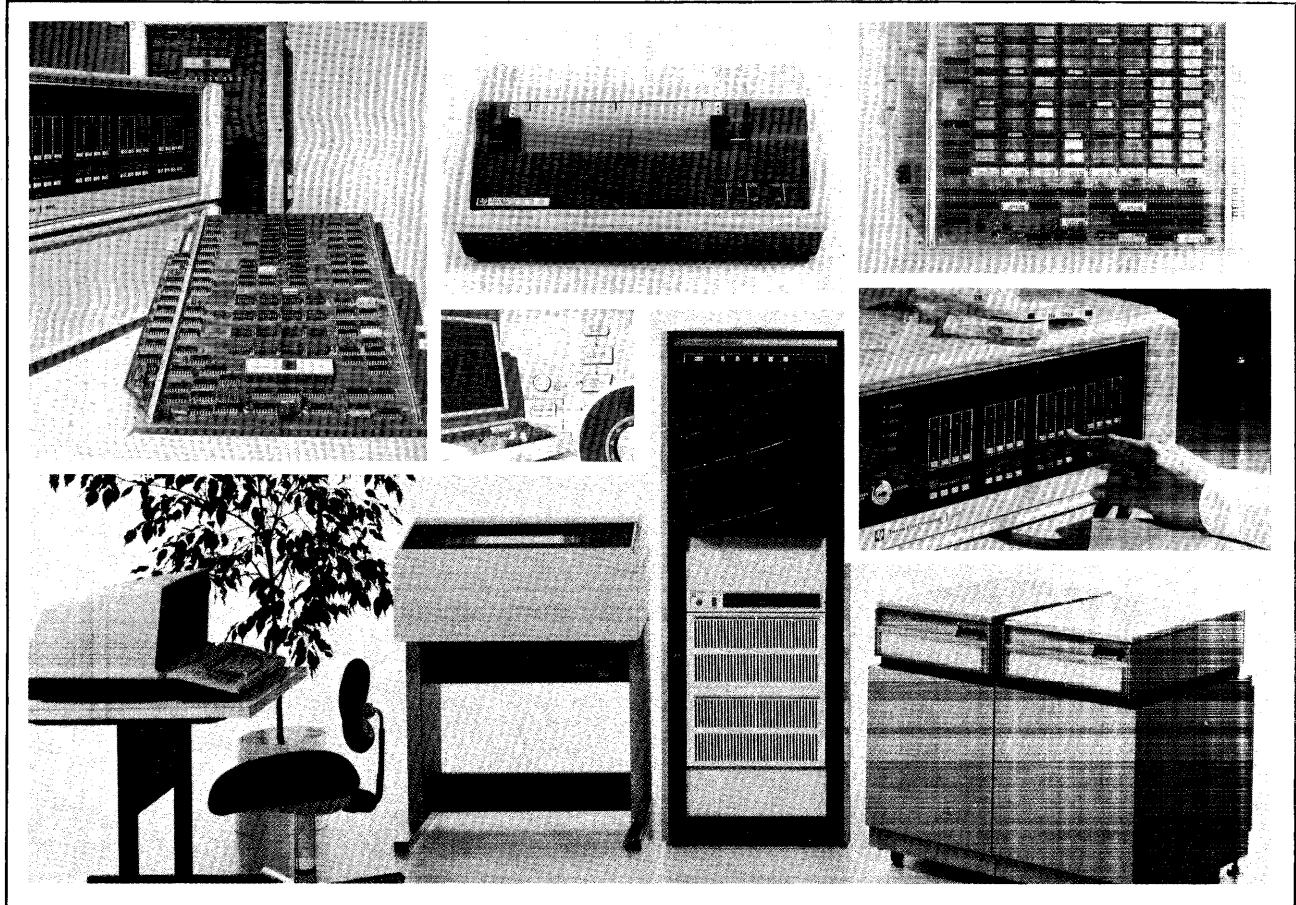


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# Model 990/10 to Model 990/12 Computer Upgrade Manual

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Part Number 2268682-9701 \*A  
15 March 1980

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# TEXAS INSTRUMENTS

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## **MANUAL REVISION HISTORY**

**Model 990/10 to Model 990/12 Computer Upgrade Manual (2268682-9701)**

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**Revised..... 15 March 1980 (MCR 000525)**



## PREFACE

This manual contains the information needed to install the Model 990/10 to Model 990/12 upgrade kit and to generate and to install new operating system software for use with the upgraded computer. The information in this manual is organized into five major sections:

### Section

- 1 Upgrade Kit Description — Defines the purpose of the upgrade kit, lists the equipment supplied in the kit, and provides an installation checklist.
- 2 Site Requirements — Contains the electrical, space and environmental requirements that must be met at the installation site.
- 3 System Generation — Provides the information needed to generate and to install a new operating system.
- 4 Unpacking and Installation — Provides information on unpacking components of the kit and electrical and mechanical installation procedures.
- 5 System Checkout — Describes how the new system should be checked for proper operation.

The following manuals contain information that may be helpful in installing and checking out the upgrade kit:

Title	Part Number
<i>Model 990 Computer DX10 Operating System Release 3, Reference Manual Volumes 1 through 6</i>	946250-9701 through 946250-9706
<i>DS990 Model 20/30 Site Preparation Manual</i>	2250692-9701
<i>DS990 Model 20/30 Operator's Service Guide</i>	2250694-9701
<i>Model 990/12 Computer Hardware User's Guide</i>	2264446-9701





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## SECTION 1

### UPGRADE KIT DESCRIPTION

#### 1.1 PURPOSE OF KIT

The Model 990/12 Computer upgrade kit is designed for upgrading the 990/10 minicomputer system. The 990/12 uses the standard DX10 disk-based operating system that allows system hardware upgrading without having the added expense of a new operating system.

#### 1.2 EQUIPMENT SUPPLIED

The Model 990/12 Computer upgrade kit consists of the following items:

- One 990/12 SMI board
- One 990/12 AU board
- One 17-slot chassis with two 40-ampere, 5-volt power supplies and one plus and minus 12-volt power supply
- Either a 76.2 cm (30-inch) single-bay pedestal cabinet or a 177.8 cm (70-inch) rackmount cabinet
- One *DS990 Model 20/30 Site Preparation Manual*
- One *DS990 Model 20/30 Operator's Service Guide*

#### 1.3 INSTALLATION CHECKLIST

The following checklist should be used as a guide when installing and checking out the new system. Ensure that all applicable items in the list are completed. Refer to the referenced section of this manual for detailed information concerning completion of each item in the checklist.

- \_\_\_ 1. Verify that the site has the proper space, power and environment for installation of the upgrade kit. Refer to Section 2 for details.
- \_\_\_ 2. Generate a new software system configured to communicate with and control the hardware that will be installed in the new system. Section 3 contains an example generation procedure.
- \_\_\_ 3. Verify that there is a back up system disk before attempting reconfiguration and installation. Refer to Section 3.
- \_\_\_ 4. Print out the existing operating system generation configuration. If problems are encountered, you may have to return to this configuration for debugging. Refer to Section 3.
- \_\_\_ 5. Verify that the hardware is installed properly. Refer to Section 4 for installation information.



- \_\_\_ 6. Verify that the hardware is operating satisfactorily. Refer to Section 5.
- \_\_\_ 7. Fill in the chassis configuration label for future reference.
- \_\_\_ 8. Verify the system generated for the new configuration is operational. Refer to Section 5.

#### **1.4 RECOMMENDED SUPPLIES**

Texas Instruments suggests the use of supplies available from our current price list. TI will not be responsible for equipment malfunctions due to the use of disk packs, magnetic tapes or other supplies that do not meet Texas Instruments specifications.



**SECTION 2**  
**SITE REQUIREMENTS**

**2.1 GENERAL**

This section contains the power, space and environmental requirements that should be considered before beginning installation of the upgrade kit.

**2.2 ELECTRICAL REQUIREMENTS**

The Model 990/12 Computer upgrade kit requires a dedicated ac power circuit to protect it from line noise and power fluctuations. There should be no electric motors (pencil sharpeners, copiers, typewriters), fluorescent lights, or air conditioners connected to the power lines supplying the computer system. Voltage irregularities and line noise are major causes of unnecessary errors, downtime and service calls.

Table 2-1 lists the voltage and frequency of the power required for U.S. and international installations. The current requirements of various items that may be included in the system are listed in the *DS990 Model 20/30 Site Preparation Manual* (included in this kit).

**Table 2-1. Electrical Requirements**

**U.S. Installations**

<b>30-Inch Cabinet</b>	<b>70-Inch Cabinet</b>
115 Vac 60 Hz	208 Vac (2-Phase) 60 Hz

**International Installations**

100 Vac 50/60 Hz	200 Vac (2-Phase) 60 Hz
220 Vac 50 Hz	200 Vac (2-Phase) 50 Hz
240 Vac 50 Hz	220 Vac            50 Hz
	240 Vac            50 Hz

Notes:

1. The ground wire must be connected to true earth ground; connection to a conduit is not acceptable.
2. Refer to applicable national standards for wall socket requirements.
3. Refer to the *DS990 Model 20/30 Site Preparation Manual*, for current requirements.



**2.2.1 U.S. OR JAPANESE INSTALLATIONS.** For U.S. standard 120/208 Vac cabinets, a 3.7 meter (12-foot) power cable wired as shown in figure 2-1 is provided. When the 17-slot chassis is installed in a 70-inch cabinet, the power cable has a locking female connector that mates with a recessed male connector on the cabinet power entry panel. The other end of the cable has a heavy-duty locking plug (NEMA L21-20P) that mates with a NEMA L21-20R wall outlet. This power cable contains four 12 AWG conductors. The power cord on the 17-slot chassis plugs into a receptacle on the power entry panel of the 70-inch cabinet.

The required 120/208 Vac service for U.S. installation is shown in figure 2-2. Figure 2-3 shows the 100/200 Vac service for Japanese installations.

When the 17-slot chassis is mounted in a 30-inch cabinet, the power cord on the 17-slot chassis goes directly to the wall outlet with no cabinet wiring involved. This power cord contains three 12 AWG conductors. Table 2-2 lists the required wall socket.

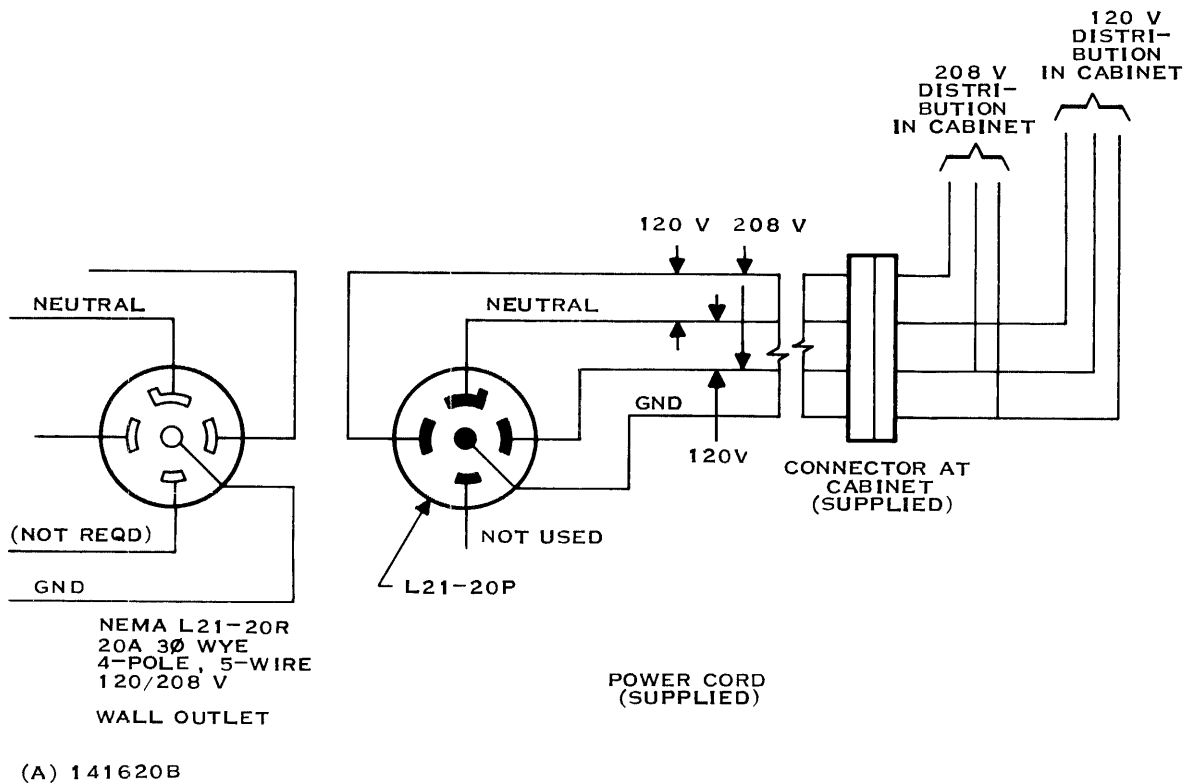
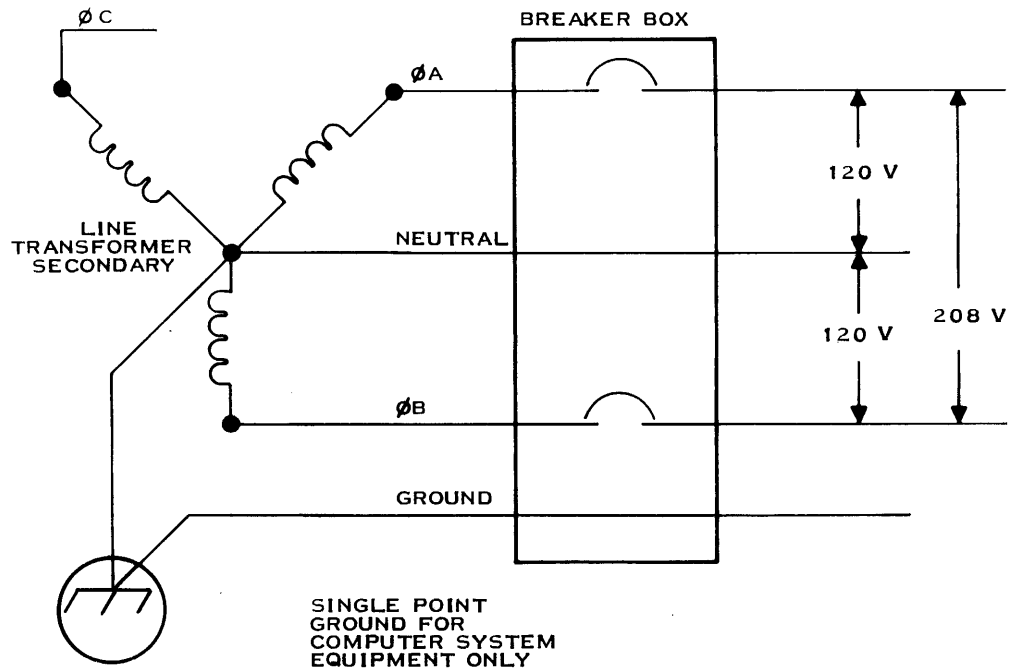


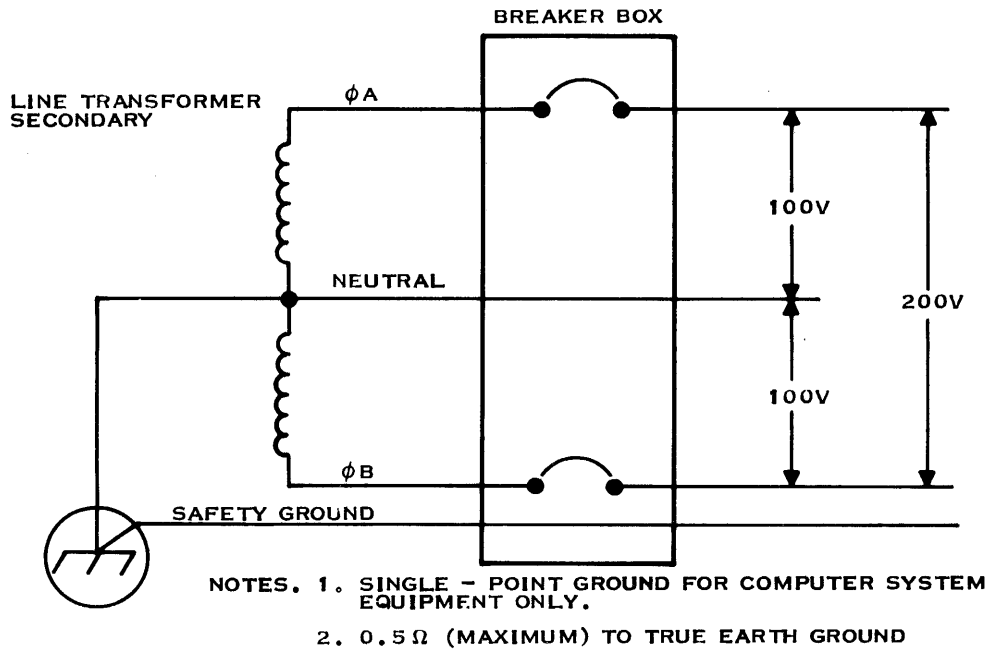
Figure 2-1. 120/208 Vac Cabinet Power Connections



- NOTES: 1. 0.5Ω (MAXIMUM) TO TRUE EARTH GROUND.  
2. PHASE A AND PHASE B MUST BE 120° APART.

(A) 141618A

Figure 2-2. 120/208 Vac, Two-Phase, Three-Wire Service with Safety Ground



(A)142210

Figure 2-3. Japanese 100/200 Vac Service with Safety Ground



Table 2-2. Power Outlets

Cabinet	Volts/Freq	NEMA Wall Socket
30-Inch	100 Vac 50/60 Hz	NEMA 5-20R
30-Inch	115 Vac 60 Hz	NEMA 5-20R
70-Inch	200 Vac 50/60 Hz	NEMA L21-20R
70-Inch	208 Vac 60 Hz	NEMA L21-20R
70-Inch	220 Vac 50 Hz	*
70-Inch	240 Vac 50 Hz	*

\*Plug type is determined by convention of country in which installation is planned.

The 70-inch cabinet is protected by a circuit breaker on the power entry panel. The 17-slot chassis is protected by its own fuse or circuit breaker.

**2.2.2 EUROPEAN INSTALLATIONS.** For Model 990/12 Computer upgrade kits sold outside the U.S. or Japan, Texas Instruments provides a locking female connector (NEMA L6-30P) that mates with the recessed male connector (NEMA L6-30R) on the 70-inch cabinet power entry panel. It is the customer's responsibility to fabricate a cable using this female connector at one end and a plug that is compatible with the service outlet at the other end. Figure 2-4 shows the recessed male connector as it is wired for European use. Figure 2-5 shows the customer-fabricated cable. The customer-fabricated cable should not exceed 4.5 meters (15 feet) in length and should contain conductors no smaller than 12 AWG (3.31 mm<sup>2</sup> area). The applicable authority should be checked when fabricating the cable as some national and local standards may be more restrictive.

When the 17-slot chassis is installed in a 30-inch cabinet, the 17-slot chassis power cord connects directly to the wall outlet. Figure 2-6 shows the power cord used for this purpose in European installations. Table 2-2 lists the required wall socket.

### 2.3 SPACE REQUIREMENTS

To ensure adequate cooling and to permit personnel access for operation and maintenance, a minimum amount of free space should be allowed around the cabinet in which the 17-slot chassis is installed. The space requirements for the 30-inch pedestal and the 70-inch rackmount cabinets are presented here.

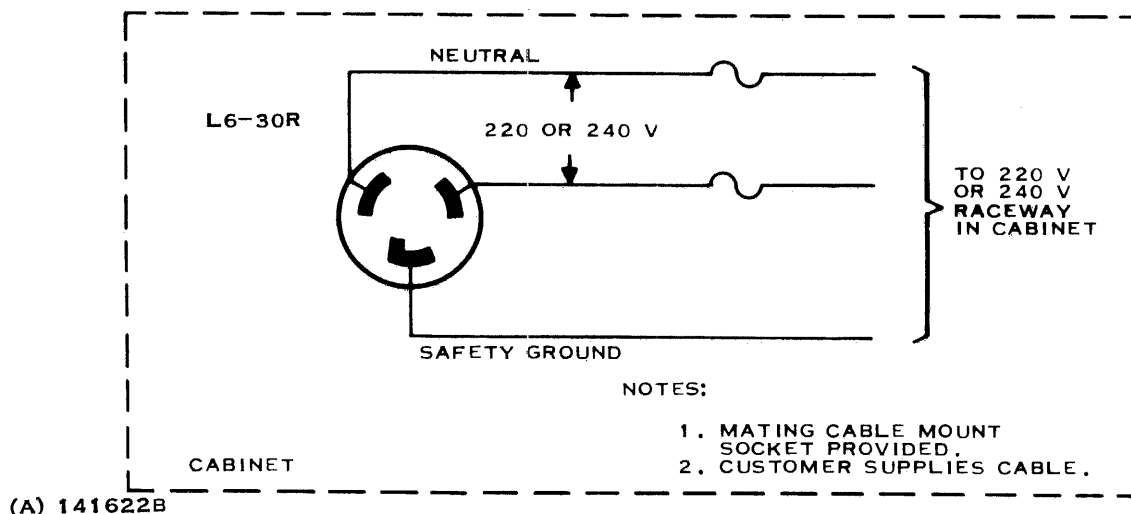
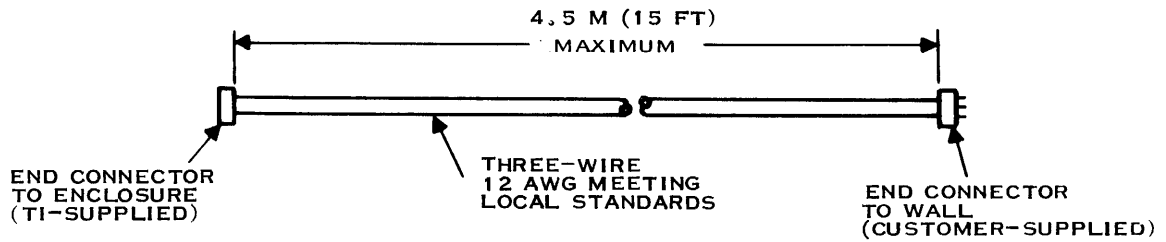
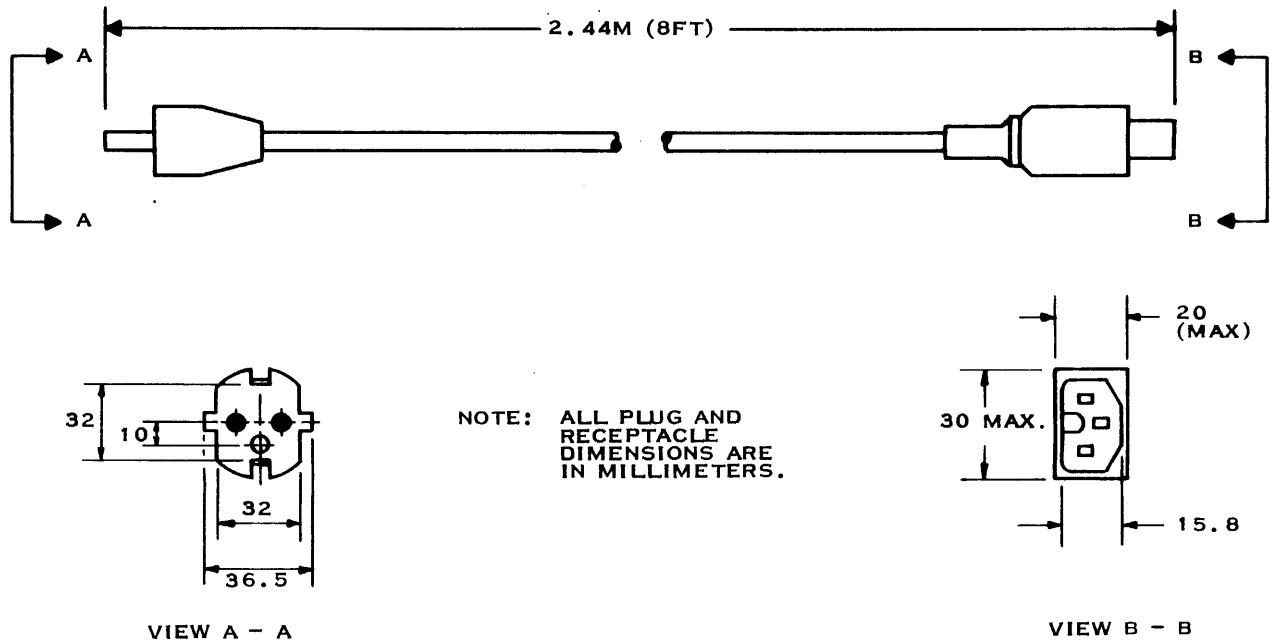


Figure 2-4. Cabinet Recessed Male Connector Wiring, European



(A)141525A

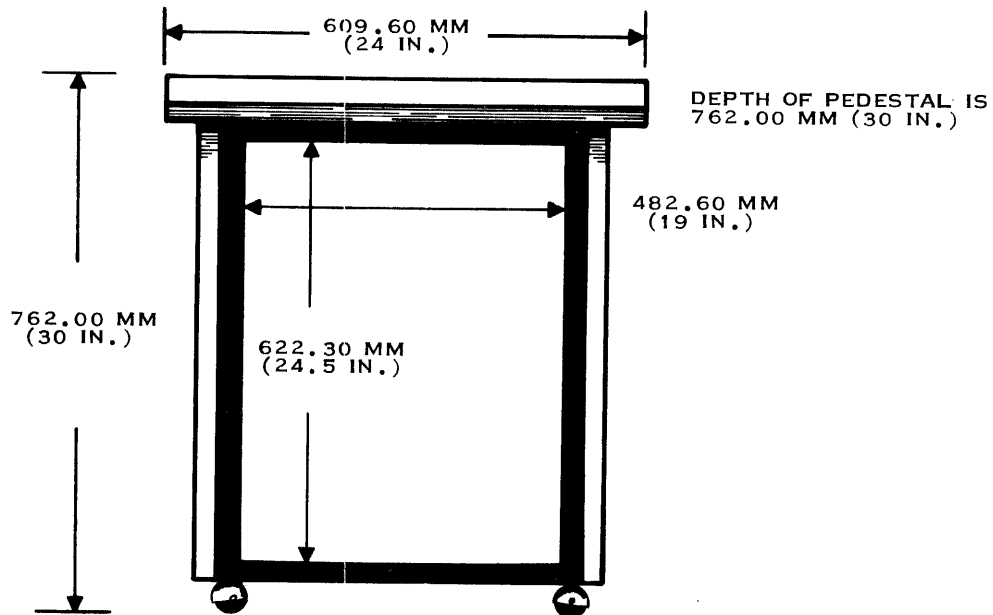
Figure 2-5. Customer-Fabricated Cable for 220/240 Vac Option



(A)142212A

Figure 2-6. European Power Cord

**2.3.1 SPACE REQUIREMENTS FOR 30-INCH SINGLE-BAY PEDESTAL.** When installed in the 30-inch single-bay pedestal, the 17-slot chassis requires the full mounting area of the cabinet. The single-bay pedestal cabinet dimensions are shown in figure 2-7. The side and rear panels of the single-bay pedestal are slotted to permit movement of cooling air through the pedestal and installed equipment. A minimum of 305 mm (12 inches) of side clearance and 152 mm (6 inches) of rear clearance are required for convection cooling of the pedestal. However, a 610-mm (24-inch) arc of clear area behind the pedestal is required to permit the opening of the rear cover of the 17-slot chassis. Clearance of 584 mm (23 inches) for service access space should be allowed at the front of the pedestal.



(A) 140388

Figure 2-7. Single-Bay Pedestal Dimensions

**2.3.2 SPACE REQUIREMENTS FOR 70-INCH RACKMOUNT CABINET.** The dimensions of the 70-inch rackmount cabinet are shown in figure 2-8. Cooling air is drawn into the cabinet through a large, washable aluminum filter on the rear door and exhausted by an enclosed 600-cfm fan at the top of the cabinet. The cooling air drawn in through the filters in the front of the 17-slot chassis is also exhausted through the fan at the top of the cabinet. A minimum of 152 mm (6 inches) of rear clearance is required for proper air flow. A clearance of 152 mm (6 inches) is also required above the exhaust fan outlet.

The cabinet is capable of exhausting approximately 6826 Btu/hour of heat. When considerations are made for cabinet placement, ensure that obstructions that create dead air space are not present. A 610-mm (24-inch) arc of clear area behind the cabinet is required to open the rear door of the cabinet and to permit opening of the rear cover of the 17-slot chassis for service. If the required maintenance area cannot be provided, allow enough slack in the cables to permit moving the equipment for maintenance or repair.

#### 2.4 ENVIRONMENTAL REQUIREMENTS

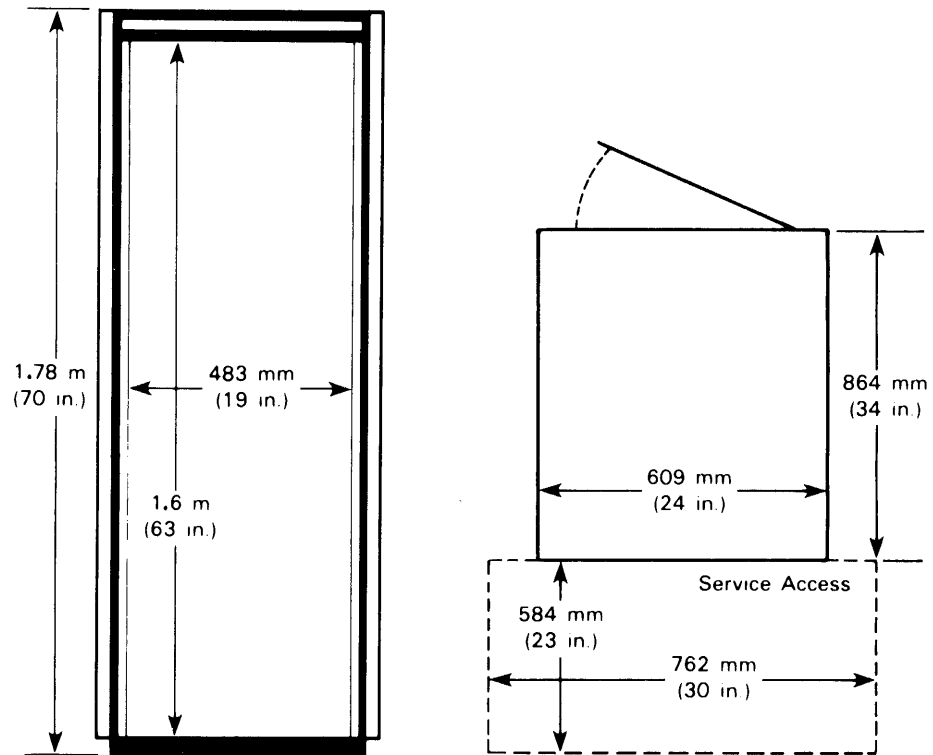
The Model 990/12 Computer is designed to operate in a controlled environment. The temperature and humidity ranges are:

- Temperature: 0° to 50° C (32° to 122° F)
- Relative humidity: 0 to 95%

The optimum operating environment for the system is 22° C (72° F) at a relative humidity of 50%.

Environmental requirements for the other devices in the system are generally more stringent than those for the Model 990/12 Computer. The environmental requirements for the other devices in the system may be found in the *DS990 Model 20/30 Site Preparation Manual*.





(A)141798

**Figure 2-8. 70-Inch Rackmount Cabinet Dimensions**

If the temperature or humidity cannot be maintained within the range listed, it can affect the operation of the computer system. Low humidity conditions create static electricity problems that can cause faulty system operation or can even destroy some semiconductor devices. Users in low-humidity climates should carefully consider static-suppression measures. Raising the humidity with humidifiers in the site air-conditioning system is one way to deal with the problem. Proper equipment grounding, which is a requirement anyway, helps reduce static hazards.

Carpeting should not be used in low humidity climates unless special precautions are taken. Anti-static mats, static suppression sprays, or special carpeting are available. Tile, wood, or properly sealed dust-free concrete flooring should be suitable. Ease in cleaning is an important factor in selecting a flooring material. It is especially important to keep the computer area very clean as it will affect the reliability of the system disk drives.

Verify that the added heat dissipation from the additional equipment can be handled by your cooling system. The heat dissipation of each device in the system is listed in the *DS990 20/30 Preparation Manual*.



## SECTION 3

### SYSTEM GENERATION

#### 3.1 GENERAL

Due to the differences in interrupt assignments in the 13- and 17-slot chassis, software changes may be necessary to allow the software to recognize the new hardware configuration. It is desirable to have someone who is familiar with system generation available at the installation site to assist in making the necessary software changes. An example system generation procedure that may be used as a guide is presented in this section. Additional information may be found in Section 1 of *DX10 Operating System Release 3 Reference Manual, Volume V, System Programming Guide*, part number 946250-9705.

The system generation procedure may be postponed until after the equipment is reconfigured if the current system software has a system disk at the same TILINE\* address and interrupt level, and at least one VDT at the same CRU address and interrupt level as they will be in the new 17-slot chassis. If delayed until the equipment is reconfigured, the system generation process is a good method of testing the new hardware configuration.

Before proceeding with system generation or hardware installation, print a listing of the current system configuration for use in comparing the new CRU and TILINE addresses and interrupts with the old. See paragraph 1.3.1.4 of *DX10 Volume V*, part number 946250-9705, for a description of the LIST command.

If the new system generation is going to be delayed until after the hardware is reconfigured, make a backup copy of the system disk at this time. If the new system is going to be generated before the hardware is reconfigured, generate the new system and then make a backup copy of the system disk. The latter procedure is followed in this section. The procedure for copying the disk may be found in paragraph 3.3 in this section.

#### 3.2 SYSTEM GENERATION PROCEDURE

An example system generation procedure is presented here to be used as a guide in generating the new system software. The new system may be generated on the existing system disk. While generating the new system, take care not to reference any device not installed at the same CRU address and interrupt level as it was in the old system or a system software crash may occur. The example operating system software is intended to control a system configured as shown in tables 3-1 and 3-2. Table 3-1 shows the configuration of the 17-slot main computer chassis; table 3-2 shows the configuration of the 13-slot expansion chassis.

\*TILINE is a trademark of Texas Instruments Incorporated.



**Table 3-1. Example 17-Slot Main Chassis Configuration**

P1 (Chassis Upper)					P2 (Chassis Lower)		
Slot	TILINE Addr.	CRU Address	Device	Interrupt Level	CRU Address	Device	Interrupt Level
1			990/12 SMI	N/A		990/12 SMI	N/A
2			990/12 AU	N/A		990/12 AU	N/A
3			Mem Cont	N/A		Mem Cont	N/A
4			Memory	N/A		Memory	N/A
5				11			11
6		02E0		10	02C0		10
7		02A0		15	0280		15
8		0260		12	0240		12
9		0220		8	0200		8
10		01E0		3	01C0		3
11	>F800	01A0	Sys Disk	13	0180	Sys Disk	13
12		0160		9	0140		9
13		0120	911 VDT# 2	10	0100	911 VDT# 1	10
14		00E0	CRU Exp	11	00C0	CRU Exp	11
15		00A0	TL Coupler	7	0080	TL Coupler	7
16		0060	Line Ptr	14	0040		4
17		0020		6	0000		6

\*These slots are dedicated to the indicated devices.

**Table 3-2. Example 13-Slot Expansion Chassis Configuration**

P1 (Chassis Left)				P2 (Chassis Right)			
Slot	TILINE Addr	CRU Address	Device	Interrupt Level	CRU Address	Device	Interrupt Level
1			CRU Buffer	N/A		CRU Buffer	N/A
2		6E0	TL Coupler	N/A	6C0	TL Coupler	N/A
3		6A0		N/A	680		N/A
4		660		N/A	640		N/A
5		620		N/A	600		N/A
6		5E0		N/A	5C0		N/A
7	>F820	5A0	TL Disk	13	580	TL Disk	13
8		560		9	540		9
9		520	911 VDT #4	8	500	911 VDT #3	10
10		4E0		12	4C0		11
11		4A0		3	480		7
12		460		14	440		4
13		420		15	400		6



[ ] XGEN  
EXECUTE AUTO SYSGEN  
=====GEN990-AUTO SYSGEN RELEASE 3.3.0=====

DATA DISC: (DS01)  
TARGET DISC: (DS01)  
INPUT:  
OUTPUT: XAMPL  
LINE: (60)  
TIME SLICING ENABLED?: (YES)  
TIME SLICE VALUE: (1)  
TASK SENTRY ENABLED?: (NO)  
TABLE: 6K  
COMMON: (NONE)  
INTERRUPT DECODER: (NONE)  
FILE MANAGEMENT TASKS: (2)  
CLOCK: (5)  
ID: (NONE)  
OVERLAYS: (2)  
SYSLOG: (6)  
BUFFER MANAGEMENT: (1K)  
I/O BUFFERS: (0)  
INTERTASK: (100)  
KIF? (YES)  
SEQUENTIAL PLACEMENT?: (YES)  
COUNTRY CODE: (US)  
POWER FAIL?: (NO)  
SCI BACKGROUND: (2)  
SCI FOREGROUND: (8)  
BREAKPOINT: (16)  
CARD 1: 11  
CARD 2:  
DEVICE: DS  
TILINE: (F800)  
DRIVES: (1) 2  
DEFAULT RECORD SIZE: (864)  
INTERRUPT: (13)  
DEVICE: DS  
TILINE: (F800) >F820  
DRIVES: (1) 2  
DEFAULT RECORD SIZE: (864)  
INTERRUPT: (13) 11  
EXPANSION CHASSIS: (1)  
EXPANSION POSITION: 13  
DEVICE: VDT  
CRU: (>C0) >100  
ACCESS TYPE: (RECORD)  
TIME OUT: (0)  
CRT TYPE: (911)  
3270 CRU ADDRESS: (NONE)  
CHARACTER QUEUE: (6)  
INTERRUPT: (11) 10  
DEVICE: VDT



CRU: (>C0) >120  
ACCESS TYPE: (RECORD)  
TIME OUT: (0)  
CRT TYPE: (911)  
3270 CRU ADDRESS: (NONE)  
CHARACTER QUEUE: (6)  
INTERRUPT: (11) 10  
DEVICE: VDT  
CRU: (>C0) >500  
ACCESS TYPE: (RECORD)  
TIME OUT: (0)  
CRT TYPE: (911)  
3270 CRU ADDRESS: (NONE)  
CHARACTER QUEUE: (6)  
INTERRUPT: (11)  
EXPANSION CHASSIS: (1)  
EXPANSION POSITION: 10  
DEVICE: VDT  
CRU: (>C0) >520  
ACCESS TYPE: (RECORD)  
TIME OUT: (0)  
CRT TYPE: (911)  
3270 CRU ADDRESS: (NONE)  
CHARACTER QUEUE: (6)  
INTERRUPT: (11)  
EXPANSION CHASSIS: (1)  
EXPANSION POSITION: 8  
DEVICE: LP  
CRU: (>60)  
ACCESS TYPE: (FILE)  
TIME OUT: (30)  
WIDTH: (80)  
PRINT MODE: (SERIAL)  
EXTENDED? (NO)  
3270 CRU ADDRESS: (NONE)  
INTERRUPT: 14  
DEVICE: BUILD  
\*\*\*\*\* CONFIGURATION FILE SAVED \*\*\*\*\*  
\*\*\*\*\* D\$DATA SOURCE FILE IS NOW BEING BUILT \*\*\*\*\*  
\*\*\*\*\* THE LINK EDIT COMMAND STREAM SOURCE FILE IS BEING BUILT \*\*  
\*\*\*\*\* BATCH FILE FOR SYSGEN COMPLETION IS NOW BEING BUILT \*\*\*\*\*  
DO YOU NEED INSTRUCTIONS TO COMPLETE THE SYSGEN? N  
\*\*\*\* GEN990 TERMINATED \*\*\*\*;



Hit CMD and enter the ALGS SCI command answering the prompts as follows:

```
[ ] ALGS
ASSEMBLE AND LINK GENERATED SYSTEM
      TARGET DISK:  DS01
      SYSTEM NAME:  XAMPL
D$DATA LISTING:  DS01.S$SYSGEN.XAMPL.D$SRCL
      BATCH LISTING: DS01.S$SYSGEN.XAMPL.ALGS
```

Enter the WAIT SCI command. The program will take 10 to 15 minutes.

```
[ ] WAIT
```

When finished, the following message will be displayed:

```
*** ALGS — NORMAL TERMINATION ***
```

Enter the PGS SCI command answering the prompts as follows:

```
[ ] PGS
PATCH GENERATED SYSTEM
      TARGET DISK:  DS01
      SYSTEM NAME:  XAMPL
      BATCH LISTING: DS01.S$SYSGEN.XAMPL.PGS
```

Enter the WAIT SCI command. The program will take from 2 to 10 minutes to complete depending on the size of the DX10 patch file.

```
[ ] WAIT
```

When finished, the following message will be displayed:

```
SYSTEM PATCH STREAM ERROR COUNT = 0:
```

**NOTE**

The patch stream error count must be zero.

Hit CMD. The following message will be displayed:

```
BATCH SCI990 (XB) TERMINATED NORMALLY:
```

### 3.3 DISK COPY PROCEDURE

A backup copy of the system disk must be made using the DCOPY SCI command. This is an additional step not included in the Volume V instructions. An example of the use of DCOPY is shown below. Additional information on DCOPY may be found in paragraph 15.12 of *DX10 Operating System Release 3, Reference Manual, Volume II, Production Operation*, part number 946250-9702.



If the volume name of the system disk or the disk to be copied to is unknown, it may be found by entering the SVS SCI command as follows:

```
[ ] SVS
SHOW VOLUME STATUS
          VOLUME NAME:
          DRIVE NAME:  DS01
          OUTPUT ACCESS NAME:
```

Information similar to the following is displayed:

```
VOLUME NAME: REL32      ADUS: 51616      # BAD: 0      BYTES/ADU: 864
AVAILABLE:14120 LARGEST AVAILABLE BLOCK:12524 CONTROLLER RETRIES: 0
PRIMARY SYSTEM IMAGE: RLSYS      SECONDARY SYSTEM IMAGE:
NAME INSTALLED: REL32C
```

Hit CMD and enter the DCOPY SCI command answering the prompts as follows:

```
[ ] DCOPY
DISK COPY/RESTORE UTILITY

= = FOREGROUND COMMAND EXECUTING = =

DISK COPY/RESTORE

ANSWER (Y/N) QUESTIONS WITH Y FOR YES AND
ANY OTHER CHARACTER EXCEPT $ FOR NO

RESPOND ANYTIME WITH $ TO RESTART

LISTING DEVICE NAME—
VERIFY ONLY? (Y/N)
DEFAULT? (Y/N) Y
MASTER DEVICE— DS01
VOLUME—          <ENTER VOLUME NAME OF SYSTEM DISK>
COPY DEVICE—     <ENTER COPY DEVICE NAME. E.G. DS02, MT01>
VOLUME—          <ENTER VOLUME NAME OF COPY MEDIA>
MOUNT DESIRED VOLUMES—TYPE <CR> WHEN READY

COPY AND VERIFY COMPLETE

QUIT? (Y/N) Y

SYSTEM DISK READY? (Y/N) Y
DISK COPY TERMINATED
```

The backup copy should be dismounted and saved for use in case the system disk is destroyed or in case it is necessary to return to the old configuration for troubleshooting.



### 3.4 NEW SOFTWARE INSTALLATION

When the new operating system software has been generated on the system disk and a backup copy of the disk has been made, enter the IGS SCI command and answer the prompts as follows:

```
[ ] IGS
INSTALL GENERATED SYSTEM
      TARGET DISK:  DS01
      SYSTEM NAME:  XAMPL
```

The system disk is now ready to be used with the new hardware configuration. Section 5 of this manual contains information on checking the new operating system software for proper operation.





## SECTION 4

### UNPACKING AND INSTALLATION

#### 4.1 GENERAL

This section contains instructions on how to unpack, install and interconnect the Model 990/12 Computer upgrade kit.

#### 4.2 UNPACKING

The items in the Model 990/12 Computer upgrade kit should be unpacked in accordance with the instructions found in the letter packet attached to the outside of the shipping crates. One of the shipping crates will have a packing list attached in an OPEN ME FIRST letter packet. Open this letter packet first and check each item as it is unpacked to verify that all items on the list were received.

Although the packing configurations are different in some cases, figures 4-1 through 4-3 show the most common shipping containers for the 17-slot chassis, the 70-inch cabinet, and the 30-inch pedestal cabinet. Figure 4-1 is an exploded view of the 17-slot chassis packed in its shipping container. The 990/12 AU and SMI boards are shipped installed in slots in the 17-slot chassis. Figure 4-2 is an exploded view of the 30-inch pedestal cabinet packed in its shipping container. Figure 4-3 is an exploded view of the 70-inch cabinet packed in its shipping container.

#### CAUTION

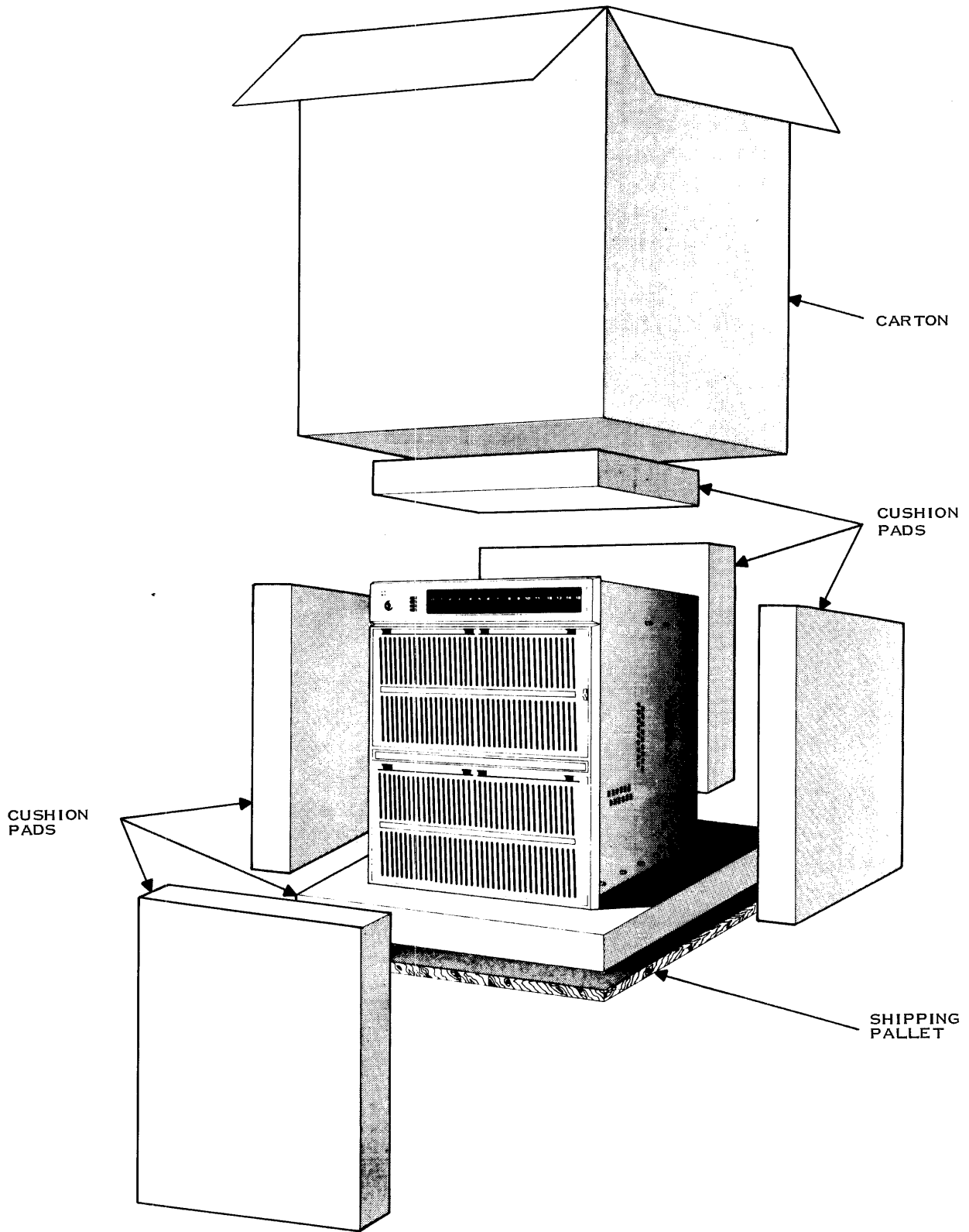
Standard safety procedures should be followed when unpacking equipment. For example: Use safety glasses when cutting steel straps and use mechanical lifting equipment or sufficient personnel to lift heavy items.

Unpack each item and compare with the packing list to ensure that the correct equipment was received. Inspect each item for possible shipping damage and if damage is detected, call the shipping agent to come and inspect the damage immediately. After the shipping agent has inspected the damage, call Texas Instruments Field Services and inform them of the damage. If no damage is detected, proceed with installation of the kit.

#### 4.3 INSTALLATION

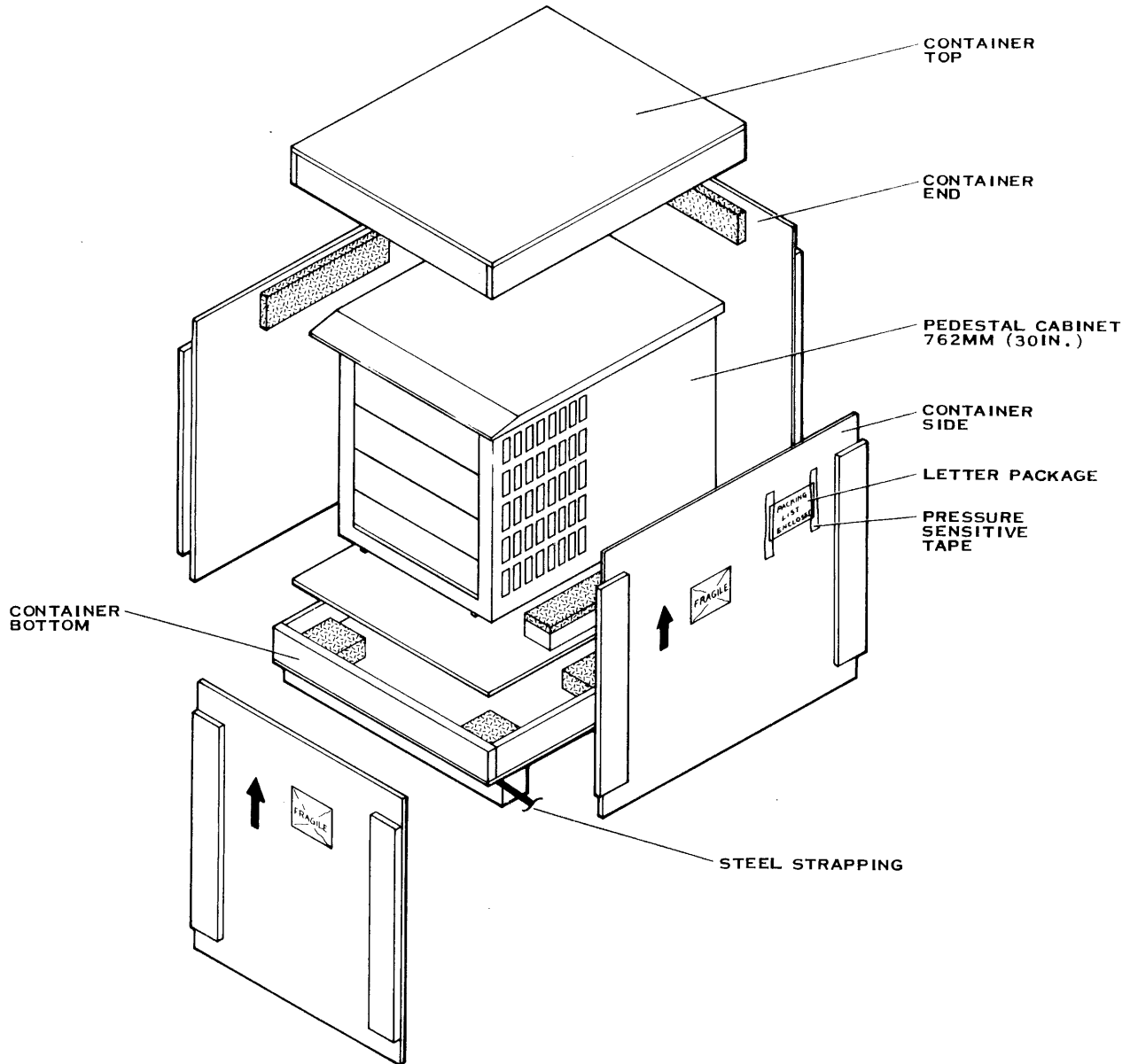
Installation of the Model 990/12 Computer upgrade kit includes removing the PCBs and the cabling from the 13-slot chassis, installing the PCBs in the 17-slot chassis, installing the 17-slot chassis in the cabinet, and recabling the system. Information on how to set the switches (TILINE access granted, memory address, etc.), how to configure the 13- and 17-slot chassis, how to configure the system if TILINE couplers are necessary, etc., is included in the PCB installation part of this section. The mechanical installation part explains how to bolt the cabinets together, to install the chassis, and to reinstall the system cabling.

To ensure that the cable length is adequate, the new cabinet housing the 17-slot chassis should be installed as near the existing system as possible if the existing system is to be used. If new and existing enclosures being used are both 70-inch cabinets, the inside doors and hinges of the cabinets should be removed and the two cabinets bolted together for added cooling and to allow internal cabling between the cabinets. Instructions for bolting the cabinets together are provided in the mechanical installation part of this section.



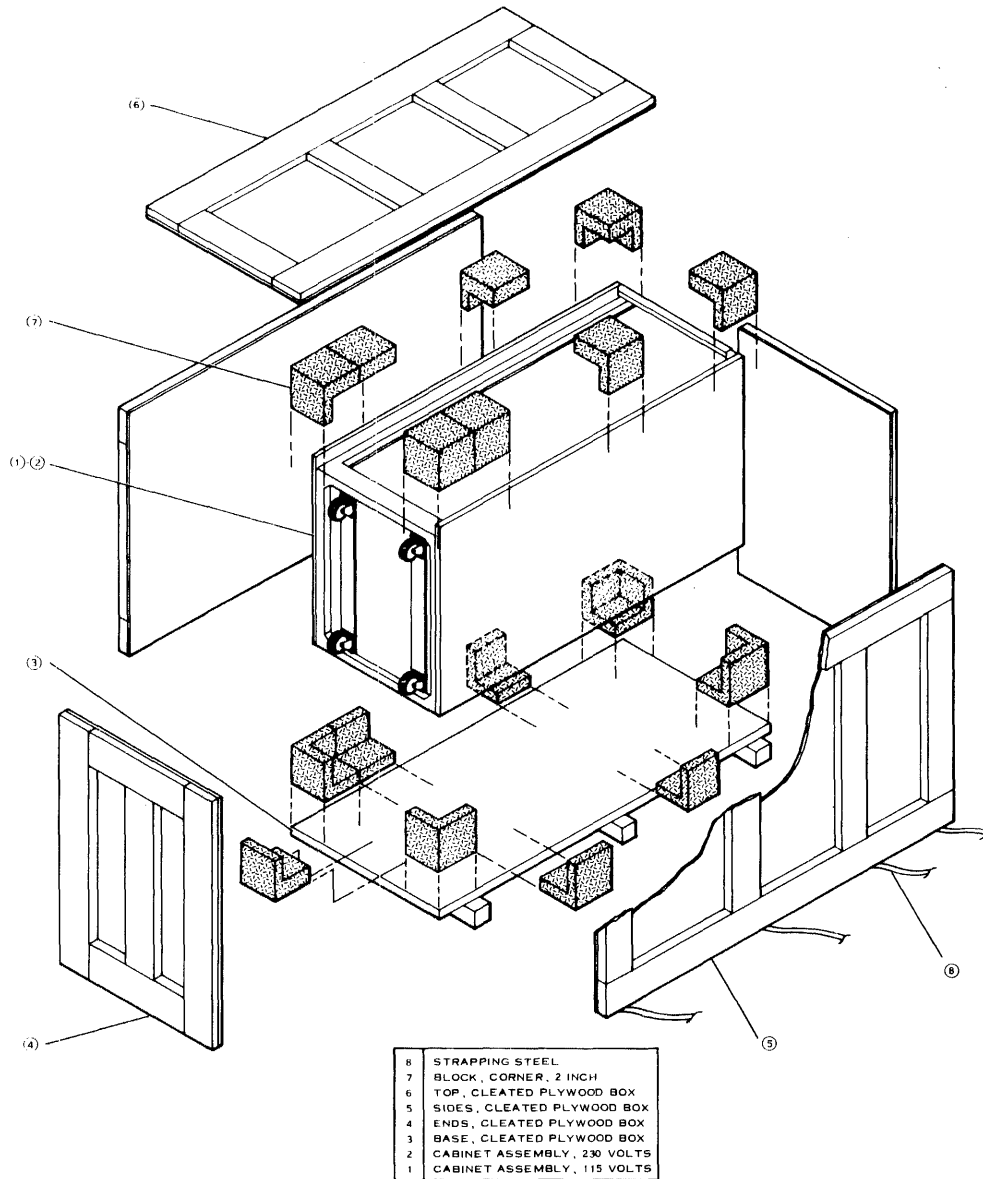
(A) 141729

Figure 4-1. 17-Slot Chassis Shipping Container



(C 140206A

Figure 4-2. 30-Inch Pedestal Cabinet Shipping Container



140207

Figure 4-3. 70-Inch Rackmount Cabinet Shipping Container

**NOTE**

Before removing any of the existing cabling or any of the PCBs from the 13-slot chassis, carefully mark all existing cables or write the cable configuration down so that the cables may be reinstalled correctly in the new chassis.

**4.3.1 TILINE MASTER CONTROLLER DELAY MODIFICATION.** The TILINE access delay on several controllers is insufficient for use in the 17-slot chassis due to the increased number of slots, increased length of etch runs, and the probability of more controllers being used on the TILINE. Table 4-1 lists the affected controllers, the revision level of the boards that require modification, the value of capacitor to be used, and the location where the capacitor is to be installed.



A letter packet (part number 2268217-0001) attached to the 17-slot chassis contains additional information about the modification that may be needed. An OPEN ME FIRST packet, part number 2265484-0001, attached to the 17-slot chassis, contains one each of the two values of capacitor (1200 and 1500 pf) needed for the modification. If additional capacitors are needed, contact the nearest TI field service location for information on obtaining them.

**Table 4-1. TILINE Controller Modification**

Controller/ Part Number	Revision Before Change*	Replace Capacitor	Capacitor Location	Old Value	New Value
DS10 Controller p/n 937505	Y	C05	UH07	510 pf	1200 pf
DS25/50/200 Controller p/n 940065	J	C19	C11 8 to 9	510 pf	1500 pf
DS25/50/200 Controller p/n 947525	R	C19	C11 8 to 9	510 pf	1500 pf
TILINE Coupler p/n 945085	AD	C29	Next to U59	750 pf	1500 pf
979A Controller p/n 2261635	H	979A controllers will have to be sent back to the factory for modification. Reference field service bulletin 02931FB004 for further details.			
p/n 2261630	J				
p/n 0948990	N				
p/n 0947555	V				

\*All controllers up to and including this level require modification.

**4.3.2 PCB INSTALLATION.** The PCB installation information is presented in tables 4-2 through 4-7 and the notes associated with each table. Table 4-2 lists the PCB locations, interrupt levels, and other information necessary to configure the new 17-slot chassis. Table 4-3 lists the 13-slot chassis configuration. Tables 4-4 and 4-5 contain information on setting up the 4K and 16K RAM boards, setting up the cache memory controller, and installing the controllers and memory arrays. Tables 4-6 and 4-7 list the lower-bound and upper-bound address switch settings needed for the TILINE couplers if couplers are used.

**NOTE**

Not all systems will contain all of the PCBs listed in the tables. Some systems will not require the 13-slot expansion chassis or TILINE couplers. Disregard information that does not apply to your system.

**4.3.2.1 17-Slot Main Chassis Configuration.** Table 4-2 shows the layout for a standard 17-slot chassis with a standard interrupt interconnecting board installed. When more than one device is shown for a slot, they are listed in order of preference. All TILINE devices (controllers) should be placed in the main chassis, if possible. If they cannot be and an expansion chassis is used, TILINE couplers are necessary. An optional interrupt plug that allows custom interrupt schemes is available from Texas Instruments (part number 2265442).

**Table 4-2. 17-Slot Main Chassis Configuration**

Slot	P1 (Chassis Upper)				P2 (Chassis Lower)			Notes
	TILINE Addr	CRU Address	Device	Inter-rupt Level	CRU Address	Device	Inter-rupt Level	
1			990/12 SMI	N/A		990/12 SMI	N/A	
2			990/12 AU	N/A		990/12 AU	N/A	11
3			Mem Cont	N/A		Mem Cont	N/A	3,4,8,9
4			Memory	N/A		Memory	N/A	3,4,8
5			Memory	11		Memory	11	3,4,7,8
6		02E0	Memory CRU Device	10	02C0	Memory CRU Device	10	1,3,4,7 4
7		02A0	Memory TL Device CRU Device	15	0280	Memory TL Device CRU Device	15	1,3,4 1,2,5,9 4
8		0260	Mem Cont TL Device CRU Device	12	0240	Mem Cont TL Device CRU Device	12	1,3,4,9 1,2,5,9 4
9		0220	Memory TL Device CRU Device	8	0200	Memory TL Device CRU Device	8	1,3,4 1,2,5,9 4
10		01E0	Memory 2nd Comm TL Device	3	01C0	Memory 2nd Comm TL Device	3	1,3,4 1,3,4 1,2,5,9

\*These slots are dedicated to the indicated devices.



Table 4-2. 17-Slot Main Chassis Configuration (Continued)

Slot	P1 (Chassis Upper)				P2 (Chassis Lower)			
	TILINE Addr	CRU Address	Device	Interrupt Level	CRU Address	Device	Interrupt Level	Notes
11	>F800	01A0	TILINE Sys Disk	13	0180	TILINE Sys Disk	13	5
12	>F880	0160	Mag Tape TL Device	9	0140	Mag Tape TL Device	9	1,2,5 1,2,5,9
13		0120	911 VDT# 2	10	0100	911 VDT# 1	10	6,7
14		00E0	CRU Exp 911 VDT	11	00C0	CRU Exp 911 VDT	11	1,4,7 1,7
15		00A0	FD800 TL Device TL Coupler	7	0080	FD800 TL Device TL Coupler	7	1,4 1,2,5,9 1,5,9
16		0060	Line Ptr	14	0040	1st Comm Card Rdr	4	1,4 1,4
17		0020	Auto C/U	6	0000	Modem EIA Term TL Device	6	1,4 1,4 1,2,5,9

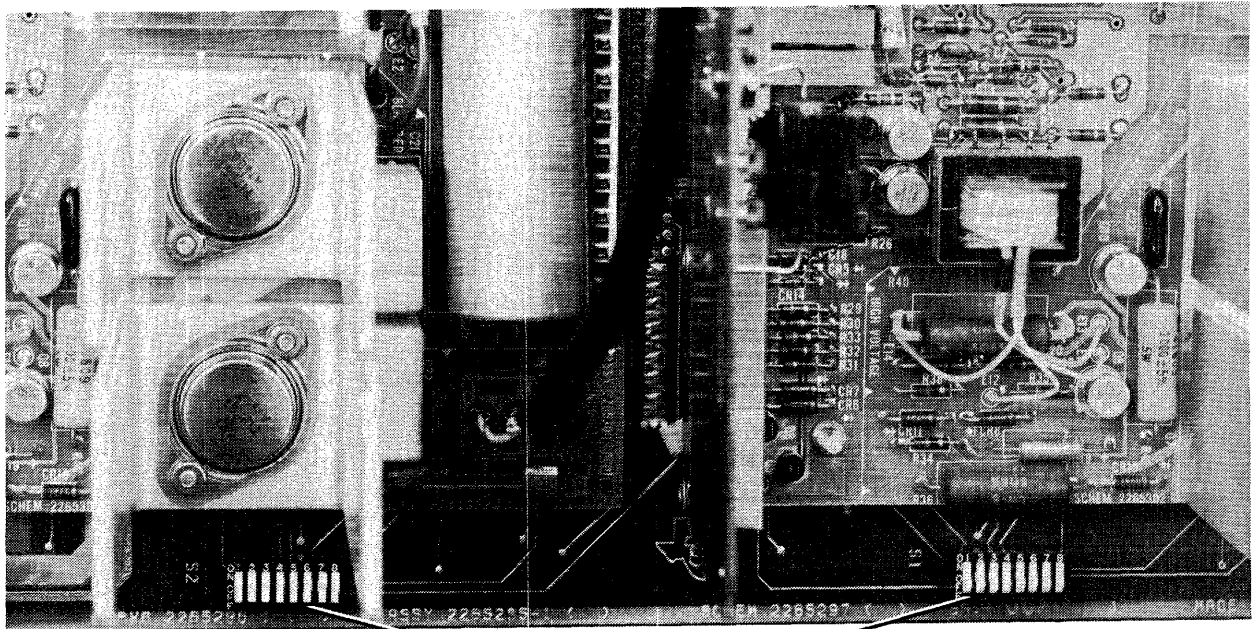
Install all boards with the component side to the right side of the chassis when viewed from the front.

The devices shown in table 4-2 are all shown in the standard locations. The rules presented in the notes that follow apply to the 17-slot chassis and should be used for the various configurations possible when a standard interrupt-interconnecting board is installed in the chassis.

1. Full- or half-size boards may occupy slots 6 through 10 and 14 through 17, if not otherwise occupied. Slot 5 may be used for a TILINE controller if slot 14 is not used or if slot 14 is used for a device that does not have an interrupt. Slot 5 may also be used for a device that does not require CRU but only requires power, such as a modem. The recommended alternate line printer location is slot 16B, if a card reader or communications I/F is not present. If a card reader or communications I/F is present, the slots shall be used in the priority 17A, 17B (main chassis), and then 12A of the expansion chassis.
2. Where more than one TILINE disk interface is used, the priority is as follows: DS10; D25,50,200. The highest priority device shall be placed in a higher numbered slot than the next highest priority device.
3. Either 16K or 4K RAM may be used; however, 4K RAM decreases the performance of the system due to its slower speed. Refer to tables 4-4 and 4-5 for memory installation instructions.



4. Jumper and switch configurations are presented later in this section.
5. A maximum of 10 TILINE device controllers may be installed in the 17-slot chassis, not including memory and the AU or SMI boards. Where a TILINE master device is used, the TILINE access granted (TLAG) switch for that slot must be placed in the OFF position. If no TILINE master controller is installed, the switch for the slot must be placed in the ON position to assure continuity of the TILINE access-granted signal. Figure 4-4 shows the location of the TLAG switches inside the back panel of the 17-slot chassis. Figure 4-5 shows example settings of the switches and indicates the switch that corresponds to each slot in the chassis.
6. The first 911 VDT controller should be installed in slot 13, additional locations are optional.
7. For slots that share interrupts (intra-slot interrupt sharing), the following rule must be followed:
  - a. TILINE devices cannot share an interrupt with another TILINE or CRU device.
  - b. CRU devices of the same or different types may share interrupts and will be supported by the DX10 operating system.
8. These slots cannot be used for CRU devices.



(A)141766

TILINE ACCESS GRANTED  
JUMPER SWITCHES**Figure 4-4. TILINE Access-Granted Jumper Switch Locations**



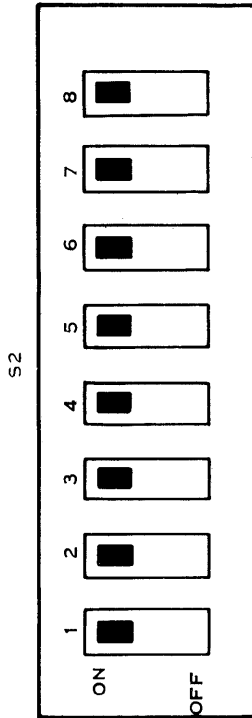


17 - SLOT CHASSIS

TILINE ACCESS GRANTED (TAG) JUMPER SWITCHES

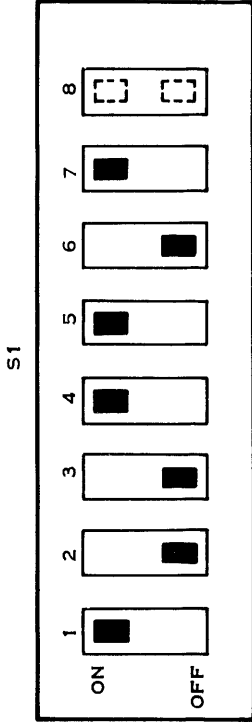
ON = TLAG JUMPERED ACROSS SLOT (P2-6 TO P2-5)

OFF = TLAG NOT JUMPERED - CONTINUITY REQUIRES TILINE CONTROLLER



CHASSIS

SLOT: 2 3 4 5 6 7 8 9



CHASSIS

SLOT: 10 11 12 13 14 15 16 N/C

NOTES: 1. SWITCHES ARE SHOWN SET FOR:

- SYSTEM DISK CONTROLLER - SLOT 11
- 979A TILINE MAGNETIC TAPE CONTROLLER - SLOT 12
- FD1000 TILINE FLEXIBLE DISK CONTROLLER - SLOT 15

2. EACH SWITCH SECTION MUST BE ON UNLESS A TILINE CONTROLLER IS INSTALLED IN THE CORRESPONDING CHASSIS SLOT. TILINE PRIORITY SYSTEM WILL NOT WORK IF SWITCHES ARE SET INCORRECTLY.

3. SLOT 17 DOES NOT REQUIRE A SWITCH.

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Figure 4-5. Chassis Slot/Switch Position Correspondence for TILINE Access-Granted Jumper Switches



9. TILINE peripheral control space address assignments are as follows:

Address (Hexadecimal)	Device
>F800	Primary TILINE Disk
>F810	TILINE Disk
>F820	TILINE Disk
>F830	TILINE Disk
>F840	TILINE Disk
>F880	TILINE Mag Tape
>FB00	1st 16K RAM Memory Controller
>FB04	2nd 16K RAM Memory Controller
>FB10	1st Cache Memory Controller
>FB14	2nd Cache Memory Controller

10. The following notes apply to TILINE couplers:

- a. When possible, all TILINE devices should be located in the main chassis. If this is not possible, TILINE expansion may be used.
- b. Set up the main chassis TILINE coupler as follows if all memory is installed in the main chassis:

Jumpers installed: J2, J5, J6  
 Bias: Switches 1 through 8 ON  
 Lower bound: Switches 1 through 8 OFF  
 Upper bound: Switches 1 through 8 ON  
 Cable vector to expansion chassis.

- c. If memory is installed in the expansion chassis, set up the main chassis TILINE coupler as follows:

Jumpers installed: J2, J5, J6

Bias: Switches 1 through 8 ON  
 Lower bound: Lowest address of memory in the expansion chassis  
 Upper bound: Highest address of memory in the expansion chassis  
 Address scheme: OFF = true  
 switch 8 = 4K words  
 switch 7 = 8K words  
 switch 6 = 16K words  
 switch 5 = 32K words  
 switch 4 = 64K words  
 switch 3 = 128K words  
 switch 2 = 256K words  
 switch 1 = 512K words

Cable vector to expansion chassis.

Refer to tables 4-6 and 4-7 for TILINE coupler lower and upper bound switch configurations.

11. Jumper E1 to E2 on the 990/12 AU board must be installed. When removed, the system will boot on power up.



**4.3.2.2 13-Slot Expansion Chassis Configuration.** Table 4-3 and the associated notes should be used as a guide for the configuration of the 13-slot expansion chassis when it is used in the system.

**Table 4-3. 13-Slot Expansion Chassis Configuration**

Slot	P1 (Chassis Left)				P2 (Chassis Right)			Notes
	TILINE Addr	CRU Address	Device	Inter-rupt Level	CRU Address	Device	Inter-rupt Level	
1		N/A	CRU Buffer	N/A	N/A	CRU Buffer	N/A	4
2		06E0	TL Coupler	N/A	06C0	TL Coupler	N/A	2,5
3		06A0		N/A	0680		N/A	
4		0660		N/A	0640		N/A	
5		0620		N/A	0600		N/A	
6		05E0		N/A	05C0		N/A	
7		05A0	TL Device	13	0580	TL Device	13	2
8		0560	TL Device	9	0540	TL Device	9	2
9		0520	911 VDT	8	0500	911 VDT	10	3
10		04E0	911 VDT	12	04C0	911 VDT	11	3
11		04A0	911 VDT	3	0480	911 VDT	7	3
12		0460	TL Device	14	0440	TL Device	4	2
13		0420		15	0400		6	2

**Notes:**

1. CRU addressing is shown for chassis number one.
2. Where a TILINE master device is used, the TILINE access granted (TLAG) jumper must be removed. Refer to the *Model 990/10 Computer System Hardware Reference Manual*, part number 945417-9701, if information on removing the access-granted jumpers is needed.
3. The devices listed have priority for those slots in which they are shown; but if the listed devices are not used, full- or half-size boards may be placed in slots 7, 8, 9, 10, 11, 12, and 13.
4. CRU expansion is required if CRU controllers are to be used in the expansion chassis. It is also required for the purpose of interrupt handling if more than one TILINE master device is used in the expansion chassis.
5. If a TILINE coupler is used in the expansion chassis, the following notes apply:
  - a. Jumpers installed: J1, J6
  - b. Bias: switches 1 through 8 ON
  - c. Lower bound: Lowest address of memory in the main chassis.
  - d. Upper bound: Highest address of memory in the main chassis.



- e. Address scheme: OFF = true;  
 Switch 8 = 4K words  
 Switch 7 = 8K words  
 Switch 6 = 16K words  
 Switch 5 = 32K words  
 Switch 4 = 64K words  
 Switch 3 = 128K words  
 Switch 2 = 256K words  
 Switch 1 = 512K words
- f. Cable vector to the expansion chassis.
- g. Refer to tables 4-6 and 4-7 for TILINE coupler switch configurations.

**4.3.2.3 Memory Installation and Switch Settings.** Table 4-4 lists the address switch settings for 4K RAM boards. Table 4-5 lists the address switch settings for 16K RAM boards. Following the tables are instructions for installing the memory arrays and controllers.

**Table 4-4. TILINE 4K RAM Memory Addressing**

Previous No. of Rows	Previous K Words	Add Switch Settings 1 = ON, 0 = OFF								P/N 0944945
		8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	0	0	
1	4	0	0	0	0	0	0	0	0	1
2	8	0	0	0	0	0	0	0	1	0
3	12	0	0	0	0	0	0	1	1	
4	16	0	0	0	0	0	1	0	0	
5	20	0	0	0	0	0	1	0	1	
6	24	0	0	0	0	0	1	1	0	
7	28	0	0	0	0	0	1	1	1	
8	32	0	0	0	0	1	0	0	0	
9	36	0	0	0	0	1	0	0	1	
10	40	0	0	0	0	1	0	1	0	
11	44	0	0	0	0	1	0	1	1	
12	48	0	0	0	0	1	1	0	0	
13	52	0	0	0	0	1	1	0	1	
14	56	0	0	0	0	1	1	1	0	
15	60	0	0	0	0	1	1	1	1	
16	64	0	0	0	1	0	0	0	0	
17	68	0	0	0	1	0	0	0	1	
18	72	0	0	0	1	0	0	1	0	
19	76	0	0	0	1	0	0	1	1	
20	80	0	0	0	1	0	1	0	0	
21	84	0	0	0	1	0	1	0	1	
22	88	0	0	0	1	0	1	1	0	
23	92	0	0	0	1	0	1	1	1	
24	96	0	0	0	1	1	0	0	0	
25	100	0	0	0	1	1	0	0	1	
26	104	0	0	0	1	1	0	1	0	
27	108	0	0	0	1	1	0	1	1	
28	112	0	0	0	1	1	1	0	0	



Table 4-4. TILINE 4K RAM Memory Addressing (Continued)

Previous No. of Rows	Previous K Words	Add Switch Settings 1 = ON, 0 = OFF								
		8	7	6	5	4	3	2	1	P/N 0944945
		1	2	3	4	5	6	7	8	P/N 0946655
29	116	0	0	0	1	1	1	0	1	
30	120	0	0	0	1	1	1	1	0	
31	124	0	0	0	1	1	1	1	1	
32	128	0	0	1	0	0	0	0	0	

**NOTE**

Memory addressing is in 4K word increments.

Table 4-5. TILINE 16K RAM Address Switch Settings

Previous No. of Rows	Previous K Words	0 = OFF, 1 = ON Switch C07/U601								Location K Bytes
		1	2	3	4	5	6	7	8	
0	0	0	0	0	0	0	0	0	0	0
1	16	0	0	0	0	0	1	0	0	32
2	32	0	0	0	0	1	0	0	0	64
3	48	0	0	0	0	1	1	0	0	96
4	64	0	0	0	1	0	0	0	0	128
5	80	0	0	0	1	0	1	0	0	160
6	96	0	0	0	1	1	0	0	0	192
7	112	0	0	0	1	1	1	0	0	224
8	128	0	0	1	0	0	0	0	0	256
9	144	0	0	1	0	0	1	0	0	288
10	160	0	0	1	0	1	0	0	0	320
11	176	0	0	1	0	1	1	0	0	352
12	192	0	0	1	1	0	0	0	0	384
13	208	0	0	1	1	0	1	0	0	416
14	224	0	0	1	1	1	0	0	0	448
15	240	0	0	1	1	1	1	0	0	480
16	256	0	1	0	0	0	0	0	0	512
17	272	0	1	0	0	0	1	0	0	544
18	288	0	1	0	0	1	0	0	0	576
19	304	0	1	0	0	1	1	0	0	608
20	320	0	1	0	1	0	0	0	0	640
21	336	0	1	0	1	0	1	0	0	672
22	352	0	1	0	1	1	0	0	0	704
23	368	0	1	0	1	1	1	0	0	736
24	384	0	1	1	0	0	0	0	0	768
25	400	0	1	1	0	0	1	0	0	800
26	416	0	1	1	0	1	0	0	0	832
27	432	0	1	1	0	1	1	0	0	864

**NOTE**

RAM addressing is in 4K word increments.



**4K RAM Board Notes.** The following notes apply to the 4K RAM boards:

1. ECC enable switches on the 0946655 memory controller are dual-in-line, single-pole, single-throw switches. Switches 1 and 2 turned ON will enable the error correction logic; 3 and 4 are not used.
2. 4K RAM boards can be used along with 16K RAM memory boards in the 17-slot chassis.

**16K RAM Controller and Arrays Notes.** The following notes apply to the installation of 16K controller, part number 2261980 and arrays, part number 0948955.

1. Verify that jumper plugs are installed as shown in the table contained in note 5 before installing boards in chassis.
2. With power OFF, install the controller as follows: Set TILINE address to >FB00 (switches 1 and 2 ON at location B09). Use the address table to set the TILINE memory address at switch group C07 on the controller. Since no memory was in the slot, the previous number of rows is zero, so the first entry for addressing applies to the controller. In all cases, 1 = ON, 0 = OFF.
3. Install arrays as follows: Count the number of rows of memory already installed and use the entry for that number to set the address at location U601. Note that the number of rows means the quantity on the controller plus the quantity on any arrays already in place. Install array in the next lower slot.
4. Install two jumper cables, part number 936401, to connect any arrays. Use 936401-1 for one array, 936401-2 for two arrays, 936401-3 for three arrays, and 936401-4 for four arrays.
5. Configure the jumper plugs as shown in the following table:

Assy Dash	Controller Jumpers	Controller Mem Rows	Assy Dash	Array Jumpers	Array Mem Rows
-1	NONE	0	-1	E10	2
-2	J10	1	-2	E9	4
-3	J9	2	-3	E9 + E10	6
-4	J9 + J10	3	-4	NONE	8

6. The TILINE peripheral control space addresses of the first and second 16K RAM memory controllers are:

>FB00	First 16K RAM memory controller
>FB04	Second 16K RAM memory controller

**Cache Memory Controller Notes.** The notes that follow apply to the cache memory controller, part number 2261990.

1. The address switch location is C31. Addressing is identical to the 16K controller. Refer to the 16K RAM switch configuration.



2. The jumper cables between the cache controller and the memory array boards are identical to those for the 16K controller. See item 4 in the notes for the 16K controller.
3. The TILINE peripheral control space switch location is D1. For an address of >FB10, place switches 1, 2 and 6 ON. For >FB14 place switches 1,2,6 and 8 ON.
4. The jumper configuration for 16K RAM chips on the cache controller are as follows: E1 to E5, E2 to E6, E7 to E8 and two jumpers installed next to R3 and R4 locations.
5. The LED indicators on the cache memory controller have the following meanings:
  - a. MERR — Uncorrectable Memory Error
  - b. CAER — Cache Error (When this LED is illuminated, cache has turned itself OFF and the board must be replaced.)
  - c. CERR — Correctable Memory Error
  - d. HIT — Cache Hit Indicator
  - e. ERROR LATCH LED INDICATORS — The row and bit latch is read identical to the error latch of the 16K memory controller.  
  
ROW — The least significant bit is the LED closest to connector P4  
BIT — The most significant bit is the LED closest to connector P3
6. The TILINE peripheral control space addresses for the first and second cache controllers are:  
  
>FB10            First Cache Controller  
>FB14            Second Cache Controller

**4.3.2.4 TILINE Coupler Address Switches.** Tables 4-6 and 4-7 list the lower-bound and upper-bound address switch settings for TILINE couplers, part number 0945085.

**NOTE**

On TILINE coupler part number 0945085, the lower-bound switches will address 0-1024K words but the switch settings for only 0-512K words are shown in table 4-6. The column labeled Number of Rows in table 4-6 means the number of rows that fall below the lowest address recognized by the TILINE coupler. The addressing is in 4K word increments.



Table 4-6. TILINE Coupler Lower-Bound Address Switch Settings

K Words	Number of Rows			(1 = OFF, 0 = ON)							
	4K	16K	64K	1	2	3	4	5	6	7	8
0	0	0	0	0	0	0	0	0	0	0	0
4	1	-	-	0	0	0	0	0	0	0	1
16	4	1	-	0	0	0	0	0	1	0	0
32	8	2	-	0	0	0	0	1	0	0	0
48	12	3	-	0	0	0	0	1	1	0	0
64	16	4	1	0	0	0	1	0	0	0	0
80	20	5	-	0	0	0	1	0	1	0	0
96	24	6	-	0	0	0	1	1	0	0	0
112	28	7	-	0	0	0	1	1	1	0	0
128	32	8	2	0	0	1	0	0	0	0	0
144	36	9	-	0	0	1	0	0	1	0	0
160	40	10	-	0	0	1	0	1	0	0	0
176	44	11	-	0	0	1	0	1	1	0	0
192	48	12	3	0	0	1	1	0	0	0	0
208	52	13	-	0	0	1	1	0	1	0	0
224	56	14	-	0	0	1	1	1	0	0	0
240	60	15	-	0	0	1	1	1	1	0	0
256	64	16	4	0	1	0	0	0	0	0	0
272	68	17	-	0	1	0	0	0	1	0	0
288	72	18	-	0	1	0	0	1	0	0	0
304	76	19	-	0	1	0	0	1	1	0	0
320	80	20	5	0	1	0	1	0	0	0	0
336	84	21	-	0	1	0	1	0	1	0	0
352	88	22	-	0	1	0	1	1	0	0	0
368	92	23	-	0	1	0	1	1	1	0	0
384	96	24	6	0	1	1	0	0	0	0	0
400	100	25	-	0	1	1	0	0	1	0	0
416	104	26	-	0	1	1	0	1	0	0	0
432	108	27	-	0	1	1	0	1	1	0	0
448	112	28	7	0	1	1	1	0	0	0	0
464	116	29	-	0	1	1	1	0	1	0	0
480	120	30	-	0	1	1	1	1	0	0	0
496	124	31	-	0	1	1	1	1	1	0	0
512	128	32	8	1	0	0	0	0	0	0	0

**NOTE**

On TILINE coupler part number 09845085, the upper-bound switches will address 0-1024K words but the switch settings for only 512K words are shown in table 4-7. The column labeled Number of Rows in table 4-7 means the number of rows from address zero to the highest address recognized by the TILINE coupler. The addressing is in 4K word increments.





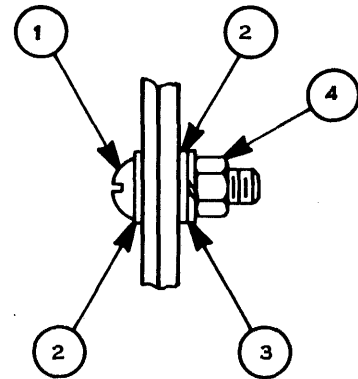
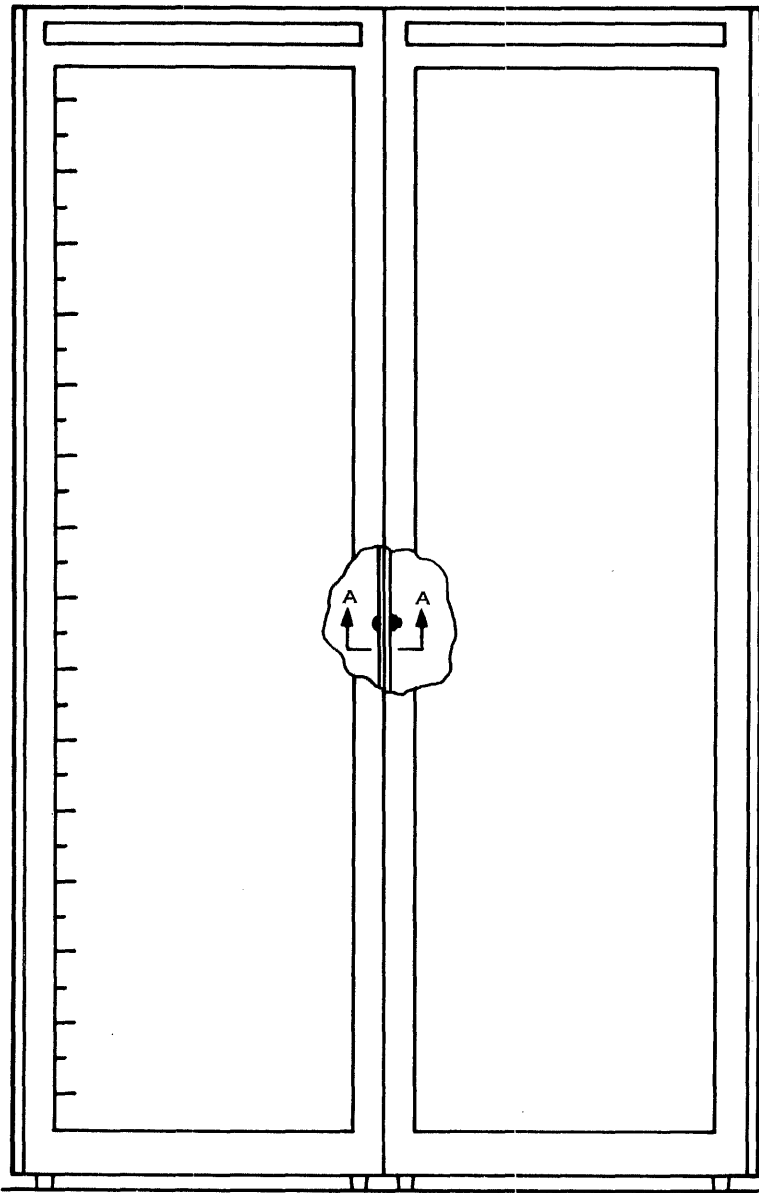
Table 4-7. TILINE Coupler Upper-Bound Address Switch Settings

K Words	Number of Rows			(1 = OFF, 0 = ON)							
	4K	16K	64K	1	2	3	4	5	6	7	8
4	1	-	-	0	0	0	0	0	0	0	0
16	4	1	-	0	0	0	0	0	0	1	1
32	8	2	-	0	0	0	0	0	1	1	1
48	12	3	-	0	0	0	0	1	0	1	1
64	16	4	1	0	0	0	0	1	1	1	1
80	20	5	-	0	0	0	1	0	0	1	1
96	24	6	-	0	0	0	1	0	1	1	1
112	28	7	-	0	0	0	1	1	0	1	1
128	32	8	2	0	0	0	1	1	1	1	1
144	36	9	-	0	0	1	0	0	0	1	1
160	40	10	-	0	0	1	0	0	1	1	1
176	44	11	-	0	0	1	0	1	0	1	1
192	48	12	3	0	0	1	0	1	1	1	1
208	52	13	-	0	0	1	1	0	0	1	1
224	56	14	-	0	0	1	1	0	1	1	1
240	60	15	-	0	0	1	1	1	0	1	1
256	64	16	4	0	0	1	1	1	1	1	1
272	68	17	-	0	1	0	0	0	0	1	1
288	72	18	-	0	1	0	0	0	1	1	1
304	76	19	-	0	1	0	0	1	0	1	1
320	80	20	5	0	1	0	0	1	1	1	1
336	84	21	-	0	1	0	1	0	0	1	1
352	88	22	-	0	1	0	1	0	1	1	1
368	92	23	-	0	1	0	1	1	0	1	1
384	96	24	6	0	1	0	1	1	1	1	1
400	100	25	-	0	1	1	0	0	0	1	1
416	104	26	-	0	1	1	0	0	1	1	1
432	108	27	-	0	1	1	0	1	0	1	1
448	112	28	7	0	1	1	0	1	1	1	1
464	116	29	-	0	1	1	1	0	0	1	1
480	120	30	-	0	1	1	1	0	1	1	1
496	124	31	-	0	1	1	1	1	0	1	1
512	128	32	8	0	1	1	1	1	1	1	1

**NOTE**

The TILINE Coupler bias switches should all be ON.

**4.3.3 MECHANICAL INSTALLATION.** To begin the mechanical installation, position the cabinets where they will be installed. The new cabinet that houses the 17-slot chassis should be installed next to the system disk drive. If the existing cabinet is to be used, position it next to the new cabinet. If the new and existing cabinets are both 70-inch cabinets, remove the side panels and hinges and bolt them together as shown in figure 4-6. Figure 4-7 shows the location of the holes used for bolting the cabinets together.

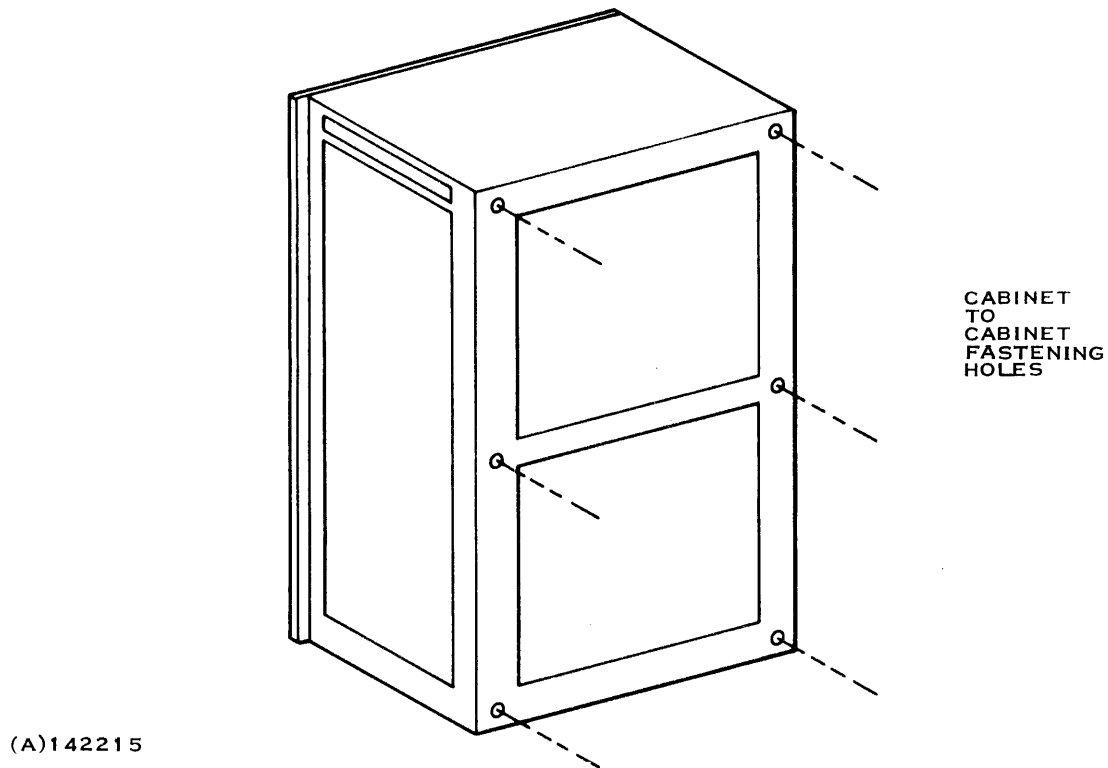


6 PLACES  
VIEW A - A

- ① BOLT, 1/4-20 X 1  
HEX HEAD
- ② WASHER, 0.281 X 0.065  
FLAT CRESCENT
- ③ WASHER, 0.25 LOCKSPLIT
- ④ NUT, 1/4-20 X 7/16 X 3/16  
THICK

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**Figure 4-6. Two 70-Inch Cabinets Bolted Together**



**Figure 4-7. Cabinet-to-Cabinet Fastening Hole Locations**

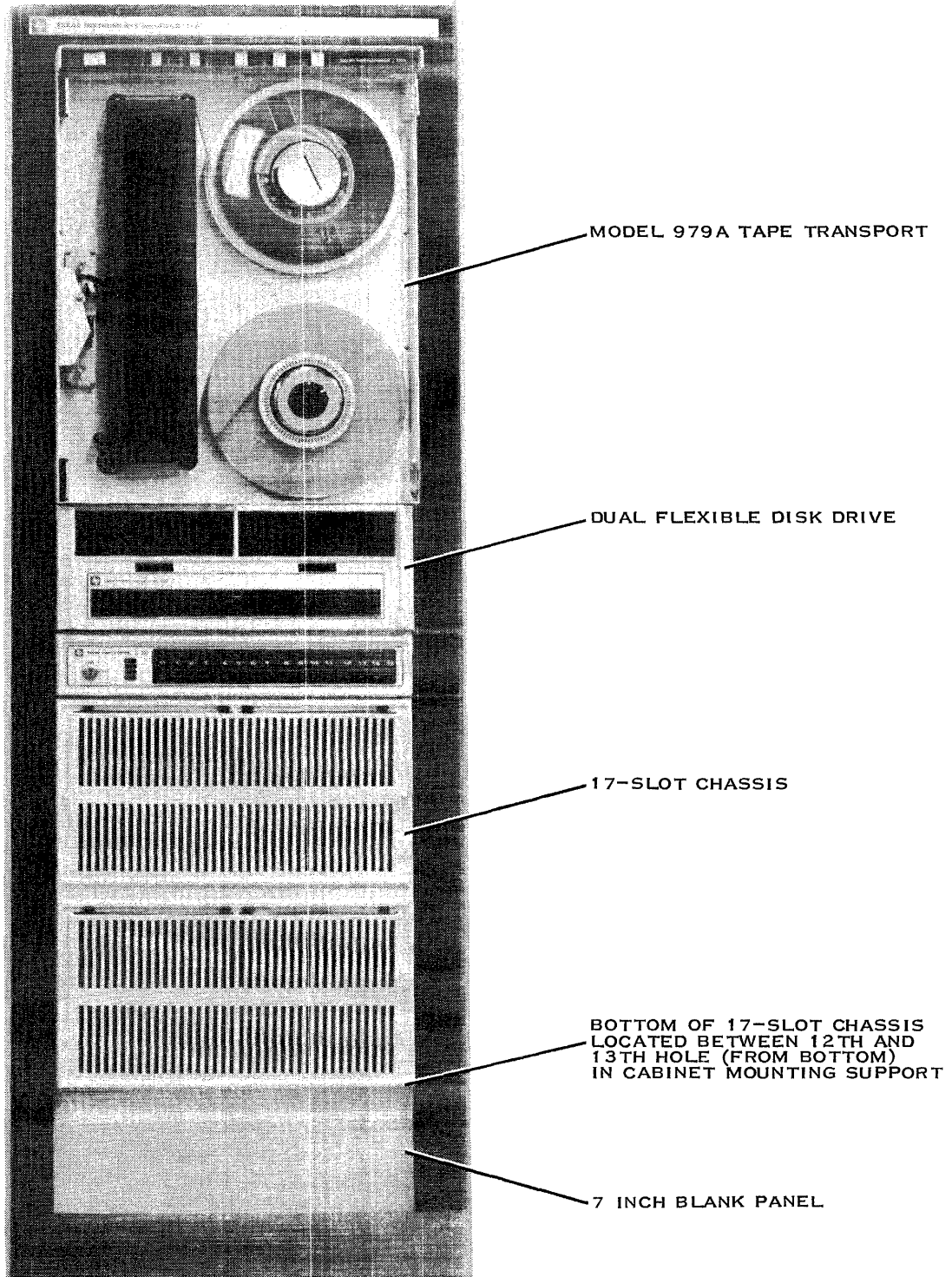
**4.3.3.1 17-Slot Chassis Installation in 70-Inch Cabinet.** The following procedure should be used for installing the 17-slot chassis in a 70-inch cabinet. Figure 4-8 shows the recommended location of the 17-slot chassis in the cabinet. The 177.8 mm (7-inch) blank panel at the bottom of the cabinet is required to allow the necessary clearance for the rear access cover of the 17-slot chassis to open freely. The Model 979A tape transport may be replaced with two 311 mm (12.25-inch) blank panels, if not included in the system. The dual flexible disk drives may be replaced with a 177.8 mm (7-inch) blank panel.

#### **CAUTION**

Steps 12 and 13 of this procedure require access to the power supply (high voltage) area of the computer. It is essential that a trained service person perform these steps due to the hazard of severe electrical shock if not done properly. Ensure that the ac power cord is disconnected from source power before performing any of the installation procedure.

#### **NOTE**

If the mounting rails are already installed in the cabinet, skip to step 6.

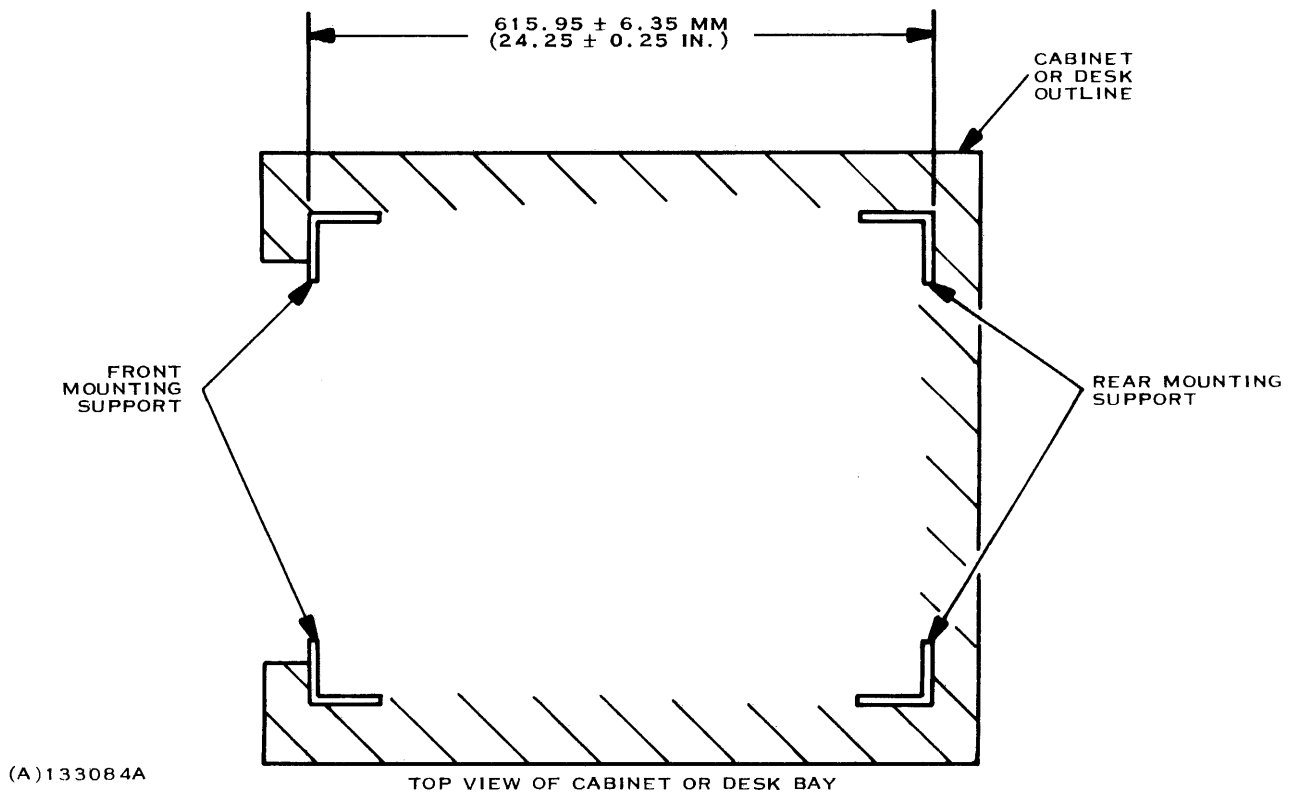


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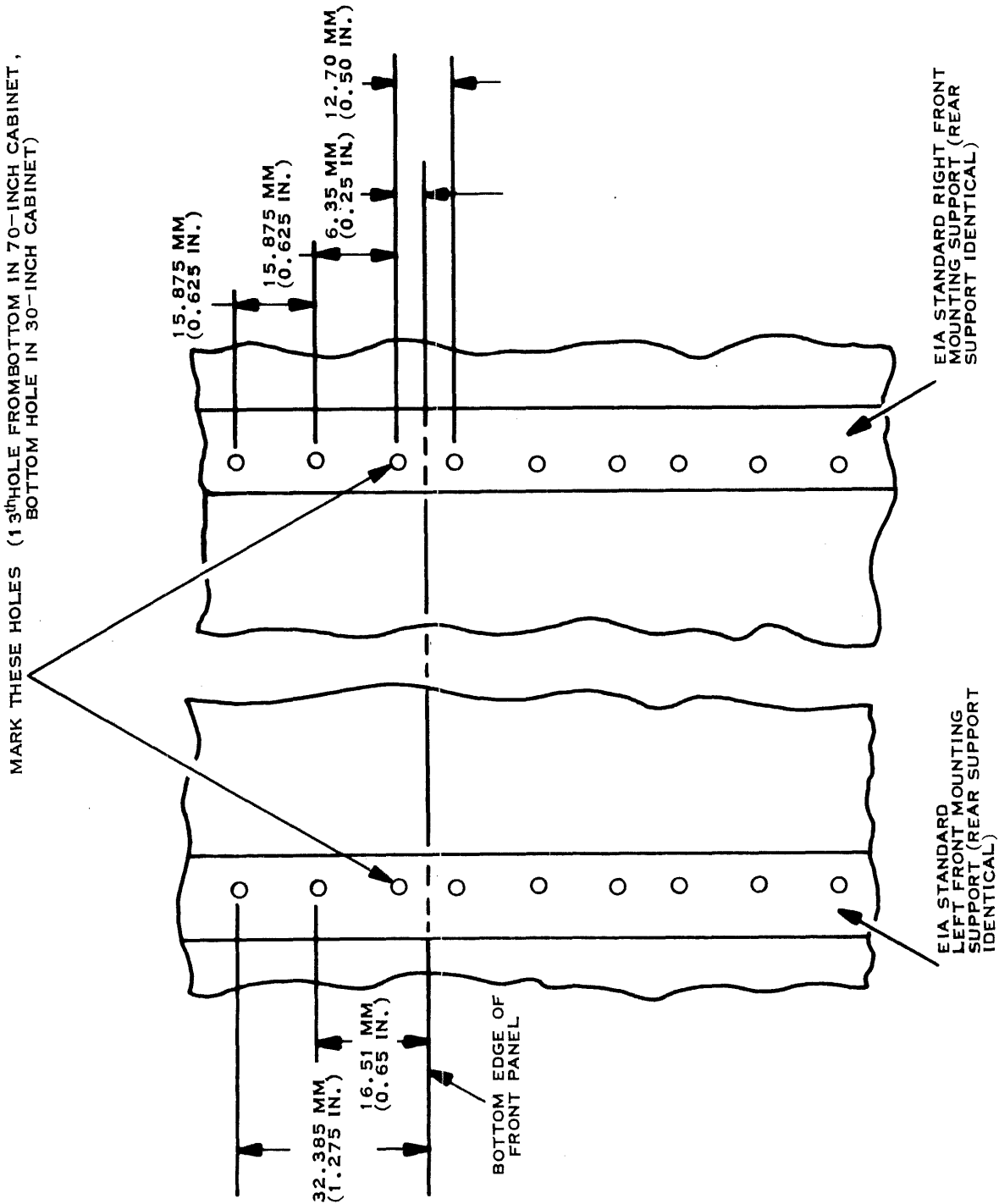
Figure 4-8. Component Locations in 70-Inch Rackmount Cabinet



1. Locate the front and rear mounting supports in the cabinet (figure 4-9).
2. The cabinet mounting supports have holes spaced on 15.875 mm (0.625 in.) centers and 12.70 mm (0.5 in.) centers. The bottom edge of the front panel must be centered between two holes that are 12.70 mm (0.5 in.) apart as illustrated in figure 4-10. Mark the upper of the two holes on the front and rear supports (four places). The upper hole should be the thirteenth hole from the bottom of the 70-inch cabinet rail for the configuration shown in figure 4-8.
3. From the cabinet mounting hardware, select and attach the four rail angles (part number 2265445-0001) to the cabinet mounting supports using the machine screws (part number 996739-0033) supplied with the mounting hardware (figure 4-11). The screw in the bottom part of the rail angle mates with the holes marked in step 2. Note that the edge of the rail angle must be flush with the edge of the mounting support and that mounting screws are installed so that the heads of the screws are on the inside of the mounting supports.
4. Install speednuts (part number 972802-0010) on the top and bottom holes of the front rail angles as shown in figure 4-11.



**Figure 4-9. Mounting Support Locations in 70-Inch Cabinet**



(A)142217

Figure 4-10. Mounting Hole Positioning

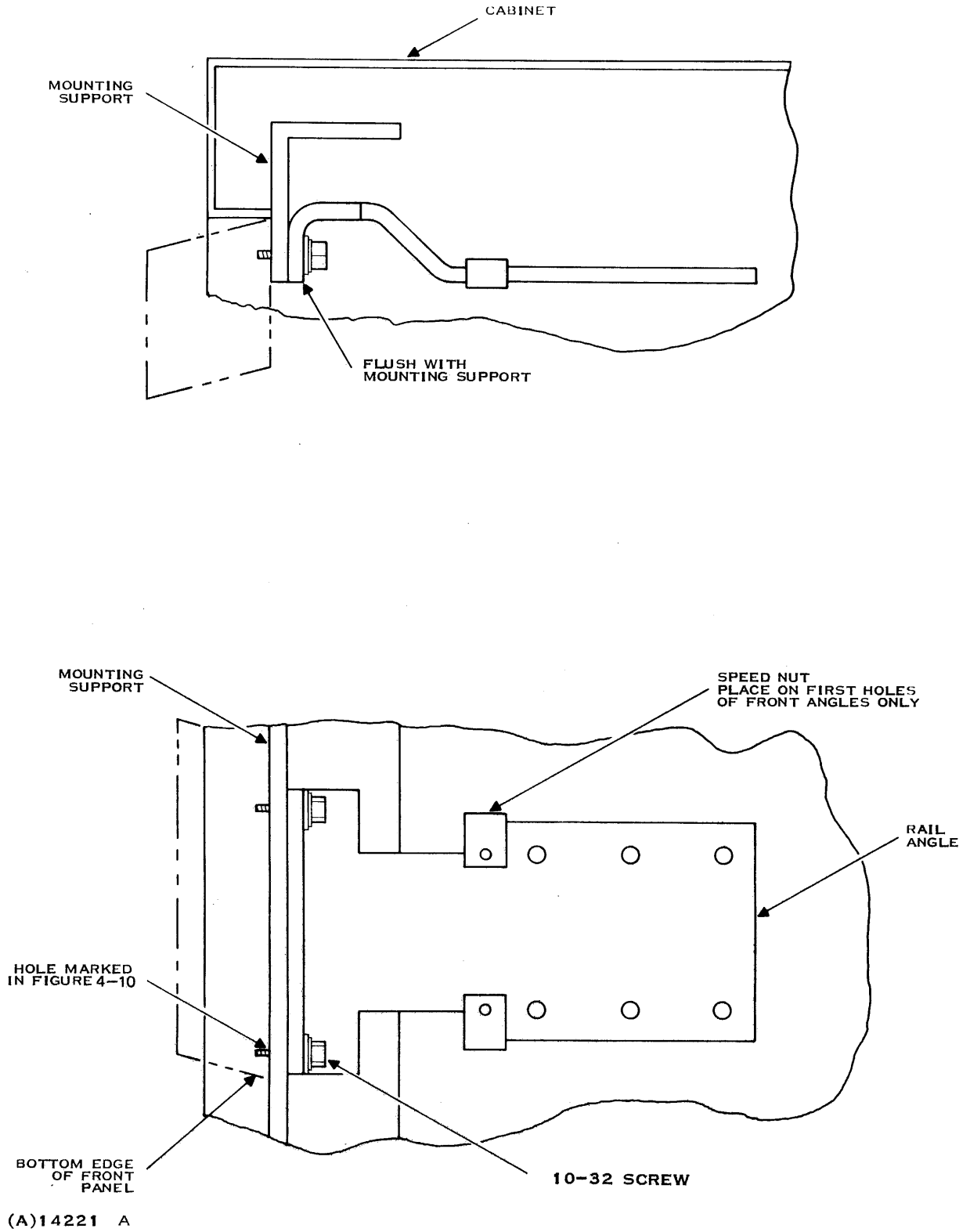
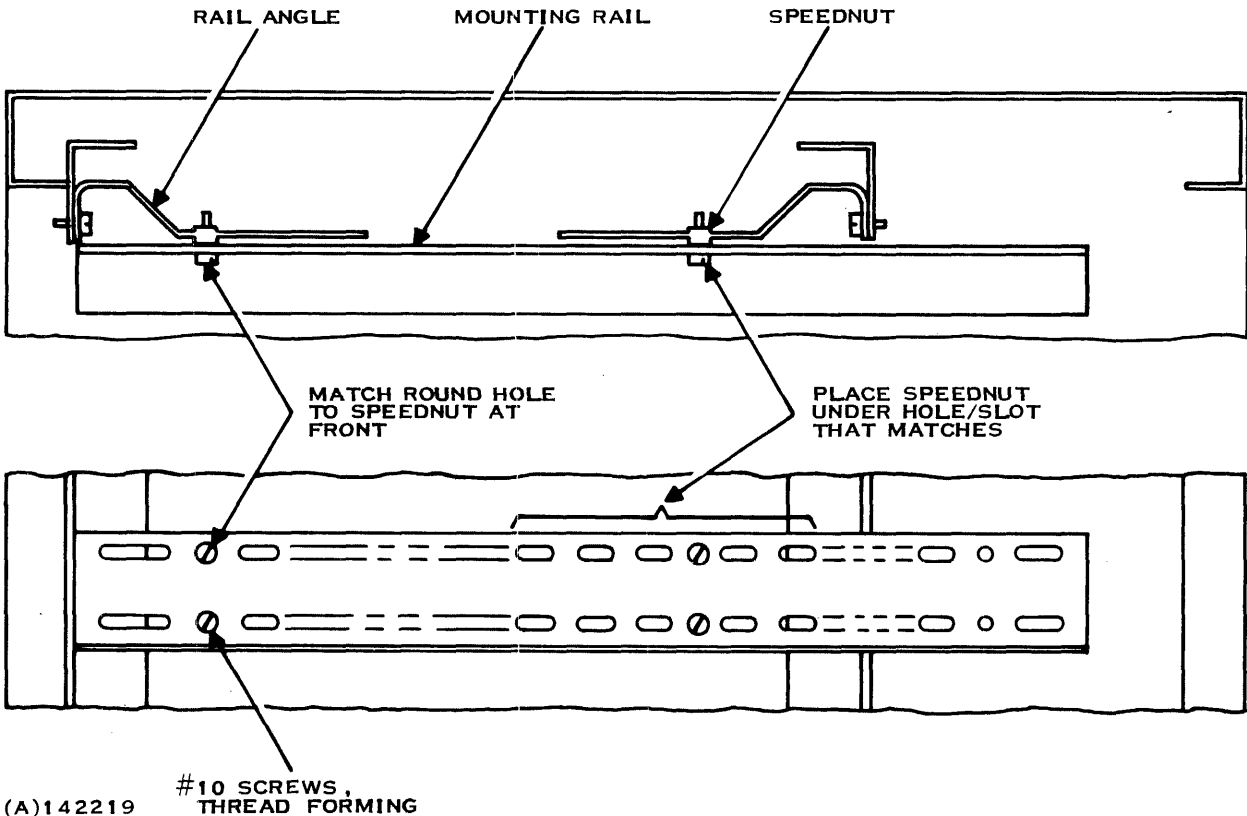


Figure 4-11. Typical Bracket Location (Four Places)



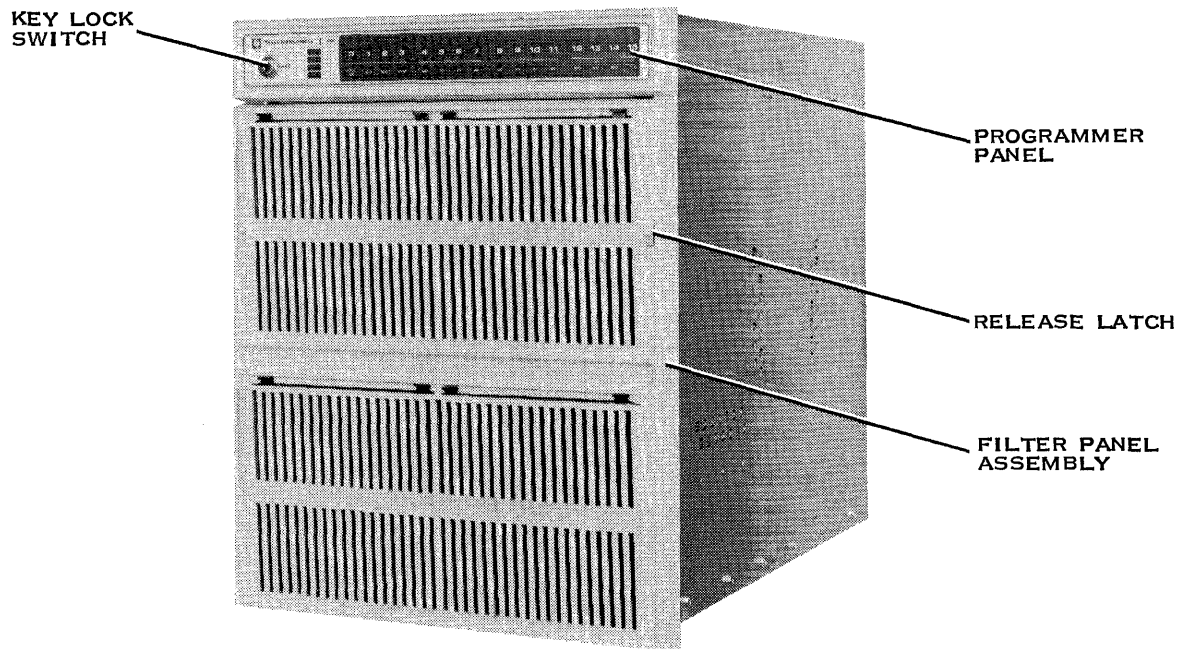
5. Position the mounting rail (part number 2265444-0001) against the rail angles as shown in figure 4-12, matching the round holes in the mounting rail with the speednuts installed in step 4. Mark the two holes on the top and bottom of the rear rail angles that best match the slots in the mounting rails. Install the speednuts in these holes as shown in figure 4-12. Screw the mounting rails to the rail angles using the thread-forming screws supplied (part number 996741-0002).



**Figure 4-12. Typical Mounting Rail Location (Two Places)**

6. Push upward on the two release latches (figure 4-13) at either side of the filter panel assembly on the 17-slot chassis to release the filter panel. Remove the filter panel assembly from the front of the 17-slot chassis by pulling outward. Place the chassis on the mounting rails and slide the chassis into the cabinet until the mounting flanges on the chassis contact the cabinet mounting supports.
7. To release the programmer panel from its chassis front panel mounting flanges, grasp the two latching tabs at each side of the bottom of the programmer panel front panel and press upward (figure 4-14). Withdraw the programmer panel from the front panel far enough to expose the two mounting holes in the chassis mounting flange. Loosely install the supplied machine screws into the 10 mounting holes in the chassis mounting flange. Tighten the two top screws and reinstall the programmer panel. Tighten the remaining screws.





(A) 141847

**Figure 4-13. Front View of 17-Slot Chassis**

8. Using a coin or screwdriver, release each of six quarter-turn latches on the access cover. Remove the access cover to expose the installed logic boards.
9. Slide the PWB retainer to its leftmost position.
10. Remove logic boards 1 through 3 (if installed) and remove the baffle board that slides into an unnumbered chassis slot just to the right of chassis slot 1 as viewed from the front of the chassis.
11. On the upper cable tray (just below and toward the front of the chassis from the logic boards), release each of five quarter-turn latches. Remove the upper cable tray, exposing to view the lower cable tray.
12. Using a coin or screwdriver, release each of 11 quarter-turn latches on the chassis rear cover (figure 4-15). Open the rear cover. The cover will be supported by the chassis-to-rear cover wire hinges.
13. The chassis is now ready to accept the system cables. It is necessary to understand the routing path and method of securing the cables in place before proceeding with this installation. The explanation of the correct method of routing and securing the cables contained in the next paragraphs should be read and understood before proceeding with the installation.

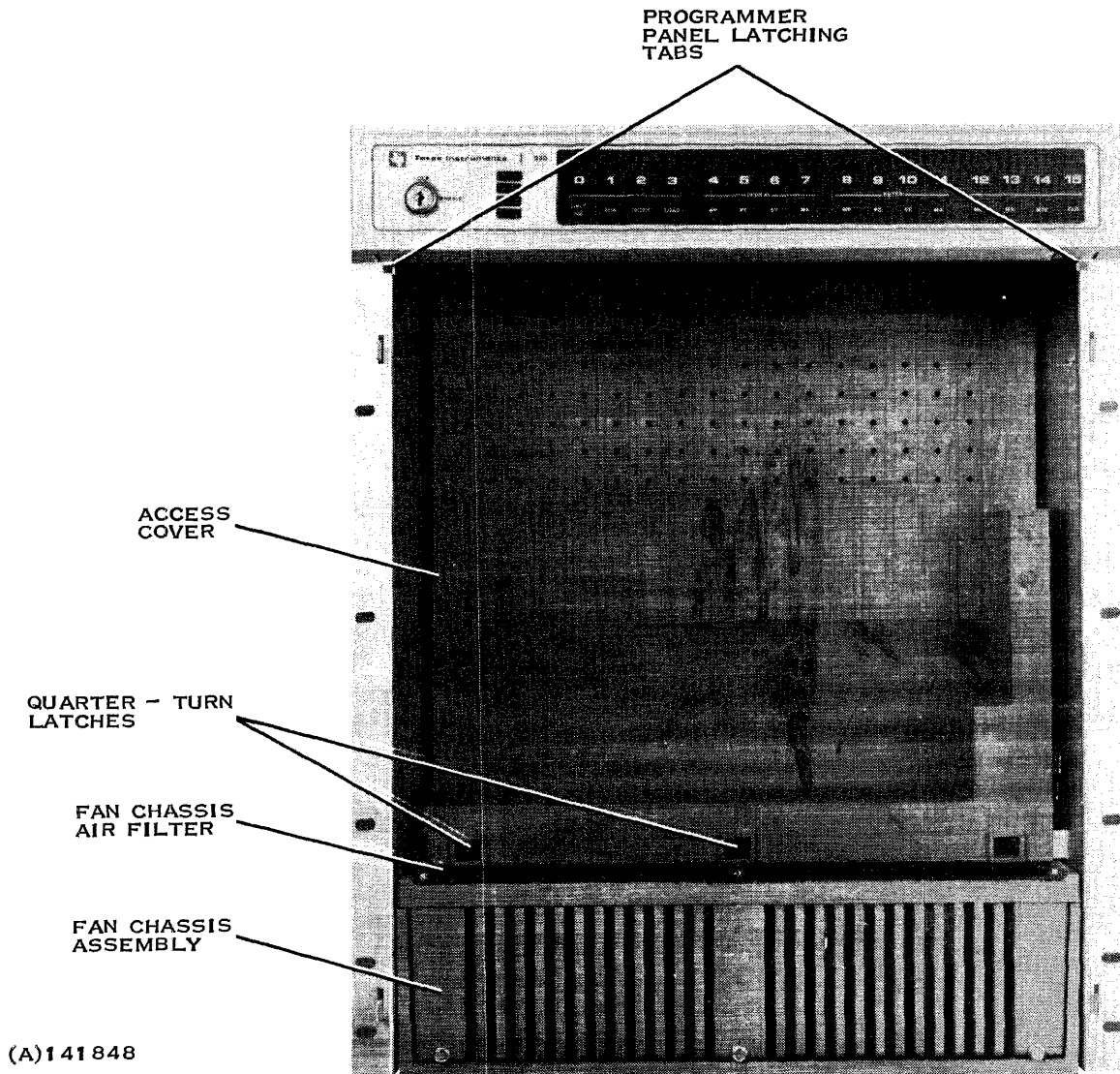


Figure 4-14. Front View of 17-Slot Chassis with Filter Panel Assembly Removed

**4.3.3.2 17-Slot Chassis Cable Installation.** The cable path (illustrated in figure 4-16) is through the cable port, up and along the left side sheetmetal (as viewed from the rear), through a cable tie, forward along the sheetmetal to another cable tie, arcing downward along the sheetmetal to another cable tie, and down to the lower cable tray. In the lower cable tray, the cable goes through a cable tie, across the cable tray from right to left (as viewed from the front of the cabinet), through another cable tie (or ties as necessary), and then is bent towards the card cage through another cable tie and up to the logic board.

The cable ties (part number 972632-0002) are installed as shown in figure 4-17. Note that the ties are installed from one side of the panel only, without access to the rear of the panel, by doubling the tie, inserting the doubled tie into the hole, and looping the doubled end around the elbow. The cable may then be secured across the tie location in one of two orientations as shown in figure 4-17.

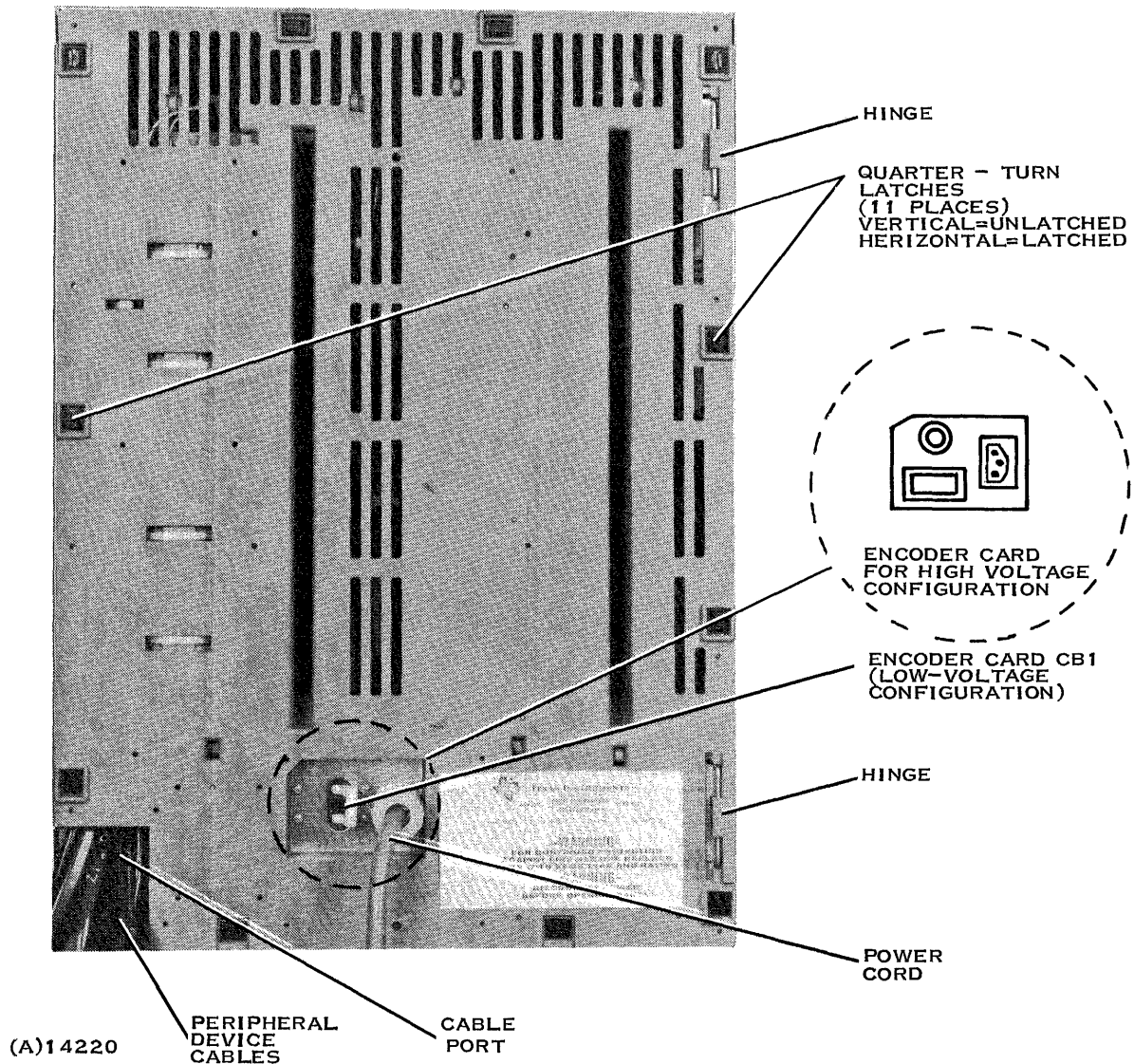
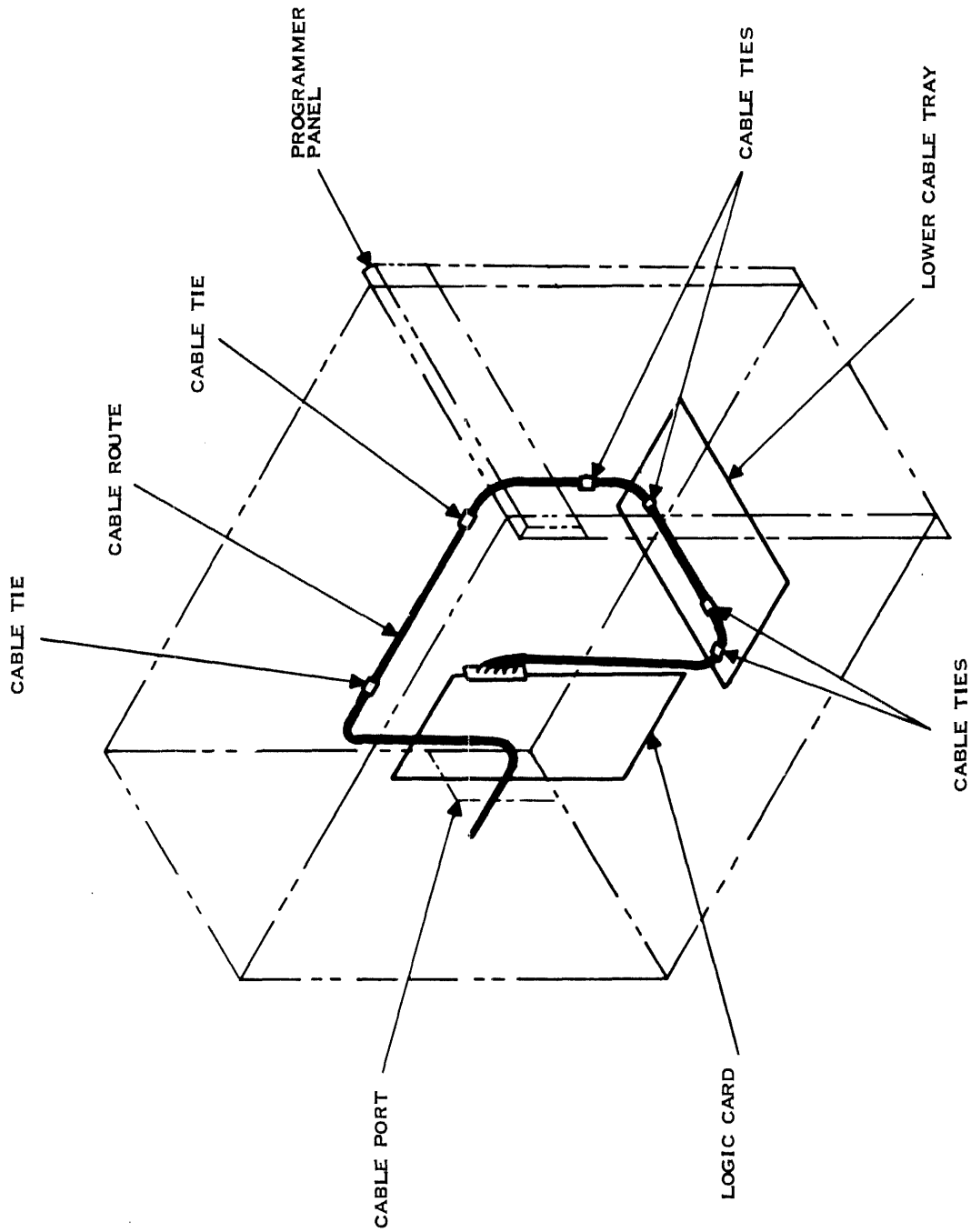


Figure 4-15. Rear View of 17-Slot Chassis

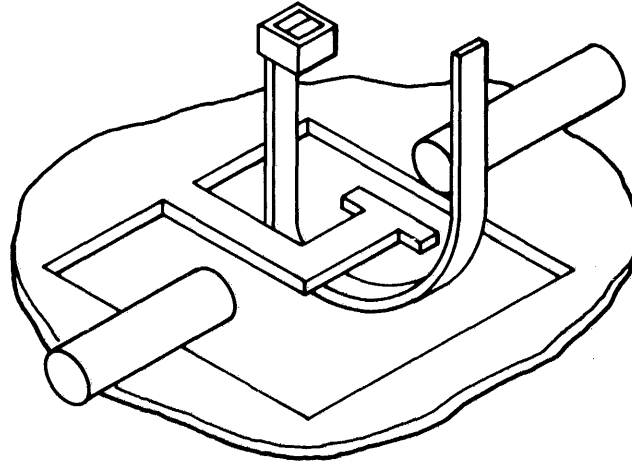
To install a cable, insert the board connector through the cable opening and follow the routing described previously without installing cable ties. Mate the connector to the logic board and route the cable straight down to the lower cable tray leaving just enough slack to disconnect the cable when necessary. Secure the cable to the lower cable tray with a cable tie. Work the cable back along the route described earlier, securing the cable with ties at the locations described. The cables must be routed neatly and tied securely. Note that it may be necessary to remove boards from the lower numbered slots after making the initial tie in order to facilitate making ties to the sheetmetal side of the chassis. Boards may be removed by sliding the board restraint to the left, leaving the board free of the connectors, and pulling the board from the chassis.

In routing the cables, it is necessary to start with the lowest numbered board slot first and work to the highest. The first cable should be routed along the lower cable tray over the cable tie locations nearest the bottom of the chassis. Subsequent cables are worked toward the front of the cable tray and toward the top of the sheetmetal side of the cabinet.

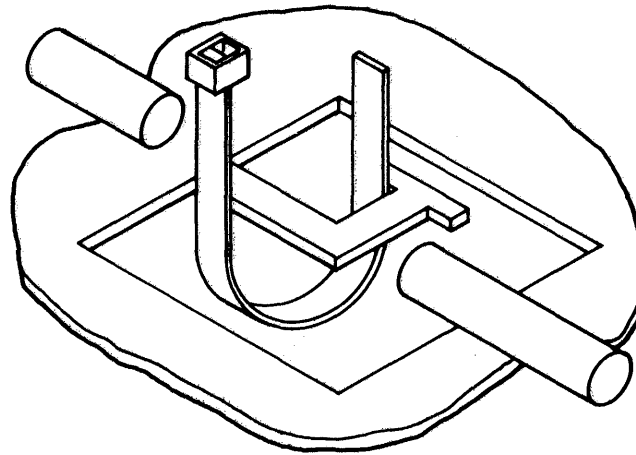


(A)141785

Figure 4-16. Cable Routing in 17-Slot Chassis



ALTERNATE A



ALTERNATE B

(A)142221

Figure 4-17. Cable Tie Installation Method



When the lower cable tray is full, the upper cable tray is reinstalled and cables are then routed across it in the same manner as they were in the lower tray. In a system that has enough cables to fill the lower tray, it will be necessary to stack the cables two deep along the sheetmetal side of the chassis. Cable ties previously used to secure single cables should be replaced with a single tie securing both cables.

Close and secure the power module (rear door). The power cord may be connected at this time but ensure that the power switch is in the OFF position.

Reinstall any logic boards removed to facilitate cable installation and connect all cables to the proper boards.

Reinstall the baffle board. Slide the board restraint to the right (as viewed from the front of the chassis). Reinstall the front access cover and filter panel.

#### **CAUTION**

Cables routed outside the cabinet should be routed away from power cords or any noise generating source.

**4.3.3.3 17-Slot Chassis Installation in 30-Inch Cabinet.** The procedure to install the 17-slot chassis in the 30-inch pedestal cabinet is the same as for installation into the 70-inch cabinet except in step 3 of the procedure, the screw in the bottom part of the rail angle must go in the bottom hole in the cabinet-mounting support.



## SECTION 5

### SYSTEM CHECKOUT

#### 5.1 GENERAL

This section contains information that will be helpful in verifying the correct operation of the installed Model 990/12 Computer upgrade kit and the operating system that was generated for the new system configuration.

#### 5.2 HARDWARE CHECKOUT

Two methods of checking operation of the system may be used. The recommended method is to load and execute diagnostics for each device in the system. This method will help locate configuration errors caused by wrong interrupt assignments as well as checking the operation of each device in the system.

#### NOTE

When performing diagnostics on the Model 990/12 AU board, the revision level of the diagnostic should be matched with the revision level of the board as follows:

Diagnostic Revision	Board Revision
A	A, B, C
B	D and up
C	All production boards

The second method is to bring up the system with the DX10 system disk. Although this method is less time consuming, it is riskier since the system software could be degraded if hardware problems exist.

#### 5.3 SYSTEM GENERATION VERIFICATION

The following paragraphs explain how to test the operating system that was generated in Section 3 to ensure that it will communicate with all of the hardware devices and that the interrupt assignments are correct. If the system generation for the new configuration has not been performed yet, it should be done at this time. Note that an incorrectly defined interrupt will cause the system to hang in a loop. In this mode, the CPU will go out of the IDLE mode and nothing obvious will occur or it may crash with a crash code of >20 displayed on the front panel LED indicators when it tries to service the interrupt. The only way to get out of this condition is to warm start the system again. This may be done by depressing HALT, RESET, and then LOAD on the CPU front panel.

**5.3.1 GENERATED SYSTEM CHECKOUT.** If the system generated for the new hardware configuration was not installed earlier, it may be tested at this time. After the system is up, enter the test generated system (TGS) command and answer the prompts as in the IGS command described in paragraph 3.4. When "TEST GENERATED SYSTEM" is displayed on the VDT, HALT the CPU, depress the RESET switch, the LOAD switch, and the new system will be brought up so that it may be checked out. If any part of the system fails checkout, depress HALT, RESET, and LOAD and the old system will come up. If everything passes, enter the IGS command as described in paragraph 3.4.



A few brief examples of how devices may be checked are presented here. For more information, refer to the *DX10 Operating System Reference Manuals*, part number 946250, Volumes I through VI.

If any part of the system fails checkout, refer to Section 3 of this manual or to the *DX10 Operating System Manuals* to verify that the system software was generated correctly.

**5.3.1.1 Line Printer Checkout.** Each line printer on the system may be checked by entering the LTS command from any operating VDT and inputting the listing device name (the line printer designation, LP01, LP02, etc.). The line printer should then print out the terminal status for all terminals generated into the system. This check can be performed on each line printer on the system.

**5.3.1.2 VDT Checkout.** Each Model 911 VDT on the system may be checked by pressing the blank orange key (upper-right corner of keyboard) and then pressing the SHIFT and EXCLAMATION keys at the same time. The VDT should then respond with either the log in message or the menu. Note that the VDTs must be in the ON status in the software terminal status table.

**5.3.1.3 Model 979A Magnetic Tape Drive Checkout.** The Model 979A may be checked for proper operation by entering the BD (backup directory) command. After the backup is complete, the VB (verify backup) command may be used to verify correct operation of the drive.

**5.3.2 GENERATED SYSTEM INSTALLATION.** After all hardware in the system has been checked for proper operation, the system generated for the new configuration may be installed if it was not installed prior to this time. Use the Install Generated System (IGS) command for this purpose. Refer to paragraph 3.4 of this manual or to the DX10 reference manuals for a description of the IGS command.





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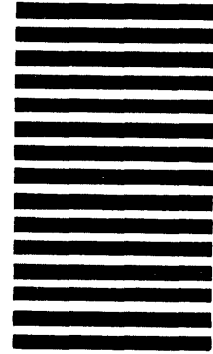
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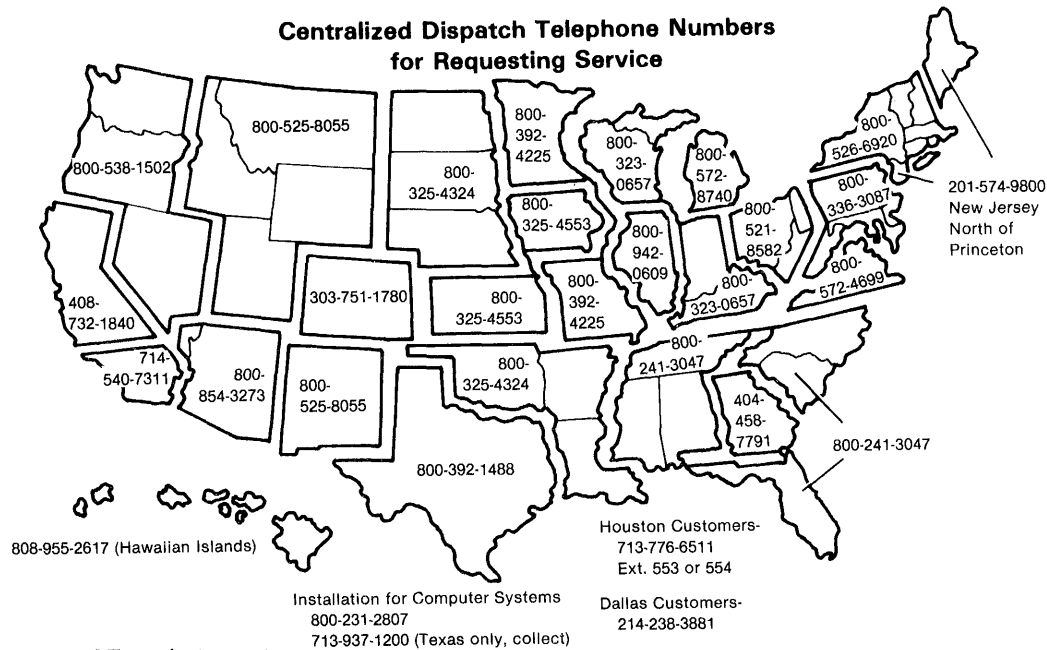
### Wisconsin

205 Bishops Way  
Suite 214  
Brookfield, Wisconsin 53005  
(414) 784-1323

\*Service telephone number

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