST	FEND	

(P+1)　　　　Absolute address for FLDD argument.

(P+2)　　　　Absolute address for FLST argument.

NOTE

Three successive core locations for double-precision arguments are required.

19.5 DIAGNOSTIC CHECKOUT

19.5.1 SMM TESTING

No SMM tests exist for this device.

19.5.2 SCMM TESTING

To perform SCMM testing, MSOS must include the SCMM routines, and the MSOS on-line monitor must be loaded into the CPU. The HFPU test may be requested through the monitor by following the procedure shown in Table 19-2. The HFPU test should start running when the last comment is terminated by a carriage return. Refer to Section 1.7.2 for details on loading the monitor and for more details on loading and running SCMM.

NOTE

Some systems may not have CDC MSOS installed. In that case, an RCOS (Reduced Core Operating System) Monitor may be utilized to load SCMM and the HFPU test.

Table 19-2. Hardware Floating-Point Unit Parameter Set-Up

OPERATOR ENTRY SCMM REPLY	COMMENTS

Press MANUAL INTERRUPT
 	
    MI
SCMM (CR)
    SCMM IN
    DATE AND TIME
    CONTROL, TEST ID
SRT, HFP
    1781-1 HARDWARE
    FLOATING POINT
    UNIT TEST, FLAGS,
    RUNS, CSQ LENGTY,
    MODE
0, x, y, z
	
	0 = Value normally used for
	            special test options
	x = Number of runs
	y = Length of calling sequences
	2 = Mode (DSA)
	            00 = Block
	            01 = HOG
	            02 = BYTE

NOTE: See the SCMM Reference Manual section pertaining to the HFPU.	

19.6 MULTIPLEX TESTING

The purpose of multiplex testing is to simulate system operation. Tests will be loaded sequentially, set into operation simultaneously, and run with either status or interrupt synchronization.

19.6.1 SMM

No SMM tests exist for this device.

19.6.2 SCMM

SCMM multiplex testing may be performed utilizing all equipments on the system provided that there is an SCMM test for all of the equipments, all devices are included in the logical unit table, and the system interrupt priority is set up correctly. To multiplex SCMM tests, use the call-up procedure as outlined in the section pertaining to the equipments to be tested. For additional information on SCMM testing, refer to Section 1.7.2.6.

19.7 VOLTAGE MARGIN TESTING

This mode of testing should be performed to fulfill the EPS requirements of on-site installations.

Logic voltage margins of the HFPU may be performed by following the voltage measurement and adjustment procedure outlined in Section 2.7. The HFPU SCMM test should perform satisfactorily at these settings. Include Vss margins as a method of verifying proper DSA operation.

19.8 TEST/MAINTENANCE AIDS

The following hand program can be used to check single-precision load and store operations. If the CPU STOP switch is not set, the program will loop. When the STOP switch is set, the A register will display the most significant word (FPAC1) of the value stored in core by the HFPU, and the Q register will display the least significant word (FPAC2).

IA	XX00	0A00	⎫
	XX01	6818	⎬ Clear storage locations
	XX02	6818	⎭
	XX03	E000	⎫
	XX04	0780	⎪
	XX05	0A01	⎬ Select HFPU and do program clear function
	XX06	0B00	⎪
	XX07	03FE	⎭
	XX08	0D03	⎫
	XX09	0A14	⎬ Select single precision with first command code at address 11
	XX0A	0B00	⎪
	XX0B	03FE	⎭

XX0C	0DFC	⎫
XX0D	02FE	⎬ Wait until HFPU is inactive
XX0E	0121	⎪
XX0F	18FD	⎭
XX10	C809	⎫
XX11	E809	⎬ Load A with first storage location, load Q with second, halt
XX12	0000	⎪ if stop set and/or repeat
XX13	18EC	⎭
XX14	5BD4	⎫
XX15	0002	⎪
XX16	0003	⎪
XX17	40C0	⎬ Command code: Select relative address/load floating point accumulator/store floating point accumulator/end operation
XX18	5555	⎪
XX19	0000	⎪
XX1A	0000	⎭

The power conversion transformer provides 115 vac, 50/60 Hz, for those devices that are restricted to using 115 vac, 50/60 Hz. The primary voltage inputs are 95 vac, 105 vac, 115 vac, or 127 vac, 50/60 Hz. The output is 115 vac, 50/60 Hz at a maximum 40 amperes. Primary input voltages of 200 vac, 220 vac, 230 vac, or 240 vac, 50 Hz, produce 115 vac, 60 Hz at a maximum of 40 amperes. Devices that may use this option are teletypewriters, card readers, or magnetic tape units.

20.1 APPLICABLE DOCUMENTS

The following manual will be useful in installing the power conversion transformer:

Title	Publication No.
Power Conversion Transformer Manual	96710000

20.2 REQUIRED PARTS

	Product No.
Power conversion transformer	10299-22

20.3 INSTALLATION

The transformer is mounted inside a perforated case that has mounting brackets attached to it. The transformer assembly is designed to be mounted on the wall adjacent to the primary power source. Lug bolts (not provided) are utilized to fasten the transformer to the wall.

20.4 POWER APPLICATION

Install customer-provided primary power according to Table 20-1.

Table 20-1. Power Conversion Transformer Primary Power

PRIMARY INPUT		SECONDARY POWER OUTPUT	
VOLTAGE	TERMINAL	VOLTAGE	TERMINAL
95 vac ⎫ 105 vac ⎬ 50/60 Hz 115 vac ⎭	1 and 2 1 and 3 1 and 4	115 vac 50/60 Hz	9 and 10
220 vac ⎫ 230 vac ⎬ 50 Hz 240 vac ⎪ 250 vac ⎭	1 and 5 1 and 6 1 and 7 1 and 8	115 vac 50 Hz	9 and 10

Ensure that input/output voltages are connected to the appropriate terminals. Measure the voltages at their respective terminals.

NOTE

If overheating occurs, check the amount of current utilized by the attached equipments and recheck the input/output connections and the current requirements of the attached equipments.

20.5 DIAGNOSTIC CHECKOUT

No diagnostics for this device exist. Proper execution of SMM and/or SCMM on the devices utilizing the conversion transformer will suffice.

This card punch subsystem consists of one card punch controller and one card punch device.

The card punch controller is a one-card device that may be inserted into any available A/Q card position of the CPU or the expansion enclosure. It has equipment number and program protect select capability and includes internal, external, and interrupt cable assemblies. When installed in an expansion enclosure, an A/Q channel expansion will be required.

The card punch is housed in a quietized cabinet mounted on heavy duty casters for maneuverability. The unit punches a full 80 columns of data at a rate of 100 cards per minute. The card punch contains a test card for off-line maintenance testing.

See Figure 21-1 for a block diagram of the card punch subsystem.

21.1 APPLICABLE DOCUMENTS

The following lists include the documents associated with the card punch subsystem. The documents with asterisks (*) are required for installation and maintenance of the card punch subsystem.
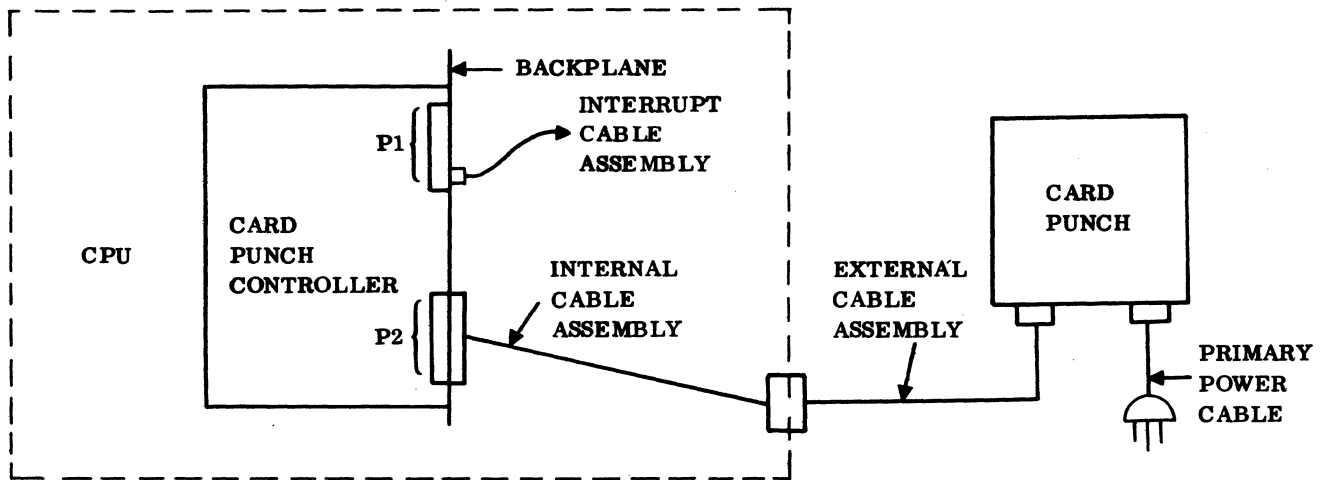
0195

Figure 21-1. Block Diagram of Card Punch Subsystem

The following documents are associated with the card punch controller:

Title	Publication No.
Card Punch Controller Customer Engineering Manual (*)	89837400
Card Punch Controller Reference Manual (*)	89837500

Documents pertaining to the card punch include the following:

Title	Publication No.
CH101 Card Punch Maintenance Manual	49760200
CH101 Card Punch Customer Engineering Manual	49760000
CH101 Card Punch Parts Manual	49759900

21.2 REQUIRED PARTS

Following is a list of hardware required for the card punch and controller:

	Product No.	Equipment No.
Card Punch Controller	1725-1	FE203-A
Card Punch	1725-1	CH101-A/B
Select jumpers	89684100	
Cable assembly, internal	89641800	
Cable assembly, external	89920000	
Cable assembly, interrupt	89724702	

21.3 INSTALLATION

21.3.1 CARD PUNCH

1. UNPACKING AND CHECKOUT

CAUTION

The card punch weighs approximately 500 lbs. Special
lifting equipment will be required to remove it from its
shipping pallet. Do not use a fork lift.

Remove the shipping carton from the card punch and remove the card punch from the shipping pallet. Inspect for external damage, missing parts, and for missing documentation. Record all discrepancies. Open the hinged front and top access panels. Remove the side panels and rear panel. The side and rear panels are secured from inside the card punch unit by one-quarter-turn fasteners accessible through top and front openings. Remove all shipping blocks, retaining straps, and packing material. Inspect the unit and record all internal damage.

2. INSTALLATION. Overall unit dimensions qre shown in Figure 21-2. A minimum clearance of three feet is recommended between the card punch and associated equipment. Maximum distance between the card punch and CPU/expansion enclosures is restricted by the 15-foot cable interface and interface cabling routing.

Detailed information on uncrating, installation, and initial checkout of the card punch can be found in the Card Punch Field Service Manual.
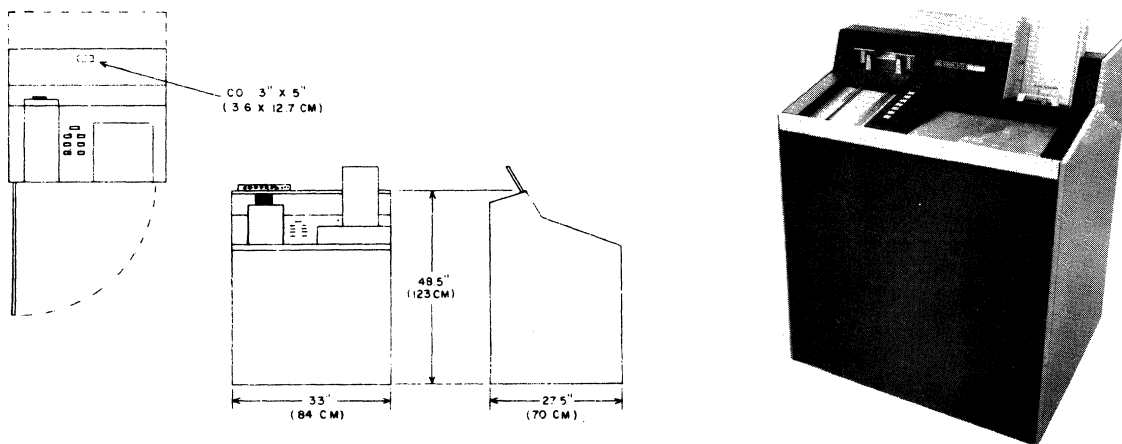

Figure 21-2. Card Punch Dimensions

21.3.2 CARD PUNCH CONTROLLER

1. UNPACKING AND CHECKOUT. Remove the controller board from its shipping package. Inspect and record any damage and/or missing parts.

2. INSTALLATION. Install the card punch equipment select jumpers and the protect jumper (if required) on the controller card. See Figure 21-3 for the location of jumpers on the board. A Q-bit jumper inserted selects that particular bit. The controller runs protected when the protect jumper is installed. The controller is normally set up for equipment number 5 (i.e., Q07 and Q09 set) with the protect jumper out.

Turn the power off on the expansion enclosure if it is included in the system. Then turn the power off on the CPU. Install the card punch controller in the customer-specified A/Q card slot. If the customer does not specify a particular slot position and if no CDC system documents specify a card slot, choose an A/Q slot that will not interfere with the installation of other equipments (some equipments require

PROTECT SELECT (PROT)

EQUIPMENT
NUMBER
SELECT —
Q07
Q08
Q09
Q10
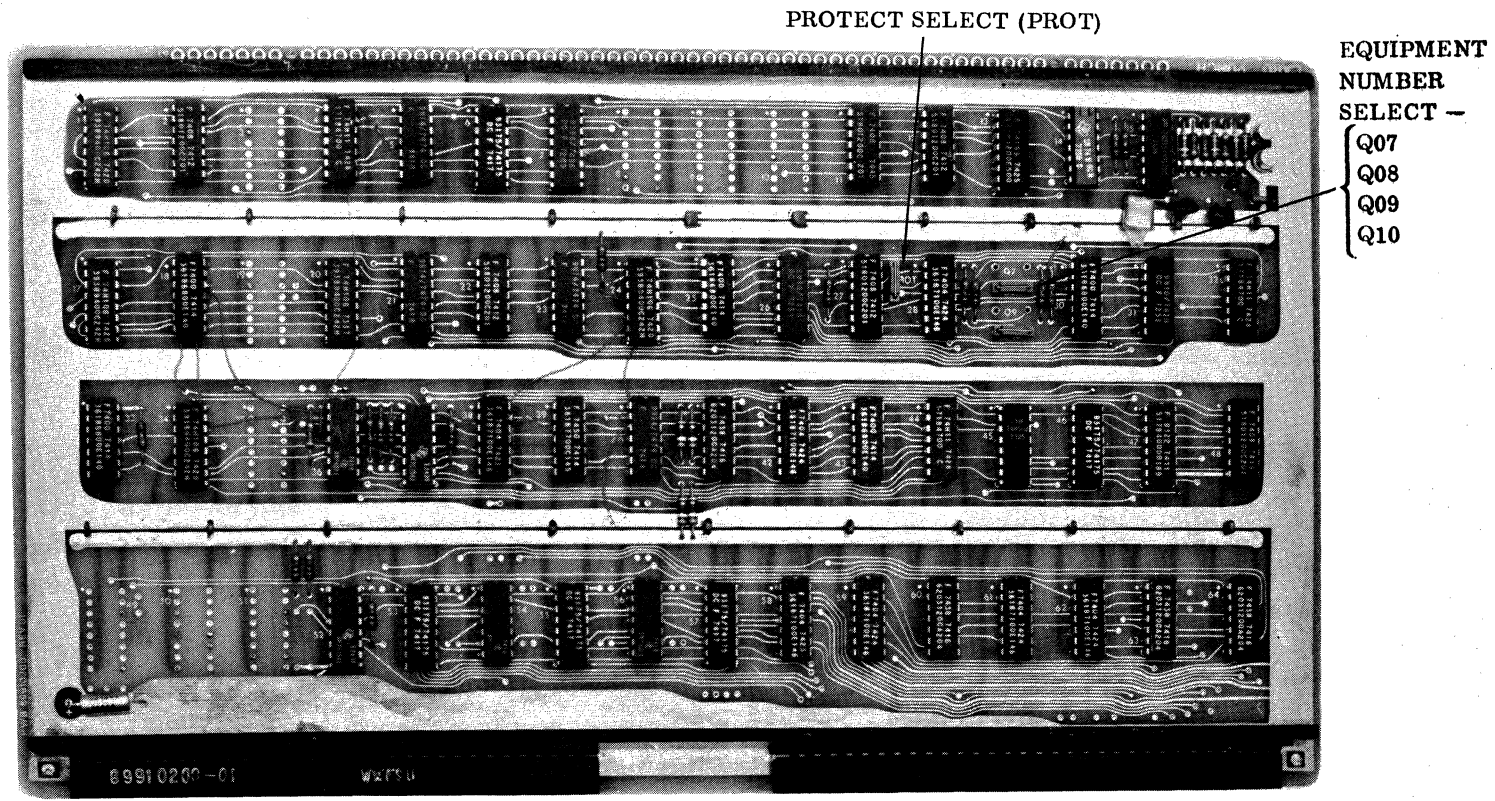
NOTES: 1. PROTECT JUMPER IN = THE DEVICE IS PROTECTED.
2. Q-BIT JUMPER IN SELECTS THE BIT.

Figure 21-3. Card Punch Protect and Equipment Number Jumper Locations

two or more card slots that must be adjacent to each other). Record the assigned card position on the card position assignment sheet. This assignment sheet should be in the site log or located on the back of the door of the respective chassis.

Remove the back cover of the CPU or expansion enclosure. If a battery pack is part of the system, pay particular attention to where the battery leads connect to the CPU or expansion enclosure before removing them.

Install the internal cable assembly between P2 of the backplane of the selected A/Q slot and the CPU/ expansion enclosure connector panel. Use four 4-40 screws to mount the 66-pin Continental connector to a convenient location on the CPU/expansion enclosure connector panel. Record this position (i.e., J6, J7, etc.) on the card position assignment sheet.

Connect the CPU end of the external cable assembly to the card punch controller connector on the connector panel. Route the punch end of the cable to and through the cable port at the left rear of the card punch (see Figure 21-4), and connect it to jack J1 located just above the cable port. The rear panel must be removed to facilitate the installation of this cable.
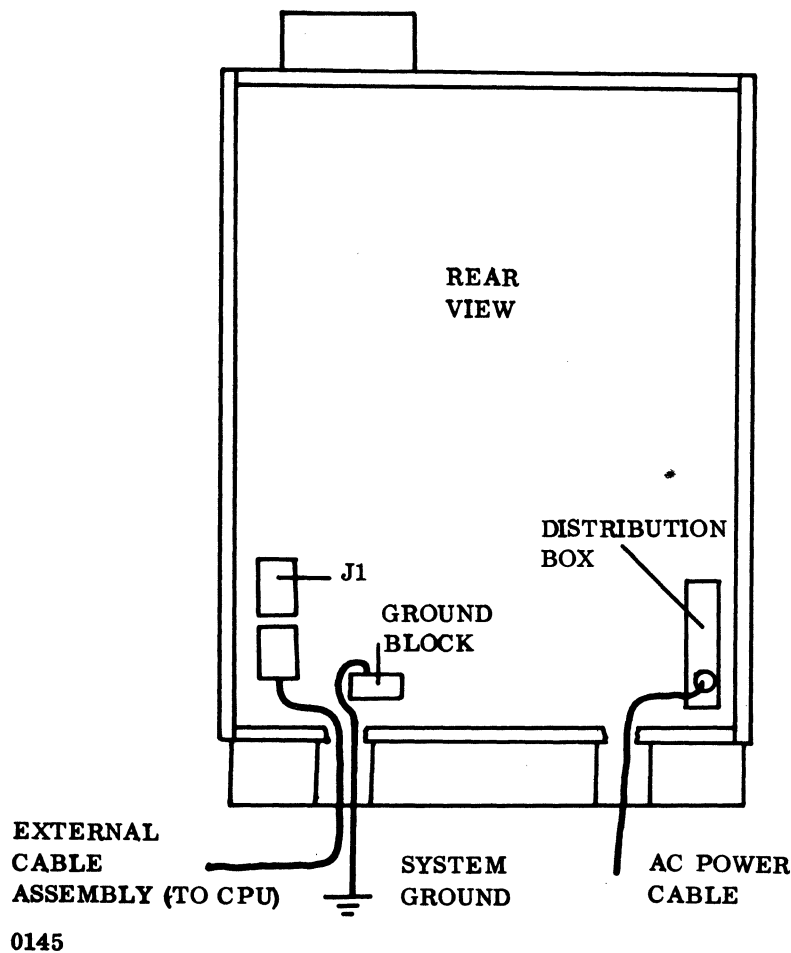

Figure 21-4. Card Punch Cable Locations

Install the interrupt cable assembly between P1 B27 of the card punch controller A/Q slot and J26 P1 A07. This selects the common interrupt as Number 10 for the card punch. See Section 1.3.1 for alternate interrupt assignments. Other interrupts from the card punch controller are available. These are the EOP interrupt at P1 B25, the data interrupt at P1 B24, and the alarm interrupt at P1 B26 of the assigned card position.

If an A/Q channel expansion is used, the interrupt line should be routed through the appropriate line of the channel expansion. See Section 5.3 for details on routing interrupts through the channel expansion. The interrupt line may be reassigned according to customer requirements. Replace the back cover and close the CPU or expansion enclosure door.

21.3.3 PRIMARY POWER INSTALLATION

21.3.3.1 CARD PUNCH CONTROLLER

The card punch controller does not require 50 Hz/60 Hz modification, since its power is provided by the expansion enclosure or the CPU.

21.3.3.2 CARD PUNCH

The card punch is manufactured as a 60 Hz unit or a 50 Hz unit. The primary input power must meet the following requirements:

$60 \, ^{+0.6}_{-1.0}$ Hz, 120 vac (104 through 127 vac), 10 amps (maximum)

$50 \, ^{+0.5}_{-1.0}$ Hz, 127 vac (115 through 136 vac), 12 amps (maximum)

700 watts

2380 Btu/hr

An isolation transformer (optional) will be required to accommodate other input voltages.

The input power connection is a terminal board A13 TB1 located in the distribution panel. The provisioning of a power cord for the card punch is a site requirement. The power cord is to be routed through the cutout in the base of the unit, underneath the distribution panel, and then up through the circular hole in the base of the distribution panel. The power cord is hardwired to A13 TB1 as shown in Figure 21-5. After the power cord is wired to the terminal board, the clamp on the underside of the relay box should be tightened around the cord. Make sure that slack exists in the wire run between the clamp and terminal board.

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two or more card slots that must be adjacent to each other). Record the assigned card position on the card position assignment sheet. This assignment sheet should be in the site log or located on the back of the door of the respective chassis.

Remove the back cover of the CPU or expansion enclosure. If a battery pack is part of the system, pay particular attention to where the battery leads connect to the CPU or expansion enclosure before removing them.

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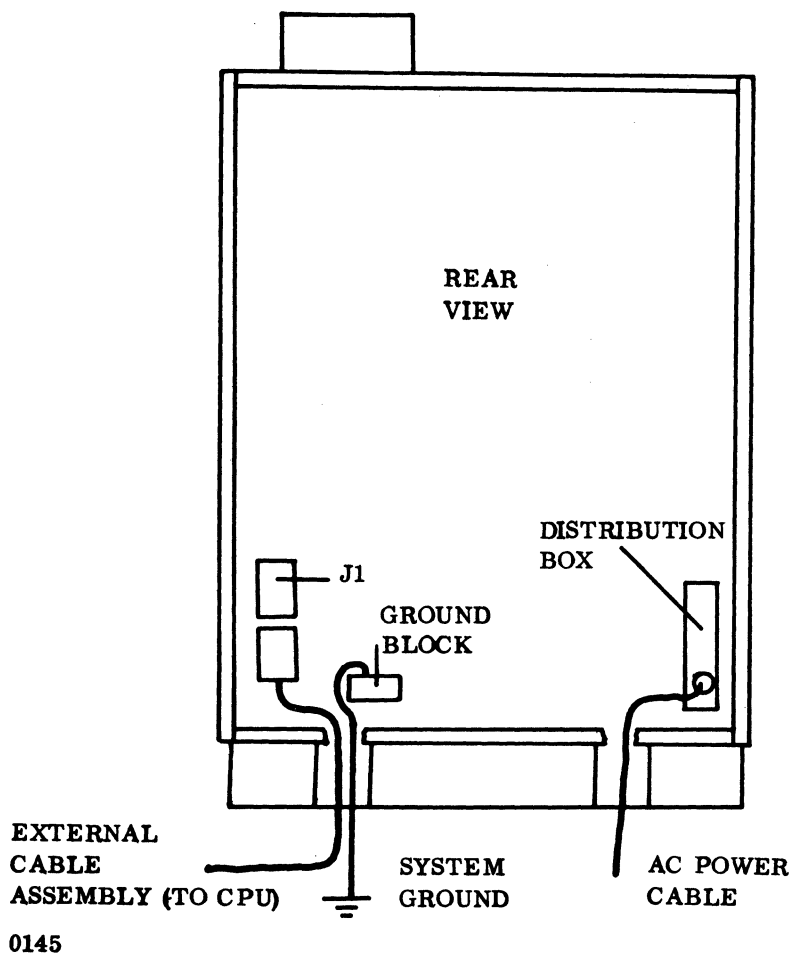

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2380 Btu/hr

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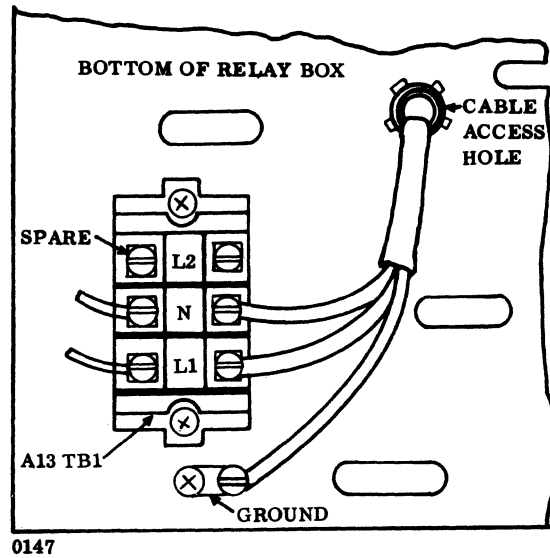
Figure 21-5. Power Cord Connections

CAUTION

Avoid positioning the I/O cable adjacent to the power
cable. Position cables at right angles to each other
when possible.

21.3.3.3 CIRCUIT BREAKERS

The circuit breakers for primary power, blowers, motor, and the +5v and +24v supplies are located
at the rear of the card punch unit. The rear panel must be removed to gain access to the circuit
breakers.

21.3.3.4 GROUNDING

Remove the rear panel. Route a one-inch braided ground strap through the punch cable port and con-
nect it to the ground block located below and to the right of external cable connector J1. See
Figure 21-4.

21.4 POWER APPLICATION AND PRELIMINARY CHECKOUT

21.4.1 POWER APPLICATION

Apply power to the CPU. Then apply power to the expansion enclosure, if it is part of the system. Use a vom or dvm to measure the Vcc voltage at test point 63 of the punch controller for +5 ±0.2 vdc. Adjust if necessary.

Connect the card punch primary power cord to the primary power source. Place all circuit breakers to the ON position. Depress the power switch.

21.4.2 PRELIMINARY CHECKOUT

Use a vom or dvm to check the card punch +5v and +24v power supply. Adjust if necessary.

The +5.0 vdc power supply should be set at +5.0 ±0.1 vdc. The voltage is measured at TB01-1 and TB01-2 (common) of the power supply, and it is adjusted by the potentiometer on the back of the upper power supply.

The +24.0 vdc power supply should be set at +24.0 ±0.1 vdc. The voltage is measured at TB01-3 and TB01-4 (common) of the power supply, and it is adjusted by the potentiometer on the back of the lower power supply.

Place the unit in OFFLINE (STANDBY) mode (see the customer engineering maintenance manual).

Feed ten cards and check for card motion along the transport and for damage to the cards.

See Table 21-1 for operational testing of buttons and lamps on the control punch of the punch unit, and see Table 21-2 for operational testing of the test card.

21.5 DIAGNOSTIC CHECKOUT

21.5.1 SMM TESTING

Load SMM17 Version 3.1-2 Monitor into the CPU. Set up the parameters as shown in Section 1.7.1. When BUILD TEST LIST is typed out, load CPC088 (Card Punch Test No. 88).

The card punch test requires 8K of memory. To verify that the card punch test ran successfully, it is necessary to load the punched deck into a card reader, and load and run SMM Card Punch Verify Routine Test CPUAFO. See Table 21-3 for SMM test parameters.

Table 21-1. Card Punch Controls

SWITCH/INDICATOR	OPERATOR PROCEDURE	EXPECTED RESULTS
POWER Switch and POWER Indicator	Turn POWER switch off.	POWER lamp is extinguished.
	Turn POWER switch on.	POWER lamp is lighted.
READY Switch/READY Indicator	Place card in input hopper. Touch READY.	READY indicator will light.
STANDBY Switch/ STANDBY Indicator	Touch STANDBY.	STANDBY indicator will light.
	Touch READY.	READY will light, STANDBY will extinguish.
FEED/JAM Indicator CLEAR Switch	Touch STANDBY. Without cards, touch FEED.	Motor will cycle and JAM lamp will light.
	Touch CLEAR.	JAM lamp will extinguish.
PUNCH INHIBIT/PUNCH Indicator	Touch PUNCH INHIBIT switch.	PUNCH INHIBIT lamp will light.
	Touch PUNCH INHIBIT switch again.	PUNCH INHIBIT lamp will extinguish.
INTERLOCK Indicator	Lift top lid.	INTERLOCK indicator will light.
	Close lid.	INTERLOCK indicator will extinguish.
TEST MODE Indicator	Touch STANDBY, open front door, depress TEST MODE switch on test mode card.	TEST MODE lamp will light.
	Push up on TEST MODE switch.	TEST MODE lamp will extinguish.
COMPARE ALERT Indicator	No external means exist to force a compare alert.	

Table 21-2. Test Card Conditions

SWITCH	OPERATOR PROCEDURE	EXPECTED RESULTS
TEST MODE	Fill input hopper with cards. Push TEST switch to ON.	Motor will turn on.
STOP/GO	Push switch to GO.	Cards will feed and punch all holes in all columns.
	Push switch to STOP.	
	Select some number of columns other than 80 (less than 82) and push GO.	Process stops.

Column Switches	Number of columns = 80
	    1 = OFF
	    0 = ON
		Punch all rows through number of columns selected.

	Set FULL to ON.	
	Push STOP.	Process stops.
PATTERN SELECT Switch ALTERNATE Switch	Set columns to 80.	
	Set FULL to OFF.	Punch alternate column in each row with adjacent rows offset by one.
	Set ALT to ON.	
	Push GO.	
	Push STOP.	Process stops
ROTATE PATTERN	Set ALT to OFF.	Punch pattern
	Set ROT to ON.	
	Push GO.	
	Push STOP.	Process stops
FULL	Set FULL to ON.	
	Set ALT to OFF.	
	Set ROT to OFF.	

Table 21-3. SMM17 Card Punch Test Parameters

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	8851	Test ID	STOP	Typically 020D or 02BD
2nd	11FF†	Sections (typical value)	0AAA	Interrupts (typical value) 0-3 = Alarm 4-7 = EOP 8-11= Data
3rd	0000	Typical value 0 = Section 4-7 under interrupts 1 = Section 4-7 under station	07D0	Maximum delay count for variable feed
4th	1800	Delay increment feed plus first punch allowance	0A00	Delay increment between feed and first punch (status driver)
5th	0300	Delay between punches (status driver)	0064	Number of cards punched per section

†If Section 9 is selected, another test stop will occur to allow selection of alternate patterns:

TEST STOP	CONTENTS OF A		CONTENTS OF Q	
1st	8851	Test ID	STJP	
2nd	x444	Pattern No. 1	x444	Pattern No. 2
3rd	xxxx	Pattern No. 2	xxxx	Pattern No. 3
	x	= 8 (bit 15 set) if pattern is to be punched		
	xxxx	= Pattern selected for particular stop		

Verify that the cards are punched correctly by using SMM17 Test FO. Test FO does not require any parameter entries. Any card reader may be used. The card reader equipment number must be specified in the Q register when the test is called up. Each punched section contains information that tells test FO what to expect. Before placing the punched cards in the card reader, ensure that the blank card following each offset separator card (end-of-file card) is removed. Also ensure that there are two separator cards at the end of the punched deck. Refer to the SMM17 Reference Manual for further details on setting up the SMM parameters, for test parameters, and for a description of errors in case the test does not run properly.

21.6 VOLTAGE MARGIN SETTING

This is an EPS requirement for on-site installations and may be utilized if problems occur within SYSTEM 17 that cannot be isolated via standard diagnostics.

Logic voltage margins on the card punch controller may be performed by following the procedure outlined in Section 2.7. SMM tests should be run at each setting. Vss margins need not be run.

It is recommended that logic voltage margins not be run on the card punch.

COMMENT SHEET

MANUAL TITLE _____ SYSTEM 17 Installation Manual _____

_____

PUBLICATION NO. ____88996000_____ REVISION _____B_____

FROM   NAME: _____

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