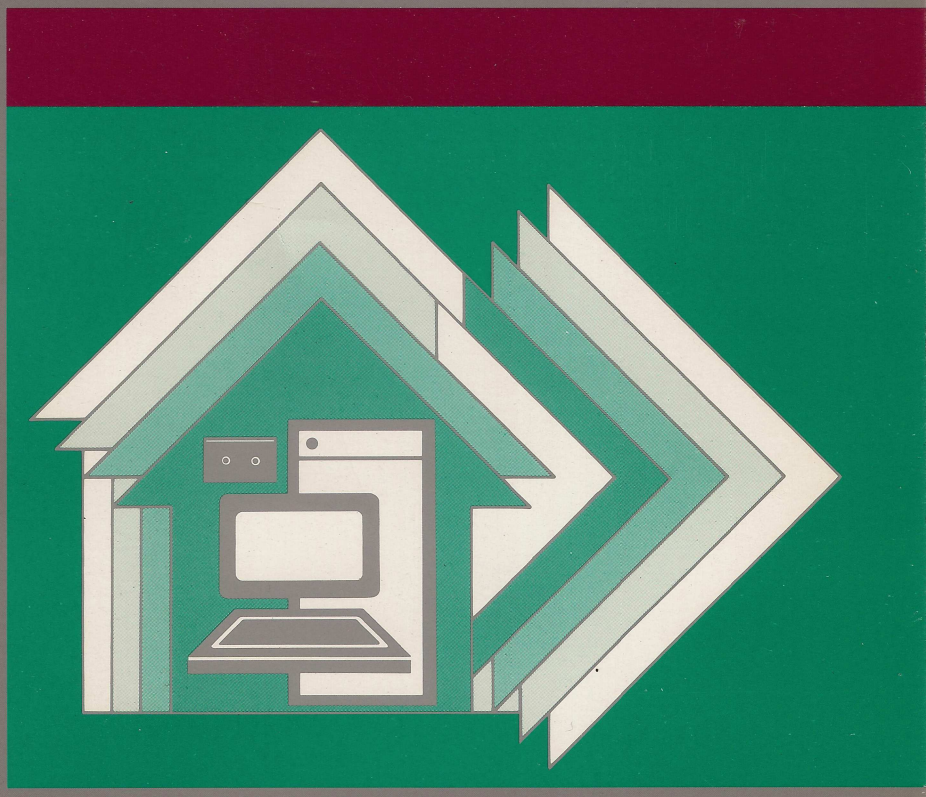
MODEL 990A13 CHASSIS

GENERAL DESCRIPTION



TEXAS INSTRUMENTS

MODEL 990A 13 CHASSIS MAINTENANCE MANUAL, GENERAL DESCRIPTION

LIST OF EFFECTIVE PAGES

Insert latest changed pages and discard superseded pages.

Note: The changes in the text are indicated by a change number at the bottom of the page and a vertical bar in the outer margin of the changed pages, with the following exceptions:

- A change number at the bottom of the page but no change bar indicates either a deletion or a page layout change.
- An entire section with no change bars but with change numbers at the bottom of each page is an entirely new section.

Model 990A13 Chassis Maintenance Manual, General Description (2308774-9701)

Original Issue ..... August 1982
Change 1 ..... February 1985

The manual consists of the most recent full revision (indicated as 0) and the following changed pages since the last revision. The total pages and change numbers in this publication are as follows:

Important Safety Instructions

Before using your 990A13, please read and comply with the following instructions:

1. Read all of these instructions.

2. Save these instructions for later use.

3. Follow all warnings and instructions marked on the product.

4. There are not user serviceable, installable, or replaceable parts inside the Model 990A13 chassis. The Model 990A13 chassis enclosure contains hazardous live electrical parts involving risk of an energy hazard-high current levels, and risk of fire. Repairs to the chassis should be done by trained service personnel.

5. The card cage area of the 990A13 chassis contains hazardous live electrical components involving risk of electrical shock and energy hazard-high current levels. This manual contains information and procedures for use by system designers, maintenance personnel, and trained system maintenance operators. These procedures assume these personnel are familiar with electrical hazards, and have a knowledge of basic hand tools and cabling techniques. A detailed knowledge of computer hardware or software is not required.

6. On models with standby power:

   a. Replace battery with same type as originally supplied. Use of another battery may present a risk of fire or explosion.

   b. Battery may explode if mistreated. Do not disassemble or dispose of in fire. Keep away from children and dispose of used battery properly.

7. Power requirements:

   a. Check the label on the product and ensure that the available power source meets the requirements of the unit.

   b. To maintain the safety of the machine use only power cord sets approved by the national test house for the power source requirements of the product.

   c. This product is a safety IEC Class I machine.

   d. This machine is not designed for connection to an IEC "I.T." power system.

8. This product is designed for data processing use.

9. When connecting or disconnecting cables to the machine, ensure that the power switch is in the OFF (O) position. Disconnect the power cord set last.

10. It is expected that reasonable care will be exercised in the final installation and operation of this machine. The manufacturer dose not assume any liability for the improper installation, application, or use of this machine.

11. Installation/application requirements:

    a. Ensure the power on/off (I/O) switch easily accessible in the final design.

    b. Cables used to interconnect the chassis and its printed wiring boards should be equivalent or better grade than those supplied by Texas Instruments.

    c. Unjacketed (single insulated) cables must not be used for external interconnections.

    d. All cables not supplied by Texas Instruments, should be verified to comply with existing electrical and fire safety codes and standards.

    e. Final system configuration should be verified to comply with applicable EMI emissions standards.

    f. Final system configuration should be verified to comply with applicable product safety standards.

Preface

Model 990A13 Chassis Maintenance Manual, General Description provides an introduction to the Model 990A13 Chassis, TI part number 2309019. Installation instructions and basic operating instructions are included. This manual is specifically limited to chassis information and does not describe the many Texas Instruments 990-family computers and computing systems that include the 990A13 chassis.

This manual serves as an independent document and as an introduction to the 990A13 field and depot maintenance manuals.

Information in this manual is divided into four sections and one appendix:

Section

1 Introduction — Features, specifications, configurations and physical description.

2 Installation — Site requirements, unpacking, installation, cabling, and initial power-up procedures.

3 Operation — Use of the operator controls and indicator lights. Preventive maintenance procedures.

4 Nonstandard and OEM Installation Data — Technical data for installations not part of a standard Texas Instruments system, or those including customer-designed devices.

Appendix

A Standby Power Supply Installation — Installation procedure for the optional standby power supply.

The following manuals also describe the Model 990A13 Chassis:

Title	Part Number
Model 990A13 Chassis Maintenance Manual, Field Theory and Maintenance (available as part of manual kit 2308772-1)	2308775-9701
Model 990A13 Chassis Maintenance Manual, Depot Theory and Maintenance (available as part of manual kit 2308772-2)	2308776-9701
990 CRU/TILINE Expansion Maintenance Manual, General Description	2272075-9701

Contents

Illustrations

Tables

1

Introduction

1.1 FEATURES

A Model 990A13 Chassis (Figure 1-1) provides mounting space, cooling air, shielding, operating voltages and signal connections for a Texas Instruments 990-family computer. The 990A13 combines a rugged, attractive enclosure with a massive power supply to provide the basis for a reliable low-maintenance computing system.

CAUTION

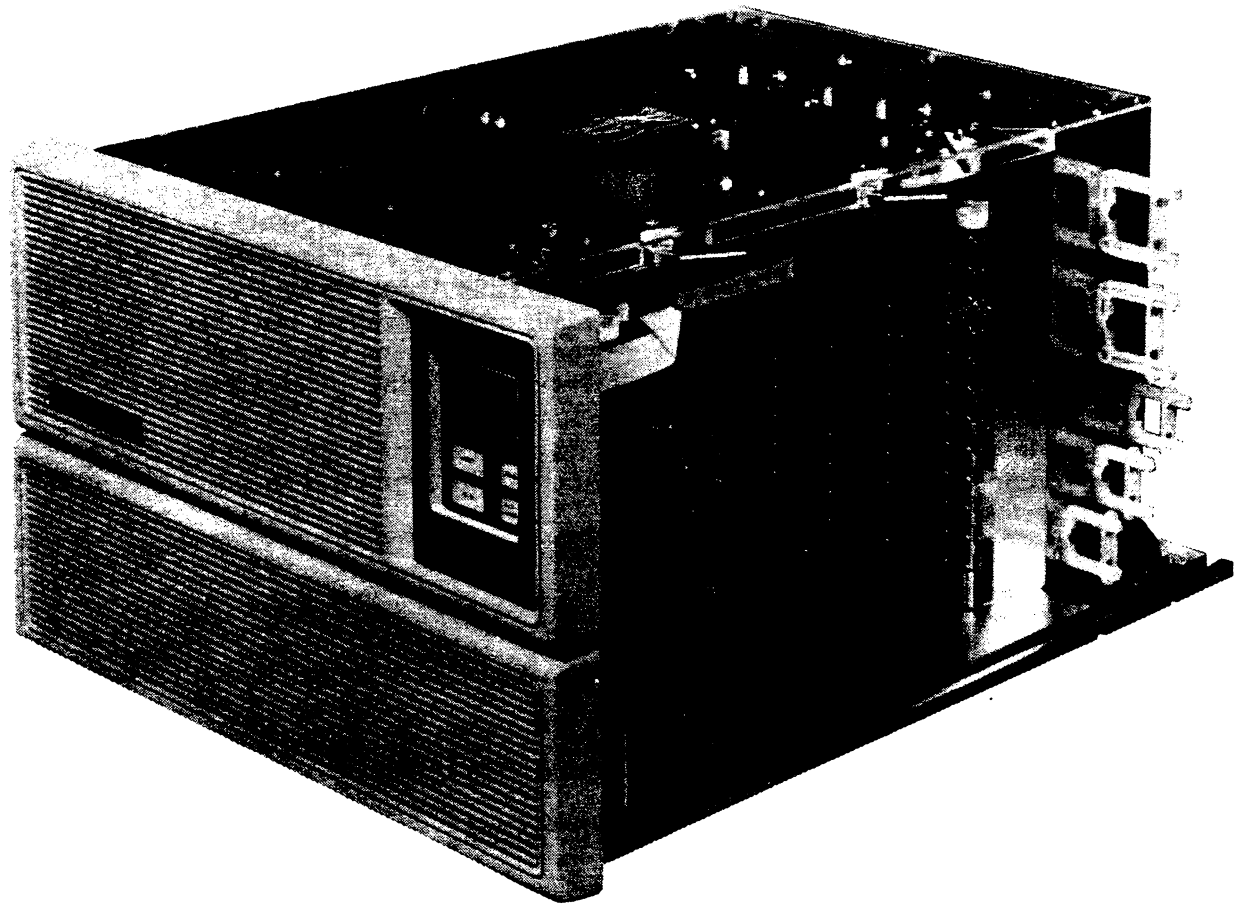
The Model 990A13 Chassis contains static-sensitive electronic components. To avoid damage to these components, ensure that you are well grounded before you remove or handle the printed circuit boards. The recommended method is to use a static-control floor or table mat and a static-control wrist strap. These are commercially available. If you do not have a static-control system, you can discharge any accumulated static charge by touching a grounded object prior to handling the board. Then, as a further precaution, place the printed circuit board on a grounded work surface after you remove it from the assembly or from its protective package. Before storing or transporting the printed circuit board, return it to its protective package or the assembly.

Chassis features include:

- Mounting slots for up to 13 full-sized 990 logic boards or a combination of full-sized and half-sized boards
- Interrupt assignment by fixed or programmable circuit board
- TILINE* and communications register unit (CRU) bus
- Control and display panel that provides basic controls, status indicators, and a four-digit (hexadecimal) address and data display
- Front panel intake and filtration of cooling air, with a plenum and four exhaust fans to provide reserve cooling capacity

* TILINE is a trademark of Texas Instruments Incorporated.

- Switching power supply that provides up to 65 amperes of +5-volt logic power plus other voltages required by 990 logic boards
- Optional standby power supply and battery pack that provide memory refresh voltages to prevent data loss during short-duration power failures
- Low-voltage and high-voltage versions that span the customary ac line voltages/ frequencies of most countries
- Extensive shielding and filtering to prevent EMI (electromagnetic interference) emission



2282978

Figure 1-1. Model 990A13 Chassis — Front View with a 990/10A Central Processor

1.2 CHASSIS CONFIGURATIONS

The 990A13 chassis is available in several variations to meet the needs at your site. Major selectable items include high or low voltage ac input power, a standby power supply option, and two versions for use as a computer chassis or as an expansion chassis.

1.2.1 High and Low Voltage Inputs

Customary ac line voltages throughout the world range from 100 volts to 240 volts nominal, with a plus or minus 10 percent tolerance. A low-voltage chassis covers the input voltage range from 90 to 132 volts, and a high-voltage chassis covers the range from 180 to 264 volts. The two versions differ only in the fan/control assembly, which is the chassis rear panel. An ac line cord and fuse adapt the chassis to the power distribution system in a specific country.

1.2.2 Standby Power Supply Option

Any programs and data in the computer memory are normally lost when you turn off ac power or if a power line failure occurs. A battery-powered standby power supply is available for applications in which a loss of memory contents is unacceptable. This option, available factory-installed or as an add-on, supplies critical memory refresh power rather than full computer operating power.

A standby power supply is a solution for brownout and short-term power loss; with a fully-charged battery, the computer will save memory contents for approximately 45 minutes. A standby power supply works with either the low-voltage or the high-voltage version of the 990A13 chassis.

Wire standby power only to slots 1-7. Do not install memory with critical refresh requirements in slots 8-13. Certain CPUs require jumpers to enable standby operation of on-board memory.

The standby power supply ON/OFF switch is concealed behind the chassis trim panels and the ON and OFF labels are molded into the air filter framework.

1.2.3 Computer and Expansion Chassis

A computer chassis includes a control and display panel that provides controls, status displays, and numeric data/address displays for a 990-family central processor. In addition to the central processor board (or boards), a computer chassis may contain memory boards, disk controller boards, and other circuit boards.

Some computing systems require more circuit boards than can fit in a single chassis, or require more dc power than one chassis can provide. In this case, the circuit boards may be distributed between a computer chassis and an expansion chassis. Either the TILINE or the CRU bus (or both) must be extended to the expansion chassis.

An expansion chassis has a single power indicator instead of a control and display panel. Otherwise, a computer chassis and an expansion chassis are identical.

1.3 CHASSIS SPECIFICATIONS

Table 1-1 summarizes the specifications for the Model 990A13 Chassis.

Table 1-1. Model 990A13 Chassis Specifications

Dimensions	
Height at front trim panel	311 mm (12.25 in.)
Width	483 mm (19.0 in.)
Depth	
Overall	628.6 mm (24.75 in.)
Behind panel	594 mm (23.4 in.)
Weights	
Chassis (no options)	22.0 kg (48.5 lb)
Standby power option	4.1 kg (9.0 lb)
Typical logic board	0.7 kg (1.5 lb)
Mounting requirements	483 mm (19 in) cabinet or EIA RS310B cabinet
Power supply outputs	
+5 main (+5.1 Vdc ± 3%)	
Without standby	5 A to 65 A max
With standby	5 A to 59 A max
+12 main (+12.0 Vdc ± 3%)	
Without standby	4 A
With standby	2 A
−12 main (−12.0 Vdc ± 6%)	
Without standby	2.5 A
With standby	2 A
−5 memory (−5.0 Vdc ± 6%)	
Without standby	0.1 A
With standby	
Line power	0.1 A
Battery power	0.1 A
+12 memory (+12.0 Vdc ± 3%)	
Without standby[1]	
With standby	
Line power	2 A
Battery power	1 A
+5 memory (+5.1 Vdc ± 3%)	
Without standby[1]	
With standby	
Line power	6 A
Battery power	3 A

Notes:

[1] Supplied by main power supply output at the same voltage.

Table 1-1. Model 990A13 Chassis Specifications (Continued)

Heat load	
Any single slot	30 watts avg; 60 watts max
Power supply	250 watts max
Acoustic noise (not in cabinet)	NC 47 or less
Electromagnetic interference (EMI)	
Conduction/radiation	Meets limits specified by FCC Docket 20780 (Class A), VDE 0871 (Level A)
Power input requirements	
Input voltage	
Low voltage	90 to 132 Vac, 3-wire service (line, neutral, earth)
High voltage	180 to 264 Vac, 3-wire service (line, neutral, earth)
Input frequency	47 to 63 Hz
Input power	900 VA max
Environmental limits	
Ambient temperature	
Operating[2]	0° to 50° C (32° to 122° F)
Storage	−40° to 60° C (−40° to 140° F)
Humidity	
Operating	5% to 90% noncondensing
Storage	0% to 90% noncondensing
Altitude (operating)	−300 to 3048 meters (−984 ft to 10000 ft)
Storage	−300 to 12192 meters (−984 ft to 40000 ft)
Vibration limits	
Operating	0.5 g, 10 to 250 Hz
Nonoperating	0.5 g, 10 to 250 Hz
Shock limits	
Operating	Any axis ±2 g, 15 ms
Nonoperating	X-axis ±15 g, 30 ms Y-axis ±20 g, 30 ms Z-axis ±30 g, 30 ms

Notes:

[2] Derate maximum operating temperature 2° C for each 300 meters altitude above sea level.

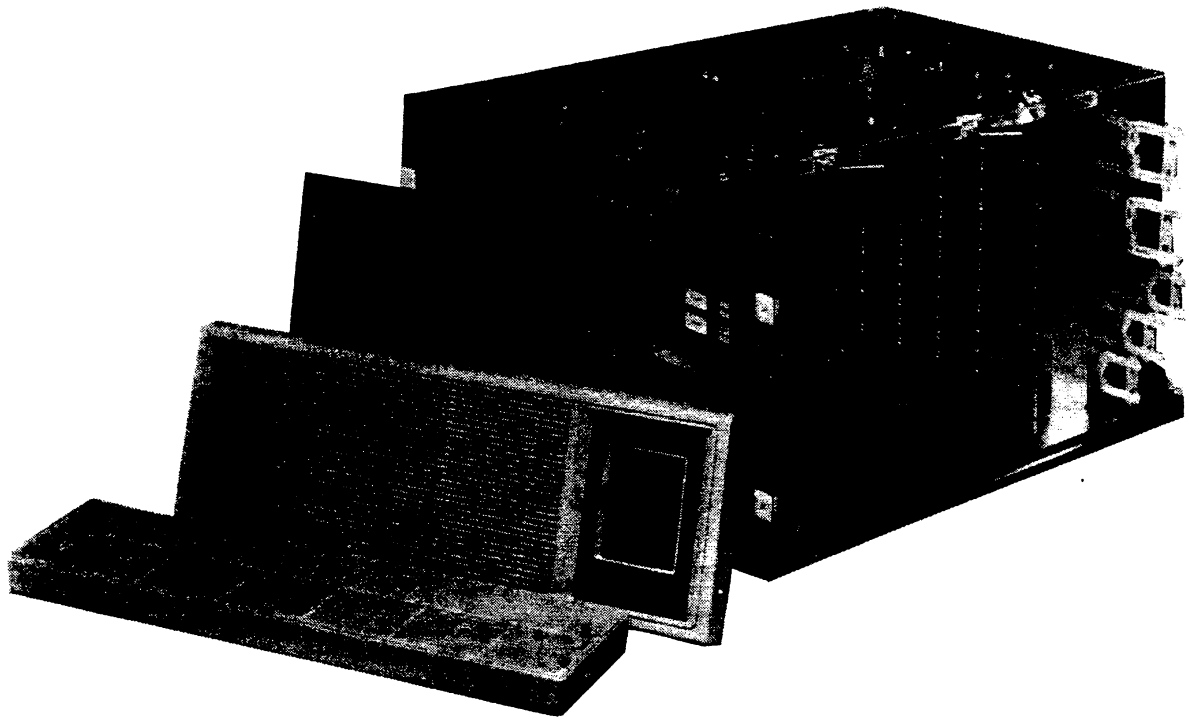
1.4 PHYSICAL DESCRIPTION

Physical details of the Model 990A13 Chassis are shown in Figure 1-1, Figure 1-2, and Figure 1-3. The main body of the chassis is a zinc-plated, sheet steel assembly that provides shielding and serves as a strong mounting structure for other chassis parts.

Two grey plastic trim panels serve as cooling air intakes and restrict casual contact with control switches and test features. Both of these removable panels are secured by snap catches at the outer edges. Removing the panels is a normal operator procedure, and does not pose any hazards to personnel or operations.

A disposable plastic air filter is located behind the trim panels. An interference fit between square pegs on the filter and round holes in the sheet metal holds the filter in place. The filter fits flush against a slotted metal grill that provides airflow, fingerproofing and shielding. A cutout in the lower left corner of the filter provides access to the optional standby power supply switch. ON and OFF labels molded into the filter identify the standby power supply switch settings.

Operating controls, status indicators, and numeric displays are located in the control and display module. A cutout in the upper trim panel provides access to switches and displays. The test connector and data security switch are hidden when the trim panel is in place. The data security switch allows you to enable the panel controls, enable a remote test panel, or disable all manual inputs. Section 3 (Operation) provides descriptions of all control and display panel switches.



2282979

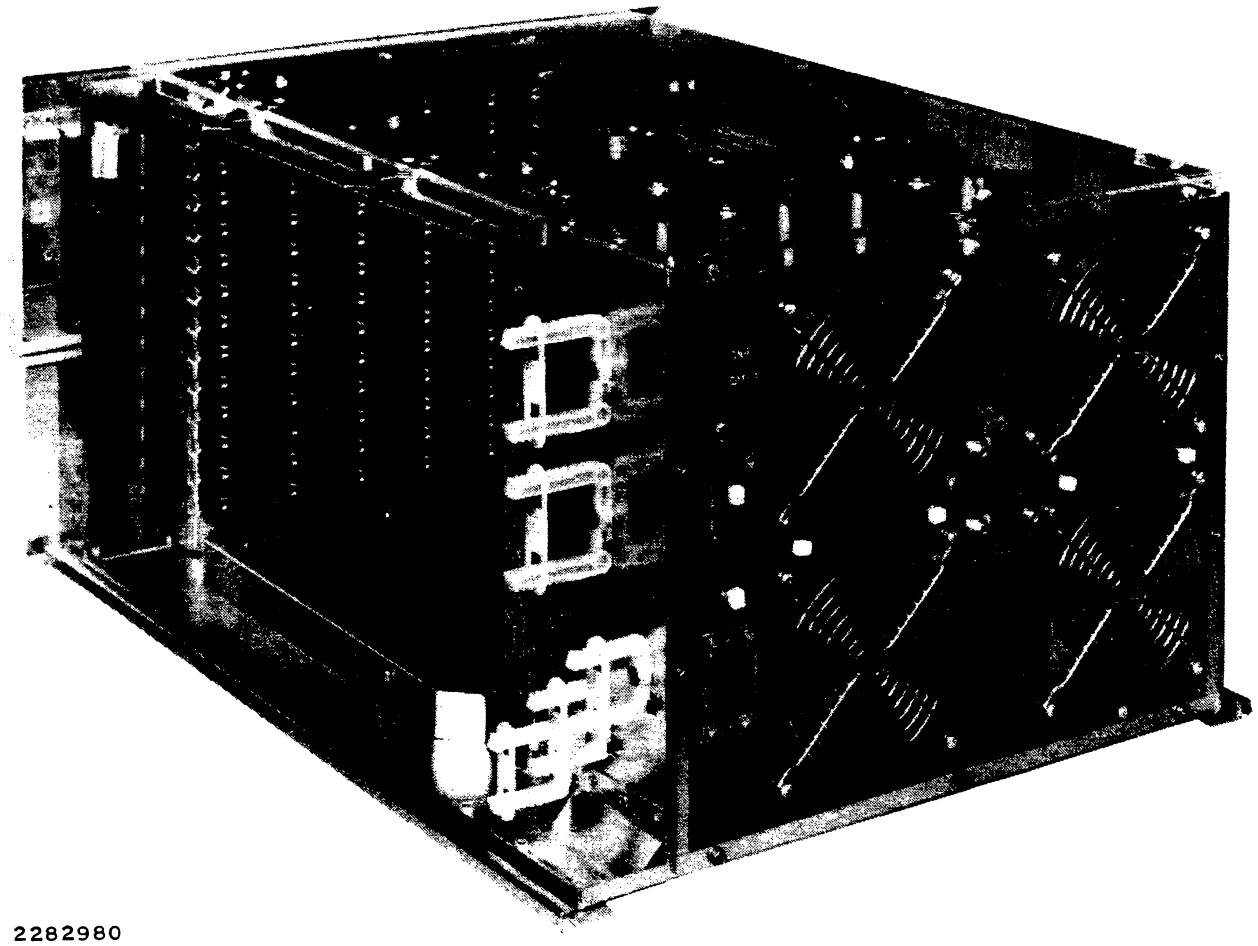
Figure 1-2. Model 990A13 Chassis with Trim Panels Removed

An expansion chassis has a display module that provides a power-on indicator, with no controls and no test connector.

The chassis provides 13 horizontal mounting slots for the plug-in circuit boards that make up a computer system. Access to the slots is on the right side, viewed when facing the front of the chassis.

Each slot has two connectors that mate with edge connectors on the plug-in circuit boards. A shielded backpanel supports the connectors and provides operating power distribution and signal connections between slot positions.

Slot 1 (the top slot) is reserved for a central processor board in a computer chassis, and for a CRU buffer board in an expansion chassis. Slots 2 through 13 are general-purpose slots that can be used for other 990-family boards. With the addition of an optional center card guide kit, TI part number 940045-2, a chassis slot can hold 1 or 2 half-size 990 boards, up to a maximum of 24 in a single chassis.



2282980

Figure 1-3. Model 990A13 Chassis — Rear View

Interrupt connections between slot 1 and slots 2 through 13 are made by an interrupt board installed directly above slot 1. Interrupt boards are available in standard and programmable versions.

A movable sill and a pair of adjustable leaf clamps above slot 1 form the upper part of an electromagnetic interference (EMI) shield for the logic boards. An adjustable sill below slot 13 and shield/stiffeners on the logic boards complete the shield, as described in Section 2.

Figure 1-3, the chassis rear view, shows the fan/control assembly which includes four exhaust fans, an ac power input connector, line fuse and the ac power ON-1/OFF-0 switch. This panel determines whether the chassis is a low-voltage or high-voltage version.

Power enters the chassis on a CEE (22) VI connector that includes a built-in filter. The fuse is either a UL/CSA-approved type GLH fuse or a 5 by 20 millimeter type SPT fuse, depending on whether a US or international fusecap is installed. Either type requires a screwdriver for access to the fuse. A label identifies the fuse type and current rating. Table 1-2 summarizes the fuse data and supplies Texas Instruments and manufacturer part numbers.

Table 1-2. Fuse Data

Fuse Type	Voltage Range	Current Rating	Source	Part Number
GLH	Low	10.0 A	TI Bussman Mfg	0416434-5 GLH10
SPT	High	5.0 A	TI H. Schurter AG	2220531-8 034.3124

2

Installation

2.1 GENERAL

This section supplies preparation, unpacking, mounting, and cabling information needed to install a Model 990A13 Chassis at your site. If you are doing a nonstandard or original equipment manufacturer (OEM) installation, you may need the additional technical information in Section 4. If your 990A13 chassis is part of a complete Texas Instruments computing system, refer to the system installation instructions. Much of the work described in this manual is already done for you in a standard TI system.

CAUTION

There are not user serviceable, installable, or replaceable parts inside the Model 990A13 chassis. The card area of the Model 990A13 chassis contains hazardous live electrical components involving risk of an energy hazard-high current levels. Installation instructions provided in this manual are to be used by trained personnel familiar with electrical hazards, and with a knowledge of basic hand tools and cabling techniques. A detailed knowledge of computer hardware or software is not required.

CAUTION

These instructions are intended for design and installation personnel who are familiar with safety practices associated with electrical/electronic product packaging.

2.2 SITE REQUIREMENTS

A computer site must provide the electrical power, environmental control, and mounting space the chassis requires for proper operation. Refer to the chassis specifications in Section 1 for a summary of these requirements. If the chassis is installed with additional equipment, more stringent environmental limits may be required. If your chassis is supplied as part of a standard Texas Instruments computing system, refer to the site preparation manual for your system.

2.2.1 Electrical Power Connectors and Cord Sets

A low-voltage version of the 990A13 chassis can operate on any ac voltage in the range 90-132 volts (47-63 Hz) without adjustment. A high-voltage version operates on any ac voltage between 180 and 264 volts (47-63 Hz), also without adjustment. With a full set of logic boards, ac line input is 900 volt-amperes or less.

These wide input voltage ranges allow the 990A13 chassis to operate in most countries. Both versions of the chassis have a recessed-male power input connector that accepts a CEE(22) V plug. A three-wire line cord with separate line, neutral, and earth ground conductors connects between the chassis connector and the wall socket.

Figure 2-1 shows the CEE (22) VI chassis input connector and the prewired cord sets available for many countries. Details of the line plugs are shown at the left side of the figure. The NEMA 5-15P line plug is supplied in the USA, Canada, and Japan. Standard line voltage is 120 volts in the USA and Canada; 100 volts in Japan. Great Britain has a 240-volt power system, and the line cord has a BS 1363 plug. This plug contains an internal 13-ampere BS 1362 fuse as shown in Figure 2-2. Replacement fuses are available from Texas instruments (part number 2211740-1) or from MK Electric Ltd (part number 610).

Western European countries (except Switzerland and Denmark) commonly use the CEE (7) VII line plug supplied for Germany, France, Belgium, Austria, Norway, Sweden, the Netherlands, and Finland. The nominal line voltage is 220 volts in these countries.

2.2.2 Electrical Power Distribution and Grounding

Voltage irregularities and noise on ac power lines can cause errors in computer operation. In order to minimize line noise pickup, provide a dedicated ac power circuit for your 990A13 chassis and any related computer equipment. This power circuit must be routed away from large switching devices, motors, welders, and other sources of induction fields. Copiers, electric typewriters, and other office machines can also generate electrical noise.

If you are installing the 990A13 chassis as part of a standard Texas Instruments computing system, the accompanying site preparation manual describes any special power distribution or grounding requirements. These requirements come from the additional computing equipment, not from the 990A13 chassis. Any power circuit must meet the safety and good practice standards of the regulatory agencies having jurisdiction at your site.

2.2.3 Environmental Requirements

Chassis environmental requirements include limits or minimums for air temperature, air flow, humidity, and airborn dust.

Although the 990A13 chassis is rated for a wide range of operating temperatures and humidities, longest life and best reliability are obtained at about 22 degrees centigrade (72 degrees fahrenheit) and 50 percent relative humidity. This operating point coincides with the comfort range setting of most office air-conditioning systems.

A 99013A chassis does not require conditioned air for cooling. Room-temperature air is pulled in through the front panel (Figure 2-3) and warmed air is forced out the rear by four exhaust fans. However, if the computer is installed in a restricted space or unventilated cabinet, the internal temperature can build up, reducing component life and leading to increased maintenance costs.

Low humidity promotes static charge and dust buildup. Static charges can cause operating faults or destroy some semiconductor devices. Peripheral devices, such as printers, disks, and tape drives determine the minimum and maximum humidity for reliable operation.

Excessive dust can clog the intake air filters and reduce cooling efficiency. You must clean or change the intake air filter regularly to prevent clogging and overheating. Section 3 includes a sample schedule for these preventive maintenance operations.

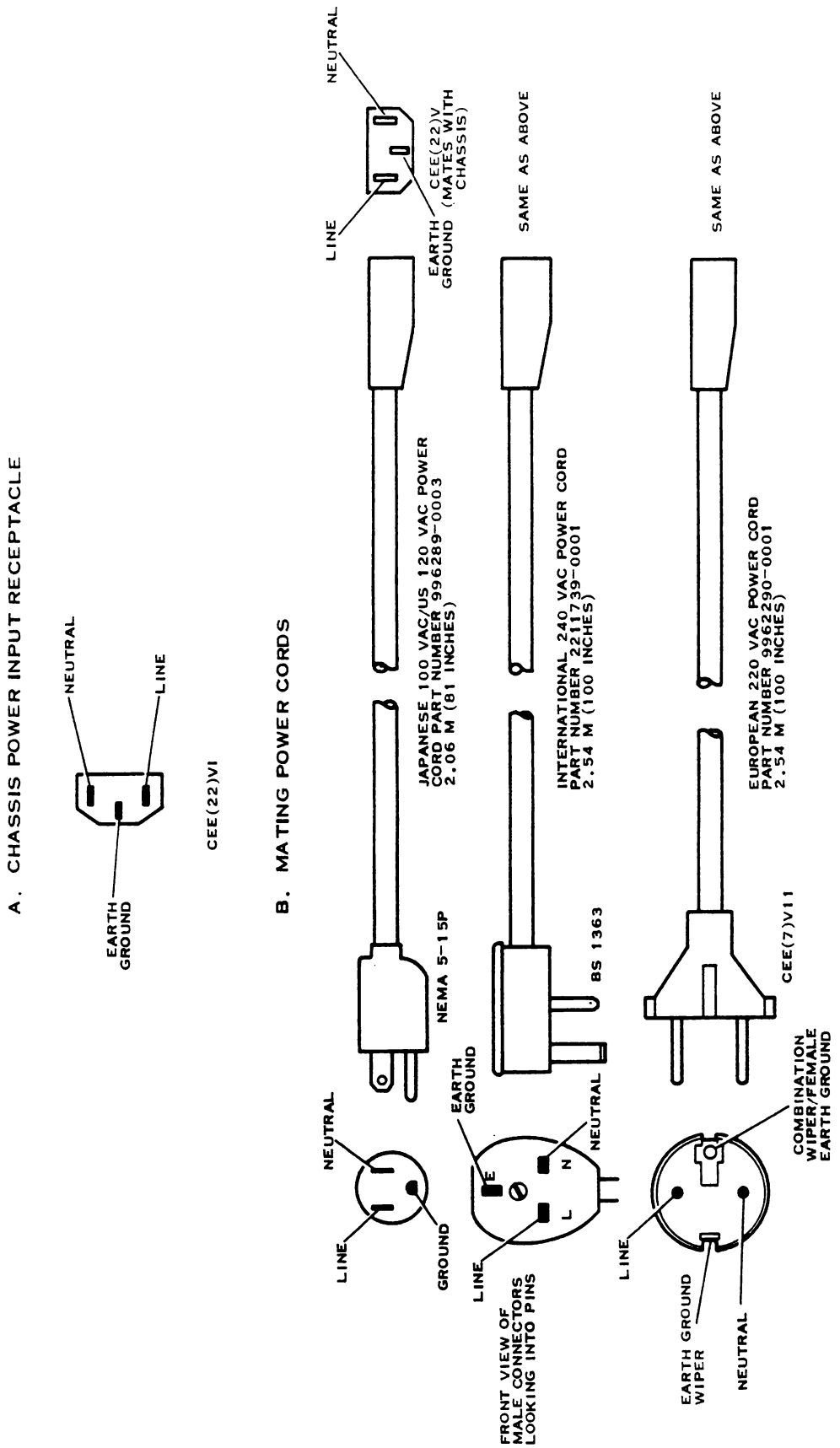


Figure 2-1. Power Cord Sets and Connectors

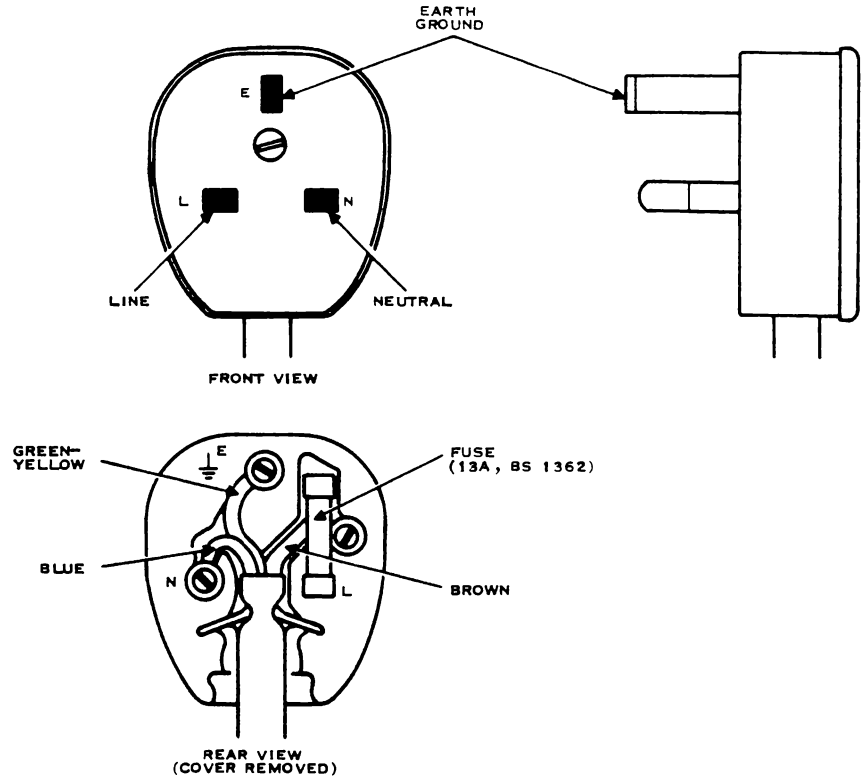


Figure 2-2. BS 1363 Fused Power Connector for Great Britain

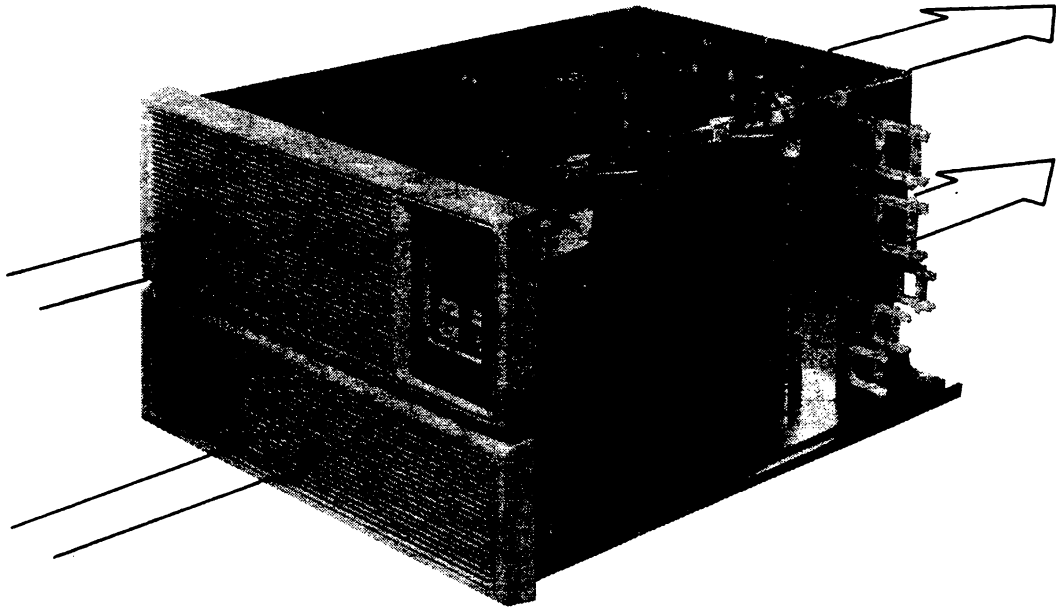


Figure 2-3. Cooling Air Flow

2.2.4 Space Requirements

Space requirements include the mounting space for the chassis and the access space needed to operate and maintain the chassis.

A 990A13 chassis mounts in a standard 483-millimeter (19-inch) EIA cabinet, often called a rack. Cabinets are available commercially or from Texas Instruments. A 990A13 chassis occupies 311 millimeters (12.25 inches) of front panel height and 594 millimeters (23.4 inches) of depth behind the front panel.

Allow a 50-millimeter (approximately 2-inch) minimum clearance behind the chassis for exhaust air escape. This is an absolute minimum figure; cooling efficiency and reliability are increased with larger exhaust air clearances. You may want to use a cable carrier, part number 0996745-1, to prevent cable lay from blocking exhaust air flow.

Your cabinet must have enough natural or forced-air ventilation for all equipment in the cabinet. Chassis exhaust fans are not rated to blow into a sealed cabinet or into high back pressure.

CAUTION

Failure to provide adequate cabinet ventilation or exhaust air clearance can lead to overheating, reduced equipment life, and unnecessary service calls.

Figure 2-4 shows the chassis access requirements for service and operation. These are absolute minimums with allowances for tool lengths where needed. Space for visibility and personnel standing room are not included. There are two ways to meet these access requirements:

1. Mount the chassis in a cabinet that has removable access panels and enough internal clearance to allow removal of logic boards and the main power supply.

2. Mount the chassis with an extension slide kit, TI part number 945127-1, so the chassis can be pulled out of the cabinet for service.

If you are going to mount the chassis on slides, allow approximately 635 millimeters (25 inches) in front of the cabinet for full slide extension and for removing the chassis from the slides. Allow approximately 274 millimeters (10.8 inches) on the right side for access to cables and for removing circuit boards.

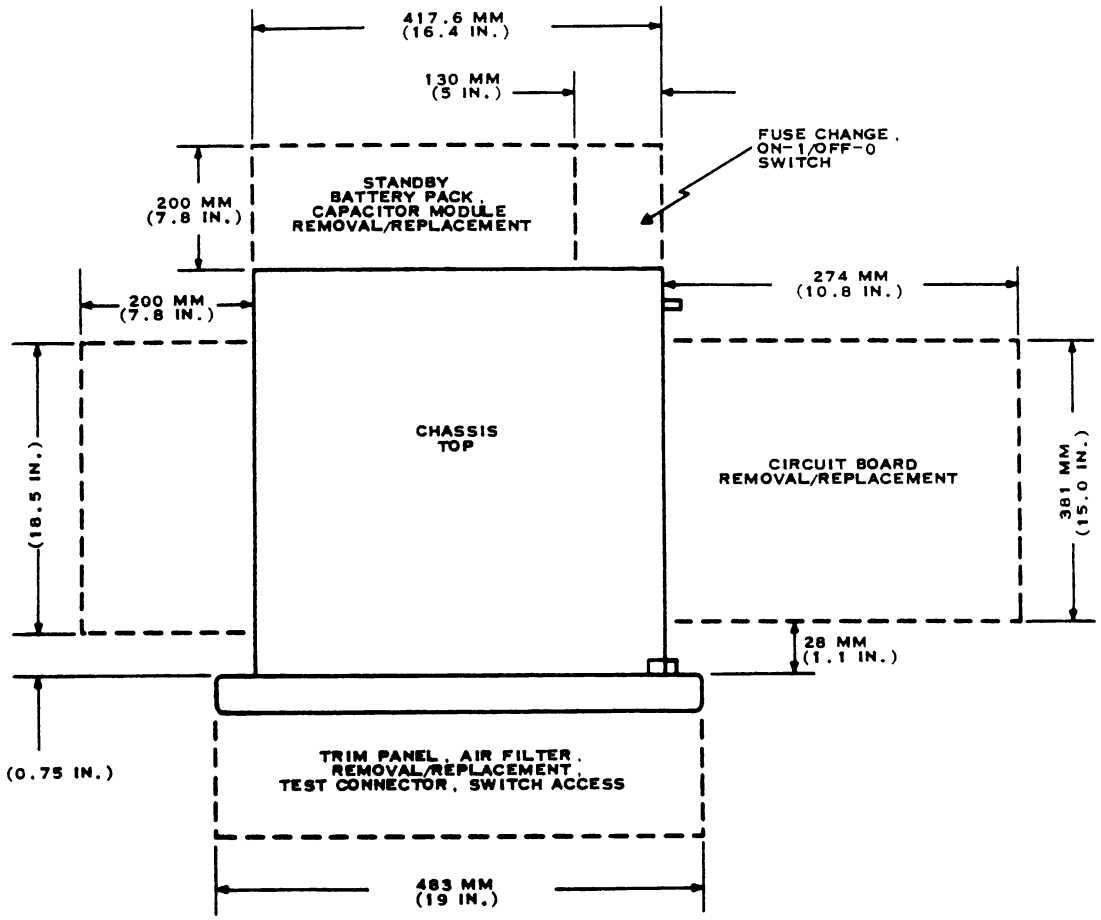


Figure 2-4. Chassis Minimum Access Requirements

2.3 UNPACKING

The chassis is shipped in a corrugated cardboard container with a built-in pallet, as shown in Figure 2-5. Logic boards, if included, are shipped installed in chassis slots, held in place by metal shipping brackets. If a standby power supply is included, both the power supply and battery pack are installed at their final locations in the chassis.

Front trim panels are not installed prior to shipment. A trim panel kit, which includes an upper and lower trim panel and three air filters (one for installation, two for spares) is packaged in a separate corrugated container. This container is placed in front of the chassis, and a composite buildup pad is placed at the open side of the chassis. A protective cardboard sleeve is slipped over the combination of the chassis, buildup pad, and trim panel kit.

The sleeve is sandwiched between two identical cushion trays made of closed-cell foam padding and corrugated cardboard. These cushion trays suspend the chassis at the center of an antishock structure built of padding and packaging material.

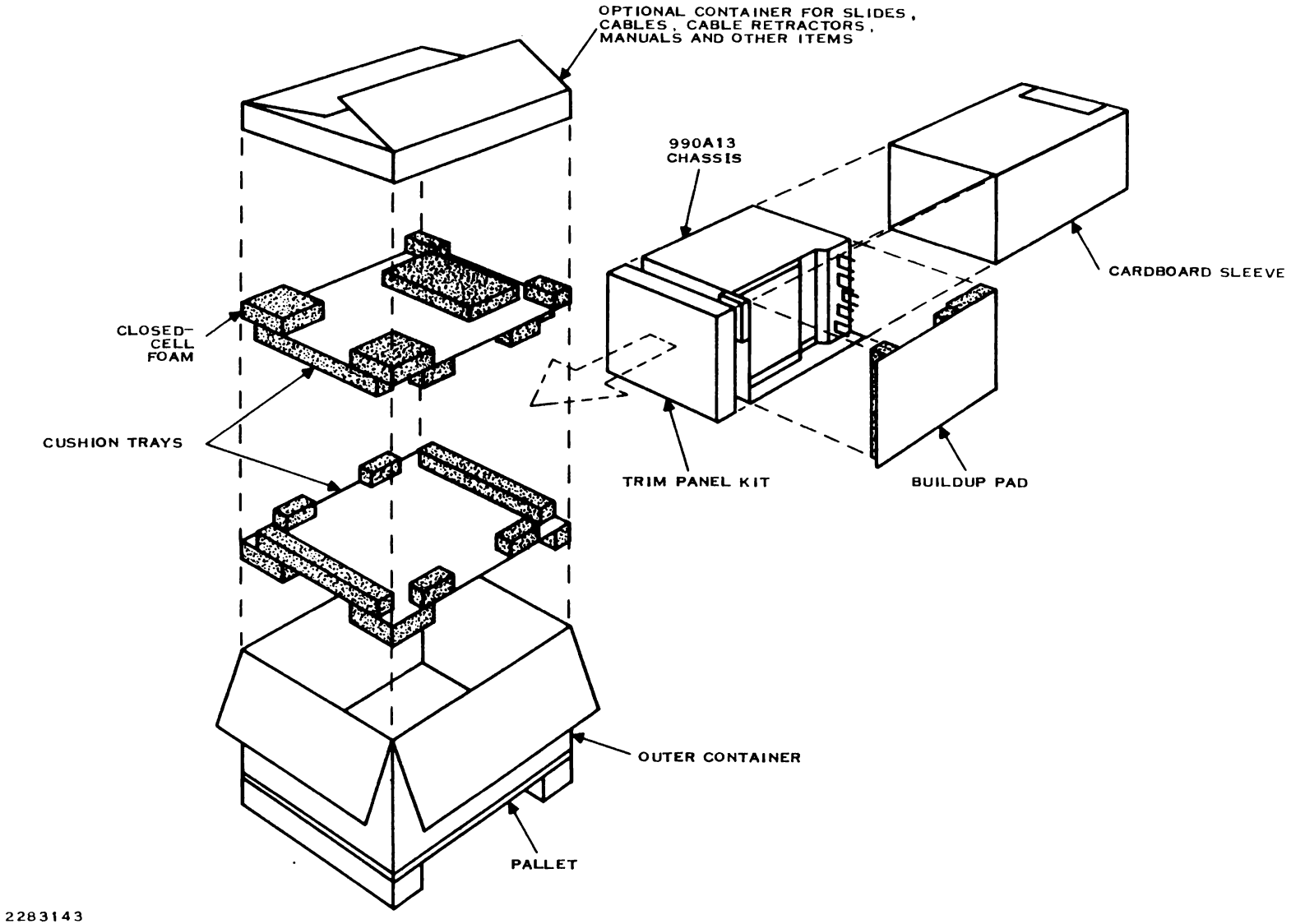


Figure 2-5. Unpacking the 990A13 Chassis and Trim Panel Kit

Smaller items, such as cables, cable retractors, slides, programmable interrupt kits, manuals, and software are packaged in a shallow cardboard box that fits between the upper cushion tray and the top of the outer container. This box is omitted and a slightly shorter outer container substituted if there are no small items to ship.

When you receive the container, inspect the outside for physical damage and signs of mishandling. Note any damage and contact the carrier at once. After your external inspection, perform the following unpacking procedure:

NOTE

Save the shipping carton and all packing materials for use in reshipping the unit.

1. Position the container right-side up, as indicated by the arrows on the outside.
2. Use a short-bladed knife to cut the tapes that hold the container top closed. Open the container and lift out the box of cables, manuals, and other small items.
3. Lift out the upper cushion tray.

WARNING

Use proper lifting techniques to avoid backstrain when lifting the chassis or the sleeve containing the chassis.

CAUTION

Exercise care when handling the sleeve to assure that the chassis or trim panel kit does not slide out.

4. Lift out the sleeve and its contents (chassis, buildup pad, trim panel kit), and place on a stable work surface.

5. Slide the sleeve off of the chassis and remove the buildup pad and the trim panel kit.

CAUTION

The two clamps above the logic board area are NOT handles; do not use them to lift the chassis. Also, the small control and display panel (or display panel) at the chassis right front is NOT a load-bearing surface; do not use it to lift the chassis.

Use only the chassis exterior sheet metal to lift the chassis.

6. Use a flat-blade screwdriver to remove the shipping brackets from the left and right sides of the logic board area. Tape the mounting screws to the shipping brackets and place the brackets back in the shipping container.

7. Use a short-blade knife to open both the box of small items and the trim panel kit. Remove all of the contents and set them aside in a safe place.

8. Replace the two cushion trays, buildup block, sleeve, boxes and other shipping materials in the container. Store the container for possible future use.

9. Inspect the chassis and other components for signs of damage. If any damage is detected, notify the carrier immediately.

10. To reship the chassis, reverse this procedure and use the original shipping materials. Note the positions of all the packing materials as shown in Figure 2-5.

2.4 STANDBY POWER SUPPLY INSTALLATION

Refer to Appendix A if you are going to add a standby power supply kit, part number 2309088-1, to a 900A13 chassis. A standby power supply can be installed either before or after installing chassis slides. If you have a choice, install the standby power supply first, because the slides reduce the available space.

CAUTION

Ensure chassis power switch is OFF(O) and power cord is disconnected from chassis prior to starting installation.

NOTE

If the standby power supply and 990A13 chassis are ordered on the same sales order, the chassis is shipped with the standby power supply and batteries installed.

Operational control of the standby power supply is behind the lower trim panel, through a cutout in the air filter. Refer to Section 3 when you are ready to operate with standby backup.

2.5 CHASSIS INSTALLATION IN AN EIA CABINET

CAUTION

Final system configuration should be verified to comply with applicable product safety and EMI emission standards.

The following procedure describes how to mount a 990A13 chassis with a standard 990 slide kit, TI part number 0945127-0001. This kit includes left and right telescoping slides, two adjustable-length rear mounting brackets, and four clamp or nut plates. Nut plates are threated for use with unthreated EIA rails; clamp plates are unthreated for use with threaded EIA rails. Small mounting hardware items (screws and washers) are also included.

Slide mounting consists of four operations:

1. Selecting the mounting location in the cabinet.
2. Mounting the slide set in the cabinet.
3. Mounting the inner slides to the chassis.
4. Installing the inner slides (and chassis) in the cabinet as shown in Figure 2-6.

NOTE

The intake air filter and front trim panels are not installed until after cabinet mounting is complete. The trim panels do not provide purchase for lifting the chassis or extending the slides.

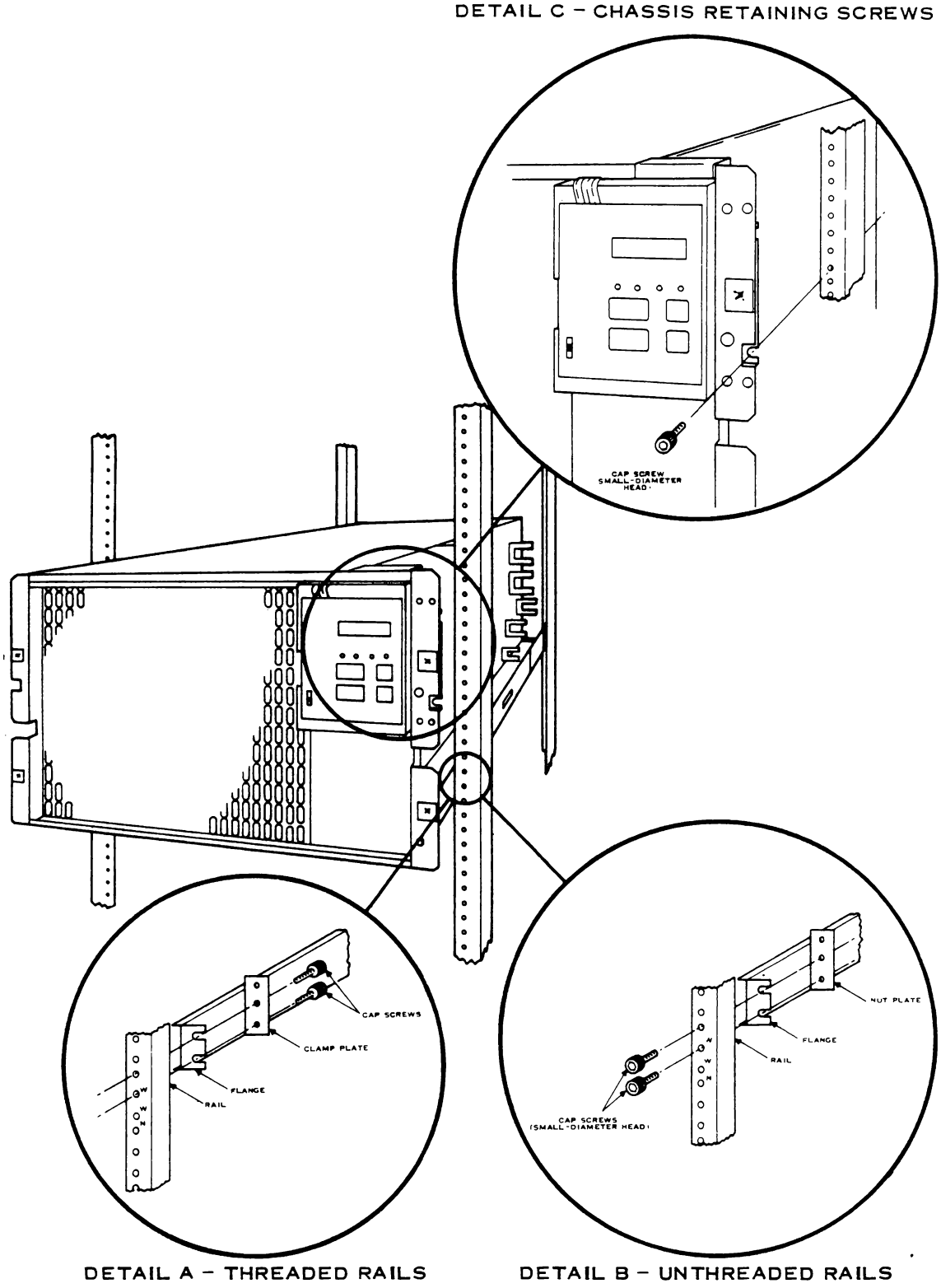


Figure 2-6. Perspective View of Slide Mounts

To mount a 990A13 chassis in an EIA standard cabinet:

1. The allowable spacing between the front and rear cabinet rails ranges from 616 to 717 millimeters (24.25 to 28.25 inches). The slide set is adjustable over this range, so spacing is not critical. Move the cabinet rear rails if the spacing is outside the allowable range.

2. Determine where you want to locate the bottom edge of the lower trim panel, as shown in Figure 2-7.

   Make a reference mark between a set of holes with narrow spacing. By EIA standards, this mark is not centered, but is 6.86 millimeters (0.27 inches) below the centerline of the upper hole. After installation, the chassis and trim panels will occupy the next 311 millimeters (12.25 inches) above the reference mark.

   Use a level or straight edge to locate the corresponding points on the rear rails.

3. Locate the slide mounting holes in the cabinet rails. Count the first hole above your reference mark as hole 1, with holes 2 and 3 as the mounting holes.

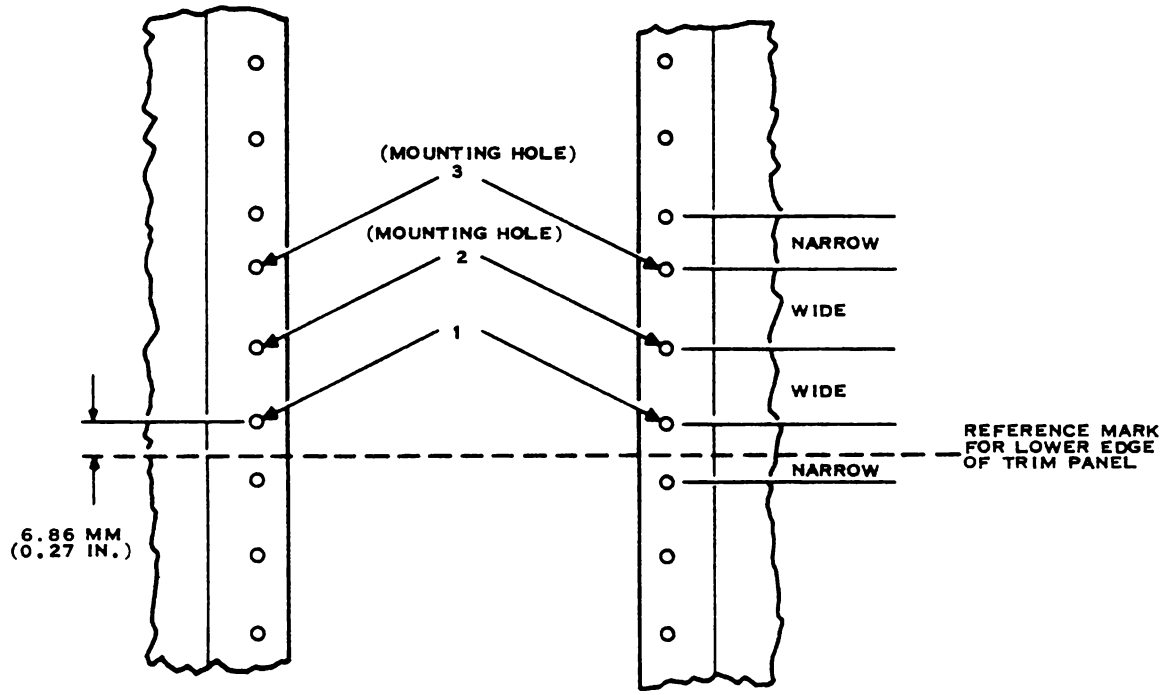


Figure 2-7. EIA Mounting Rails

4. Each slide rear extension has a number of adjustment slots. In this step, you are selecting a set of slots for a rough adjustment. The final length adjustment and tightening come later in the procedure.

   Loosely assemble the rear extensions to the slides, so the front and rear mounting flanges fit between the cabinet front and rear rails.

5. Mount the slides in the cabinet, following the appropriate mounting details in Figure 2-6:

   If your cabinet has threaded rails, follow Detail A and mount the slides inside the front and rear mounting rails with two cap screws and a clamp plate at each mounting bracket. The cap screws enter the rails from inside the chassis, and should be hex-head or hollow-head style for positive driving.

   If your cabinet has unthreaded rails, follow Detail B and mount the slides inside the front and rear mounting rails with two cap screws and a nut plate at each mounting bracket. The cap screws enter from the rail front, and the heads will interfere with panel mounting if they are larger than 7.87 millimeters (0.31 inch) in diameter.

WARNING

Make sure that each flange is firmly clamped between the inside of a mounting rail and a clamp plate or nut plate. If you assemble the parts in the wrong order or omit a plate, the slides may fail under load.

NOTE

If you do not install the slides as shown in the detailed view, the chassis front trim panels may not fit properly.

6. Tighten the rear extensions to the slides.

7. Extend the slides by slightly raising the front of each slide while pulling forward. Release the inner slides by pressing the quick disconnect buttons. The quick disconnect buttons are on the outside of the slides, about 65 millimeters (2.5 inches) from the junction of the inner slides and the middle slides.

8. Each inner slide has a chassis support lip. Three screw holes in the back and one in the front align with mounting holes underneath the chassis. Assemble the inner slides to the chassis with four 6-32 × 0.500 machine screws per slide (Figure 2-8).

9. Insert the chassis into the extended slides, press the quick disconnect buttons and push the chassis into the cabinet. Work the slides several times to be sure that they operate smoothly, without binding.

10. Recheck all mounting hardware to ensure that all screws are tight.

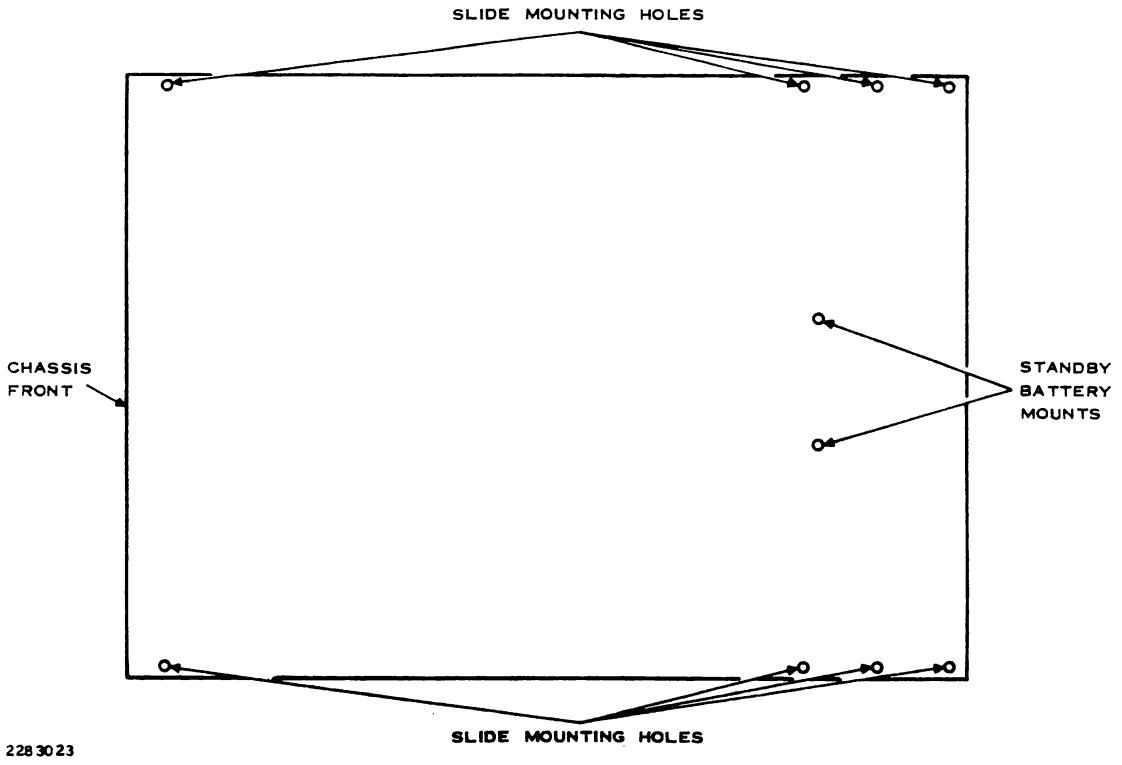


Figure 2-8. Bottom View of Chassis for Mounting

11. After completing the air filter and front trim panel installation, check that the lower edge of the front trim panel coincides with the reference mark on the rails. If not, there may be interference with other units installed in the cabinet.

    Readjust the vertical position of the slides if necessary to obtain the correct trim panel position.

The trim panels do not provide sufficient purchase for you to grip and operate the slides. Any time that you need to pull out the slides, first remove the upper trim panel by grasping at the side and pulling straight away from the chassis.

The slides hold the chassis in the cabinet with a detent. You can release the detent by lifting slightly on the sheet metal at the top of the chassis while pulling forward.

WARNING

The detent is not sufficient if the cabinet is going to be tilted forward or moved. To secure the chassis, insert two 10-32 × 0.375 cap screws through the retaining ears into the front rail.

2.6 INSTALLING THE AIR FILTER AND FRONT TRIM PANELS

Two decorative trim panels and three air filters are packaged in a trim kit. Two of the open-cell, molded frame plastic air filters are spares. One of the filters must be installed between the chassis front grillwork and the trim panels.

WARNING

Trim panels are for appearance, security, and air intake; they are not structural members. Any attempt to lift, carry, or support chassis weight on the trim panels could result in injury or equipment damage.

The front panel area of the chassis is operator-safe; you can install or remove trim panels and the filter without regard to operating power. To install the air filters and trim panels:

1. Locate the two filter mounting holes on either side of the chassis front grillwork.

2. Turn the filter so the four protruding pegs point toward the chassis front grillwork and are aligned with the filter mounting holes (Figure 2-9). The cutout portion of the filter should be at the lower left corner.

3. Press the filter into place, flush against the grillwork. An interference fit between the rectangular pegs and the round holes keeps the filter in place.

4. Select the upper trim panel; it has the Texas Instruments logo and a cutout for the control and display panel. Each end of the panel has two protruding posts: a barbed nylon locking post and a smooth plastic alignment post.

   Orient the panel with the cutout to your right and the rear of the panel pointing toward the chassis front. Slip the two smooth alignment posts into mating holes in the outer rim of the chassis sheet metal. The cutout portion of the panel must frame the control and display panel.

5. Press the panel home so the barbed locking posts lock into the white nylon latches on the chassis outer rim. Do not use excess force.

NOTE

If the slides are mounted incorrectly, or if large-headed screws are substituted for the small-diameter cap screws, the screw heads may interfere with panel seating.

6. Select the lower trim panel and orient it with the rear of the panel pointing toward the chassis front. Ensure that the smooth plastic alignment posts are below the barbed nylon locking posts; otherwise the panel is upside down.

   Slip the two alignment posts into mating holes in the chassis.

7. Press the panel home so that the nylon locking posts lock into the latches. Do not use excess force.

   Either panel can be removed at any time by pulling straight back, away from the chassis. Pull from the sides, not from the top of the panel. Do not use excess force.

CAUTION

Do not attempt to remove a panel by pulling downward from the top. The posts will bind, and may break if excess force is applied.

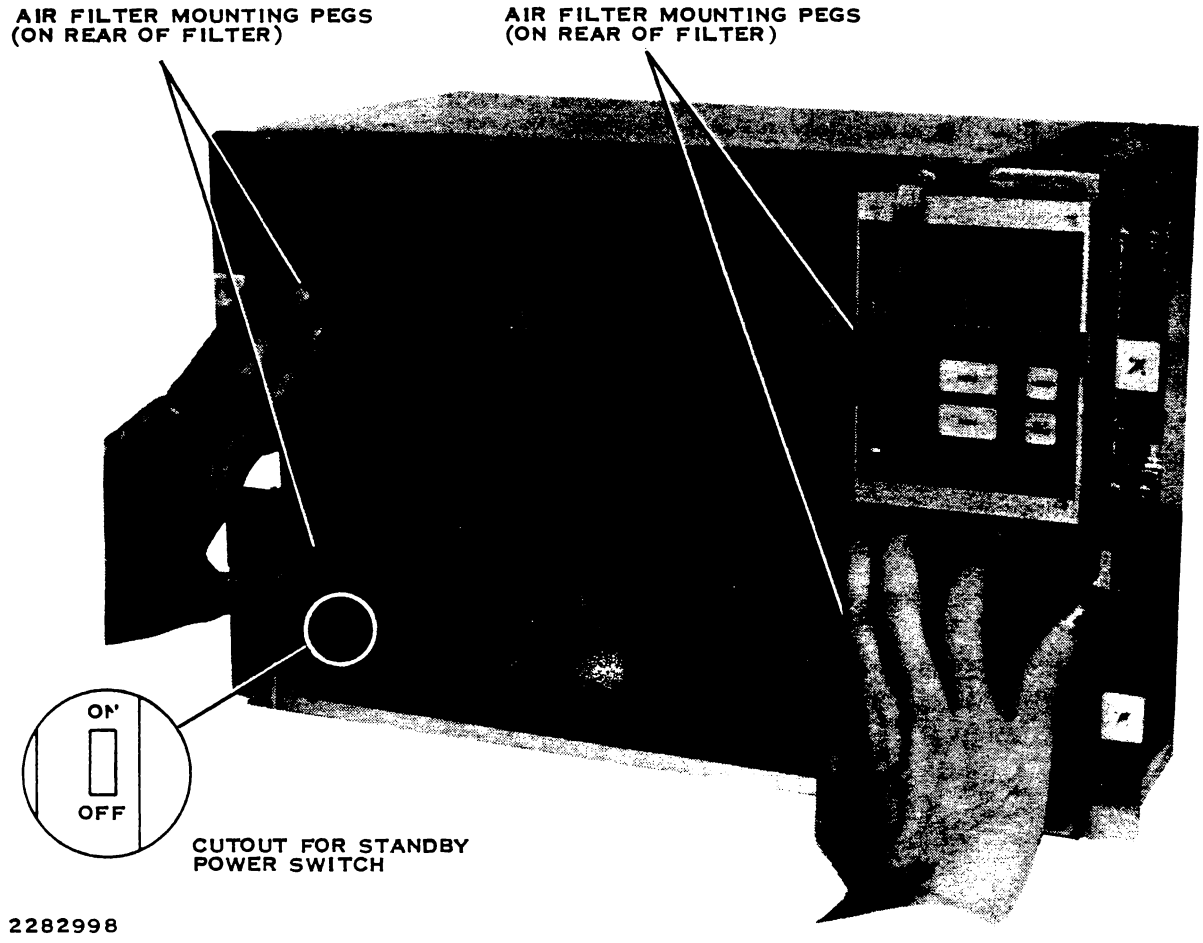


Figure 2-9. Installing the Air Filter

2.7 CHASSIS SLOT SELECTION AND PREPARATION

If the 990A13 chassis is shipped as part of a Texas Instruments computer system, all chassis slot selection and preparation work is completed. Check the top cover of your chassis for a configuration chart. If the chart is filled in at the factory with board names, part numbers, interrupt levels, CRU and TILINE addresses, no additional preparation is needed. You can go on to logic board installation and cabling. Otherwise, refer to the CRU address, interrupt level, and TILINE address information in Section 4. This information allows you to fill out your own configuration chart.

2.7.1 Installing a Center Card Guide

If your chassis is part of a standard Texas Instruments computer system, any required center card guides are factory installed. If you are building a custom system or adding to an existing system, you may need to install a center card guide kit, TI part number 940045-2. Center card guides are chassis accessories you add for half-sized logic boards.

Full-sized 362-millimeter (14.25-inch) logic boards are supported at left and right edges by formed metal slots that are part of the chassis structure. Half-sized boards can be installed in either the left side or the right side of slots 2 through 13. Only the outer edge of the board is supported by the chassis. The inner edge, at the center of the slot, must be supported by a center card guide, part number 2308637-1. A center card guide is a slotted aluminum bar that acts as a guide and structural support for one or two half-sized logic boards.

Figure 2-10 is a side view of the chassis showing the board mounting slots and connectors. A slotted vertical comb/stiffener separates the connectors. Horizontal slots in the comb serve as keys to prevent you from installing a full-sized logic board upside down. Also, the U-shaped channel is both a chassis stiffener and a mounting recess for center card guides. The metal lip at the right side of the comb has center card guide mounting holes for each slot.

NOTE

The following procedure requires complete removal of power, including standby power. Any data in computer memory will be lost. Save any critical memory data to disk or tape before turning off the power.

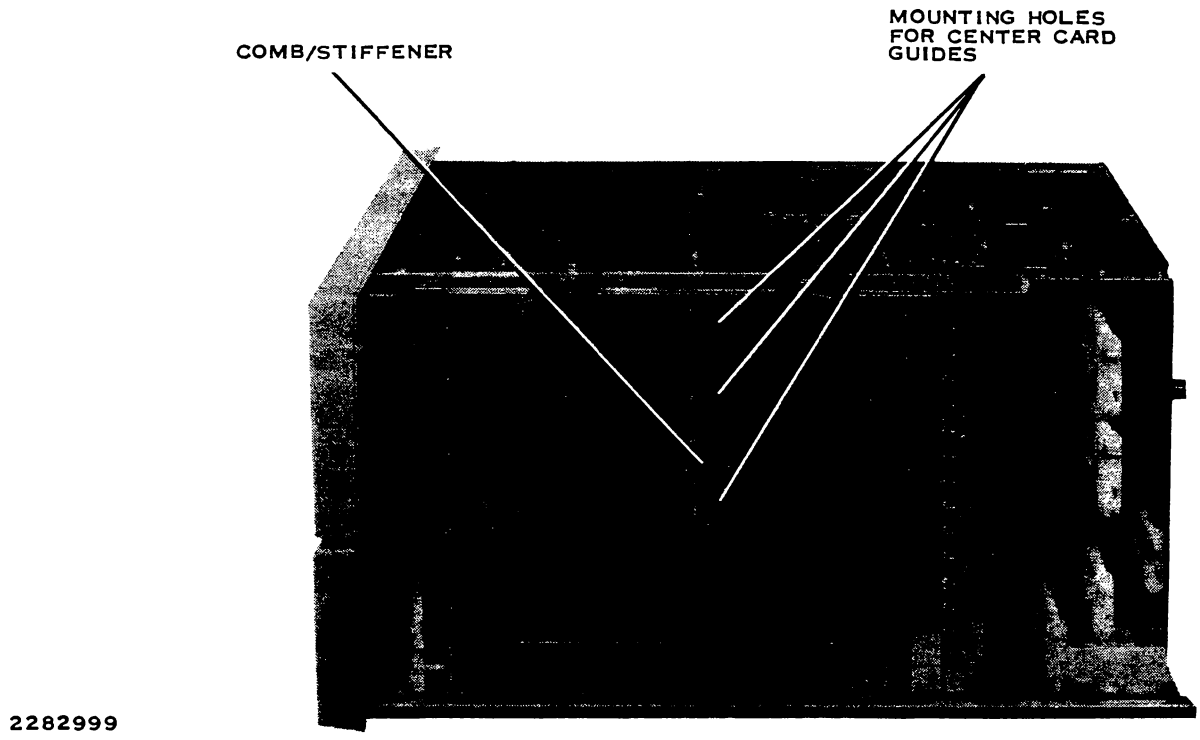


Figure 2-10. Chassis Side View for Center Card Guide Installation

To install a center card guide:

1. Set the rear panel ON-1/OFF-0 switch to the OFF-0 position.
2. Disconnect the ac line cord from the rear of the chassis.
3. If a standby power supply is installed, verify that standby power is off.
4. Extend the chassis on its slides, or otherwise gain access to the right side as viewed from the front. Remove the logic boards for easy comb/stiffener access.
5. Locate the slot selected for half-size boards and the center card guide mounting hole for that slot. Notice that the mounting hole is unthreaded.
6. Insert the 6-32 thread-forming screw into the mounting hole, keeping the screw perpendicular to the mounting hole. Carefully tighten the screw to form the threads. After forming the threads, remove the screw and set it aside for use in step 8.
7. Refer to the installation drawing, Figure 2-11. Orient the center card guide with the slots horizontal and the tang pointing to the right. Insert the base of the center card guide into the U-shaped channel of the comb/stiffener. Adjust the position in the channel to align the slotted tang with the mounting hole in the comb/stiffener.

8. Insert the 6-32 thread-forming screw through the center card guide tang and into the mounting hole. Make sure that the screw threads engage correctly with the threads that you formed in step 6. Tighten the screw to hold the center card guide in place.

9. Check the fit by inserting two half-size logic boards, or one half-size board and one dummy (part number 2309040-1). If the boards do not slide in and out smoothly, loosen the mounting screw and readjust the position of the center card guide. Tighten the screw and recheck the fit.

10. Reinstall any logic boards that you removed.

11. Reinstall the ac line cord if you removed it, and turn on the standby power supply if you turned it off.

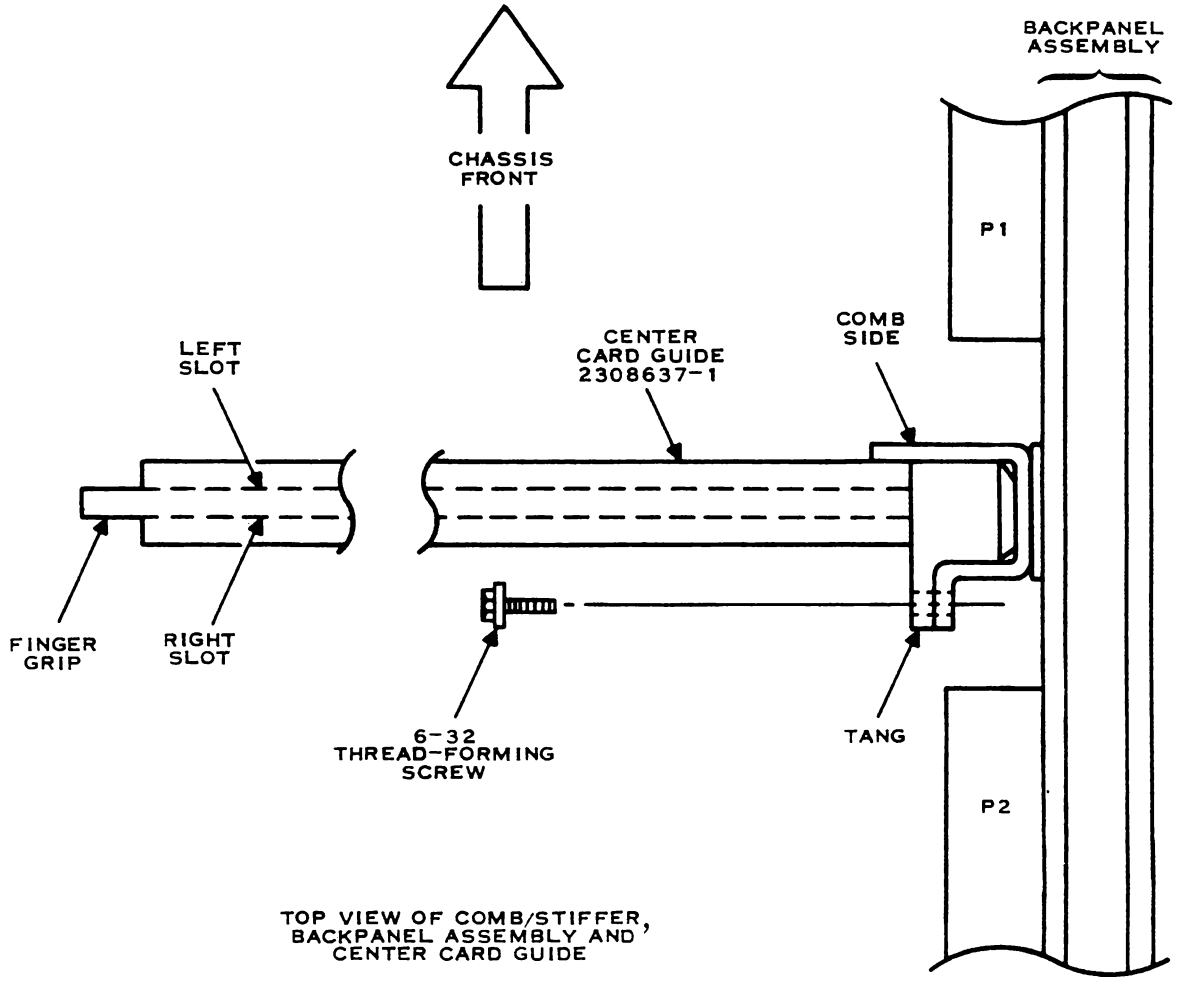


Figure 2-11. Center Card Guide Installation in a Model 990A13 Chassis

2.7.2 Installing the Interrupt Board

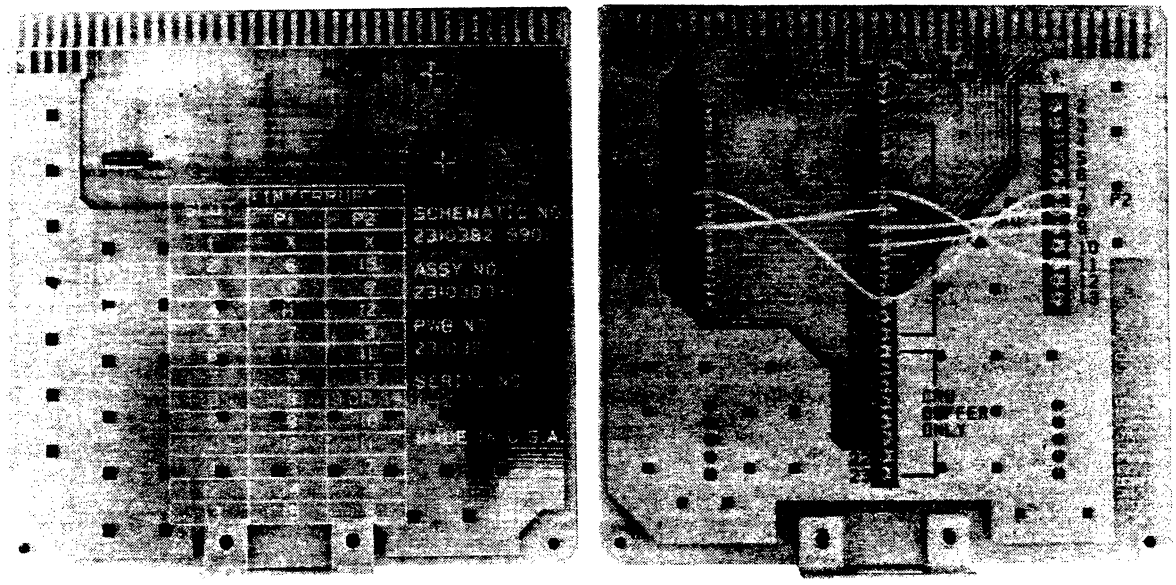
Interrupt connections in the 990A13 chassis are made by a small printed circuit board installed directly above slot 1. The interrupt connector is a standard 80-pin connector located at 0P2 (slot 0, P2 side).

Two types of interrupt boards are available, as shown in Figure 2-12. Type 13-1 is a permanent circuit board with standard interrupt assignments and one programming jumper. The other is a fully-programmable interrupt board for nonstandard interrupt assignments. Details of interrupt assignments and instructions for wiring a programmable interrupt board are given in Section 4. This installation procedure assumes that the interrupt board is supplied factory-complete or that you have completed the interrupt programming described in Section 4.

Figure 2-13 is a side view of a demonstration chassis that has the sheet metal chassis cover replaced with plexiglas. The interrupt circuit board is directly below the chassis cover, held to the cover by a bracket and latch.

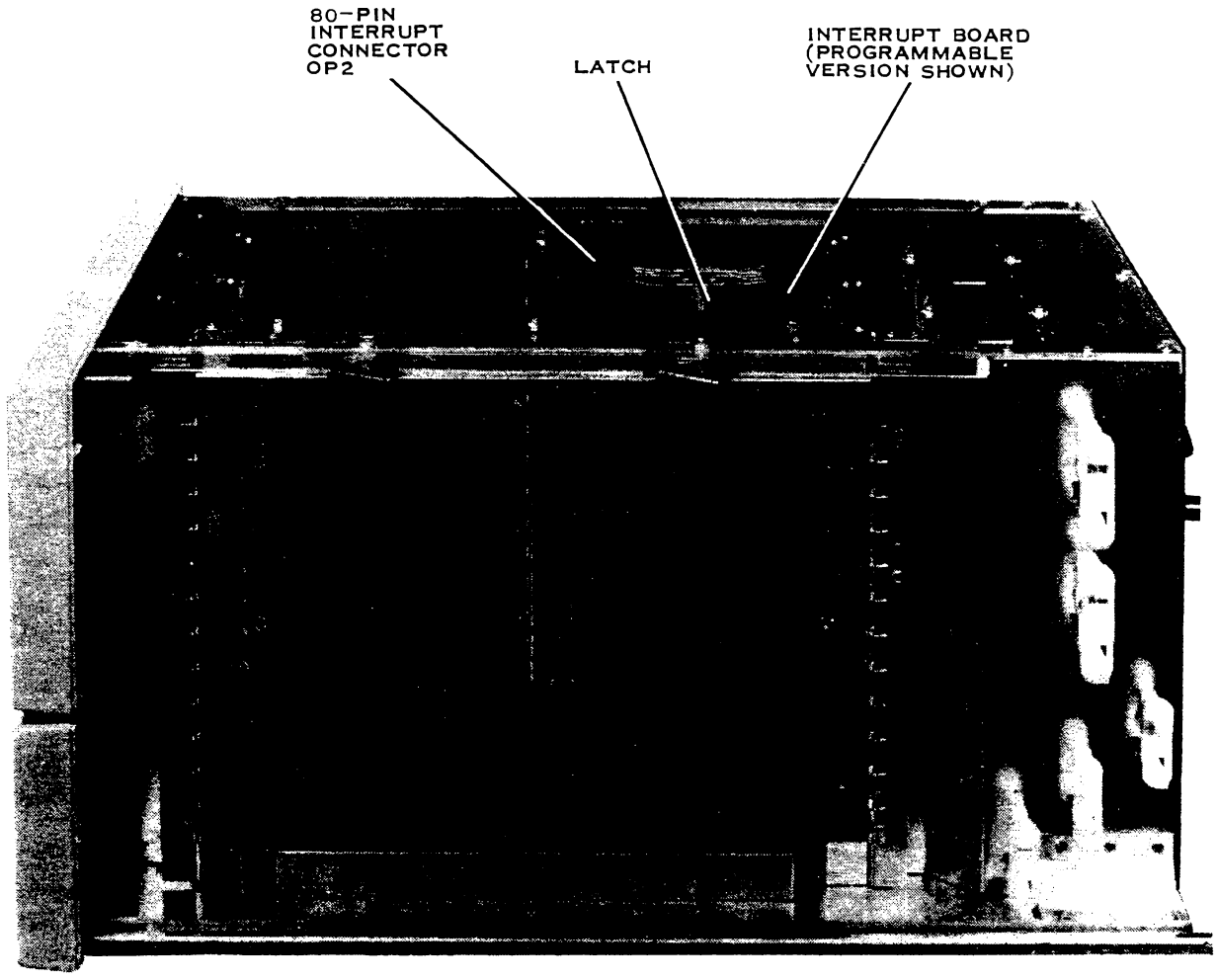
NOTE

The following procedure requires complete removal of power, including standby power. Any data in computer memory will be lost. Save any critical memory data to disk or tape before turning off the power.



2283001

Figure 2-12. Interrupt Boards



2283002

Figure 2-13. Interrupt Board Installed in Demonstration Chassis

To install an interrupt board:

1. Set the rear panel ON-1/OFF-0 switch to the OFF-0 position.
2. Disconnect the ac line cord from the rear of the chassis.
3. If a standby power supply is installed, ensure that standby power is off.
4. Extend the chassis on its slides, or otherwise gain access to the right side as viewed from the front. Remove any logic boards in slots 1 through 6 for ease of access.
5. A white nylon latch knob suspends from the chassis top cover by a metal bracket. Turn the knob so the grooved front part is horizontal and parallel to the chassis top cover.

6. Orient the interrupt board with the latch bracket on top and the connector end pointed toward the chassis backpanel.

   Insert the board into the chassis with the board connector just touching the chassis connector. Do not press home.

7. Align the interrupt board so the grooved part of the nylon latch passes through the slot in the latch bracket. Adjust the board position so the connector and latch bracket are both aligned in their mating positions.

   Gently press the interrupt board home in the chassis connector. Do not use excess force. If the connectors do not mate on the first try, realign the board and try again. A gentle side-to-side rocking motion helps.

8. Turn the nylon latch knob 90 degrees either way to hold the interrupt board in place.

9. Reinstall any logic boards that you removed.

10. Replace the line cord if you removed it.

11. Turn on standby power if you turned it off at the start of this procedure.

2.7.3 TILINE Access-Granted Jumpers

If your chassis came as part of a Texas Instruments computing system, the TILINE access-granted jumpers are factory-prepared. However, if you are adding a high-speed disk controller or other TILINE master, you may need to remove an existing jumper.

The rules and reasons for leaving, removing, or adding TILINE access-granted jumpers are given in Section 4. The installation and operation or general description manual supplied with any TILINE master will tell you to remove the jumper plug for the selected slot.

Figure 2-14 shows the comb/stiffener and the right half of the backpanel. TILINE access-granted jumpers are located at the right edge, closest to the rear of the chassis. Slots 1 and 13 have no jumper connections. For slots 2 through 7, the TILINE access-granted jumper is ***above*** the P2 connector for the slot. For slots 8 through 12, the jumper is ***below*** the P2 connector.

NOTE

The following procedure requires complete removal of power, including standby power. Any data in computer memory will be lost. Save any critical memory data to disk or tape before turning off the power.

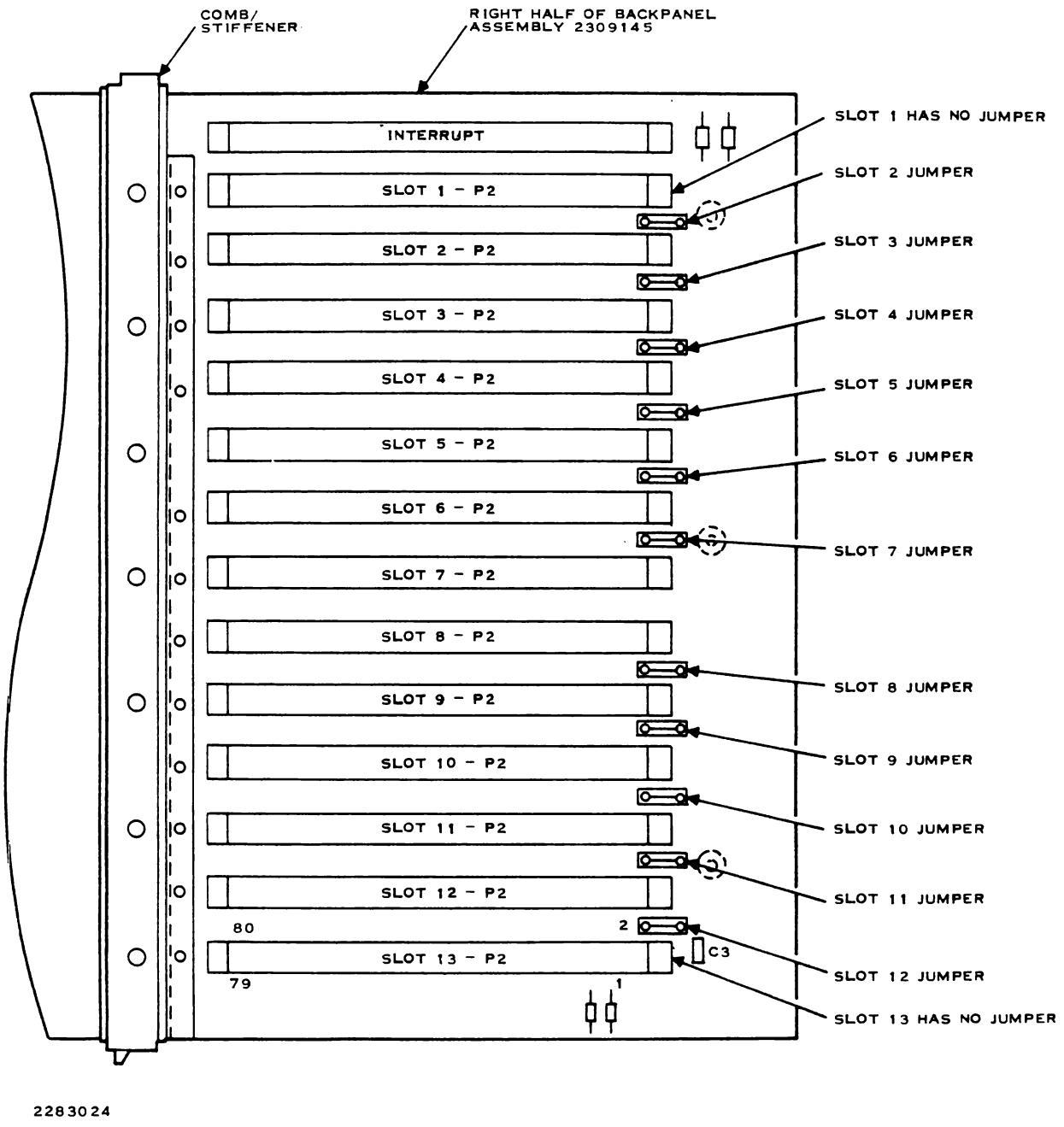


Figure 2-14. TILINE Access-Granted Jumper Locations for 990A13 Chassis

To remove a TILINE access-granted jumper:

1. Set the rear panel ON-1/OFF-0 switch to the OFF-0 position.
2. Disconnect the ac line cord from the rear of the chassis.
3. If a standby power supply is installed, ensure that standby power is off.
4. Extend the chassis on its slides, or otherwise gain access to the right side as viewed from the front. Remove the logic boards surrounding the selected slot for ease of access. Ensure that you have correctly identified the slot and jumper.
5. With a pair of long-nose pliers, gently remove the selected jumper plug by pulling straight forward, away from the backpanel. Save the jumper plug in a well-marked location; reinstallation may be necessary if you change chassis slot assignments.
6. If you install (or reinstall) a jumper plug, be very careful not to bend the jumper wires as you insert the jumper plug. A bent wire is not visible under the plug, and a failure to connect can prevent the computer from operating.
7. Reinstall any logic boards that you removed.
8. Replace the line cord if you removed it.
9. Turn on standby power if you turned it off at the start of this procedure.

2.8 LOGIC BOARD INSTALLATION AND CABLING

Texas Instruments 990 logic boards come in two basic versions, a shielded board introduced in mid-1982 and the conventional board appearing in earlier designs. Either type of board works in a 990A13 chassis and, with precautions described in this manual, they can be intermixed in a single chassis.

2.8.1 Shielded Logic Boards

Shielded logic boards have a 19.05-millimeter (0.75-inch) grounded shield and stiffener along the outer edge and large ring-style ejector-injector tabs as shown in Figure 2-15. Cable connectors mate with on-board connectors through cutouts in the shield-stiffener.

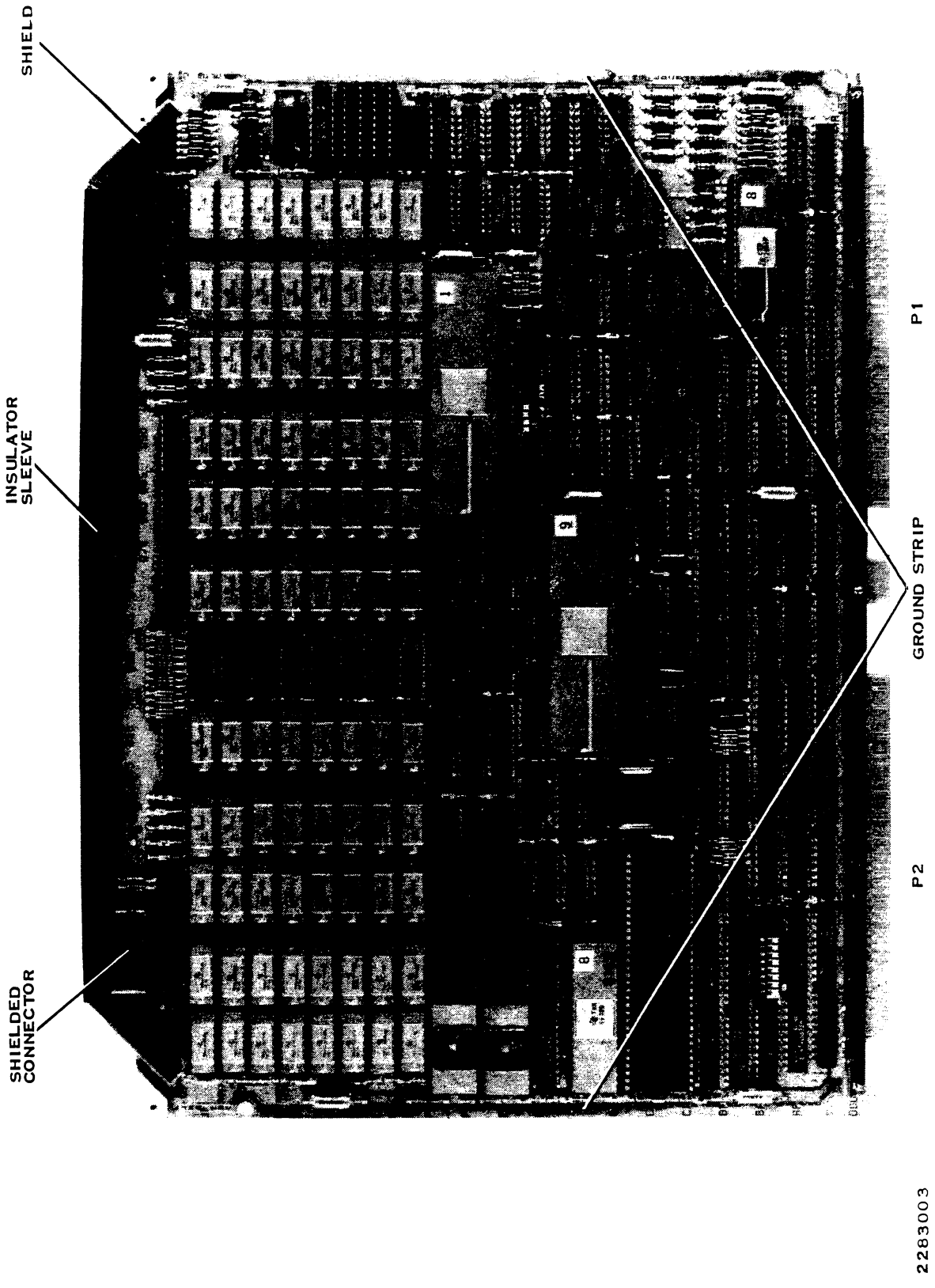


Figure 2-15. Shielded Logic Board

2.8.1.1 Installing Shielded Boards.

CAUTION

Do not remove or insert any circuit board while operating power is applied.

NOTE

The following procedure requires complete removal of power, including standby power. Any data in computer memory will be lost. Save any critical memory data to disk or tape before turning off the power.

To install a shielded logic board:

1. Set the rear panel ON-1/OFF-0 switch to the OFF-0 position.
2. Disconnect the ac line cord from the rear of the chassis.
3. If a standby power supply is installed, make sure that standby power is off.
4. Extend the chassis on its slides, or otherwise gain access to the right side as viewed from the front. Open the EMI clamps if they are closed.
5. Make sure that all logic board preparations (switch settings, jumper settings) specified in the manual for the logic board are complete.
6. Check the chassis configuration chart to identify the correct slot for the logic board. Verify that any necessary chassis preparation is complete (TILINE access-granted jumper installed/removed, center card guide installed for half-size board).
7. If conventional and shielded boards are to be mixed in one chassis, you may have to install an insulator sleeve on the top edge of the shield-stiffener. This insulator protects a conventional board in the next slot ***above*** the shielded board.

Insulator

Board Type	Part Number
Full Size	2308625-1
Half Size	2308640-1

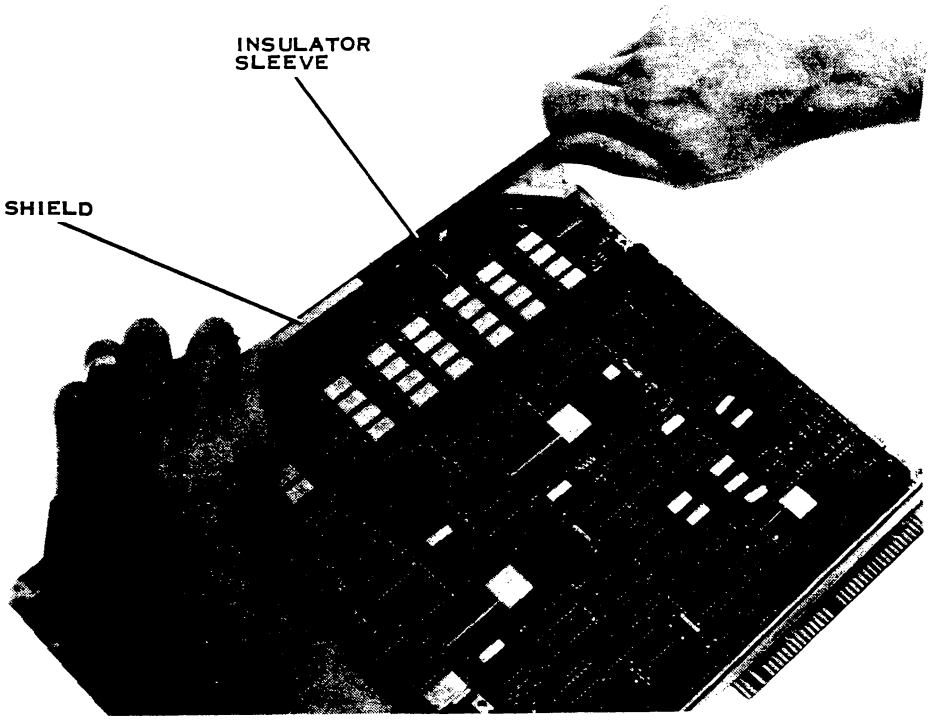
Insulator sleeves are shipped with shielded boards and slip onto the upper lip of the shield-stiffener as shown in Figure 2-16.

8. If the chassis is to contain all shielded boards, remove all insulator sleeves from the shielded boards and from the lower EMI sill below slot 13.

9. Pull the ring-type ejector/injectors apart to the open position.

   Orient the board with the component side up and the edge connector(s) facing the mating connector(s) on the backpanel. If the board is a dummy, the shield is not symmetric. Orient the board with the long side of the shield up (toward the top of the chassis).

10. Carefully slide the board into the slot. The ejector/injectors rotate slightly as the board reaches the backpanel connectors. Press the board in while pulling the ejector/injectors together (toward the center of the board) to seat and latch the board.



2283004

Figure 2-16. Installing/Removing an Insulator Sleeve

2.8.1.2 EMI Suppression with Shielded Boards. This paragraph applies to a chassis with only shielded logic boards. If both shielded and conventional boards are in one chassis, skip ahead to the cabling description.

When a chassis is completely filled with shielded boards, the shields form a complete bulkhead. The logic boards are surrounded by an anti-radiation enclosure formed by the shielded backpanel, chassis sheet metal, metal grillwork and the shield-stiffeners.

For best EMI suppression:

1. Verify that insulating sleeves have been removed from all full-size, half-size, and dummy boards. Also, remove the insulating sleeve from the lower EMI sill (below slot 13).

2. Fill any empty slots with full-size dummy boards (part number 2309032-1), and fill any empty half-slots with half-size dummy boards (part number 2309040-1). Ensure that the insulating sleeves are removed.

3. Refer to Figure 2-17, showing the side of the chassis and the EMI clamps. Open the two EMI clamps above slot 1 by pulling them toward the chassis front.

4. With a screwdriver, loosen the lower EMI sill, directly below slot 13. Raise the sill to press firmly against the shield-stiffener of the board at slot 13, closing the spaces between the boards in slots 6 through 13.

   While maintaining upward pressure, level the sill and tighten the two retaining screws.

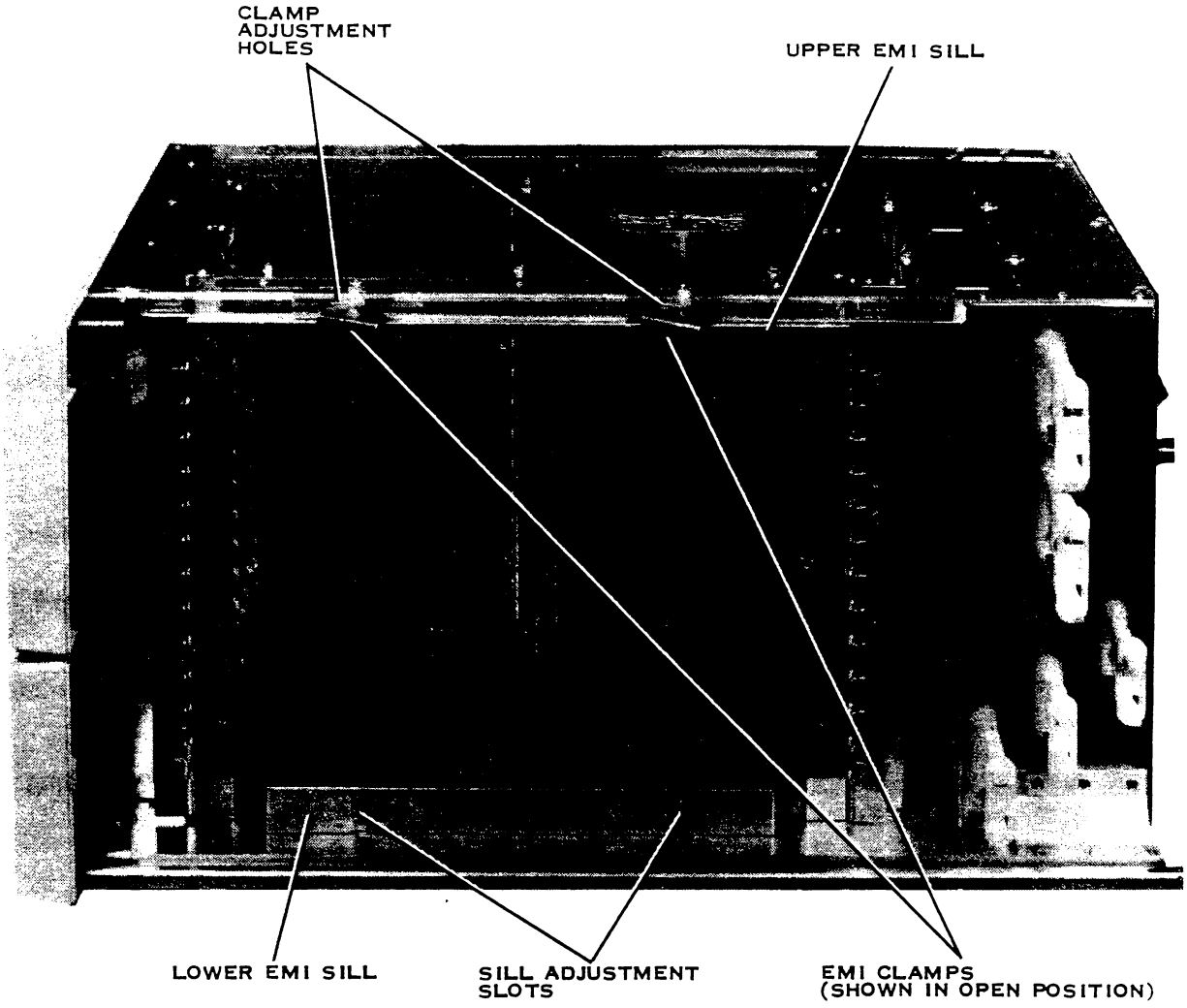
5. Close the EMI clamps by rotating them toward the rear of the chassis.

6. If necessary, adjust the clamping pressure:

   a. When the EMI clamps close, the upper EMI sill is forced down toward the the shield-stiffener of the board in slot 1. Check the clearance between the upper EMI sill and the board shield at each clamp, using a banknote.

      Insert a flat-blade screwdriver through the clamp adjustment hole and adjust the setscrew in each clamp to lightly grasp (not crush) the banknote. This sets the clearance at approximately 0.1 millimeter (0.004 inch).

   b. Turn each setscrew an additional one and one quarter turns clockwise to complete the clamp pressure adjustment.



2283005

Figure 2-17. EMI Clamps

2.8.1.3 Cabling Shielded Boards.

CAUTION

Do not connect or disconnect cables while operating power is applied to either the chassis or any device connected to the cable.

Cable connectors for shielded logic boards are not compatible with conventional boards. These connectors feature a metal shell that connects to ground when inserted into a logic board connector. Metal tabs key the connectors, preventing incorrect installation. Screwdrivers or other tools are not required at the chassis end of the cable. To cable a shielded board:

1. Ensure power is off in the chassis and in any device connected to the cable.
2. Verify that you have the correct cable as described in the manual for the logic board.
3. Dress the cable toward the rear of the chassis and through a cable clamp as shown in Figure 2-18. Leave the cable clamps loose at this time.
4. Gently insert the cable connector through the shield-stiffener cutout and press to mate with the board connector.
5. After all cables are installed, dress all cables to the rear and tighten the cable clamps. Use cable ties, wraps, retractors, or cable trays to control excess cable.

CAUTION

Excess cable can interfere with the exhaust from the 990A13 chassis or from other air-cooled equipment.

NOTE

Collect all excess cable in a flat bundle, NOT a coil. Secure the flat bundle with three cable ties, one in the middle and one at each end. Coiled cables have an undesirable antenna effect.

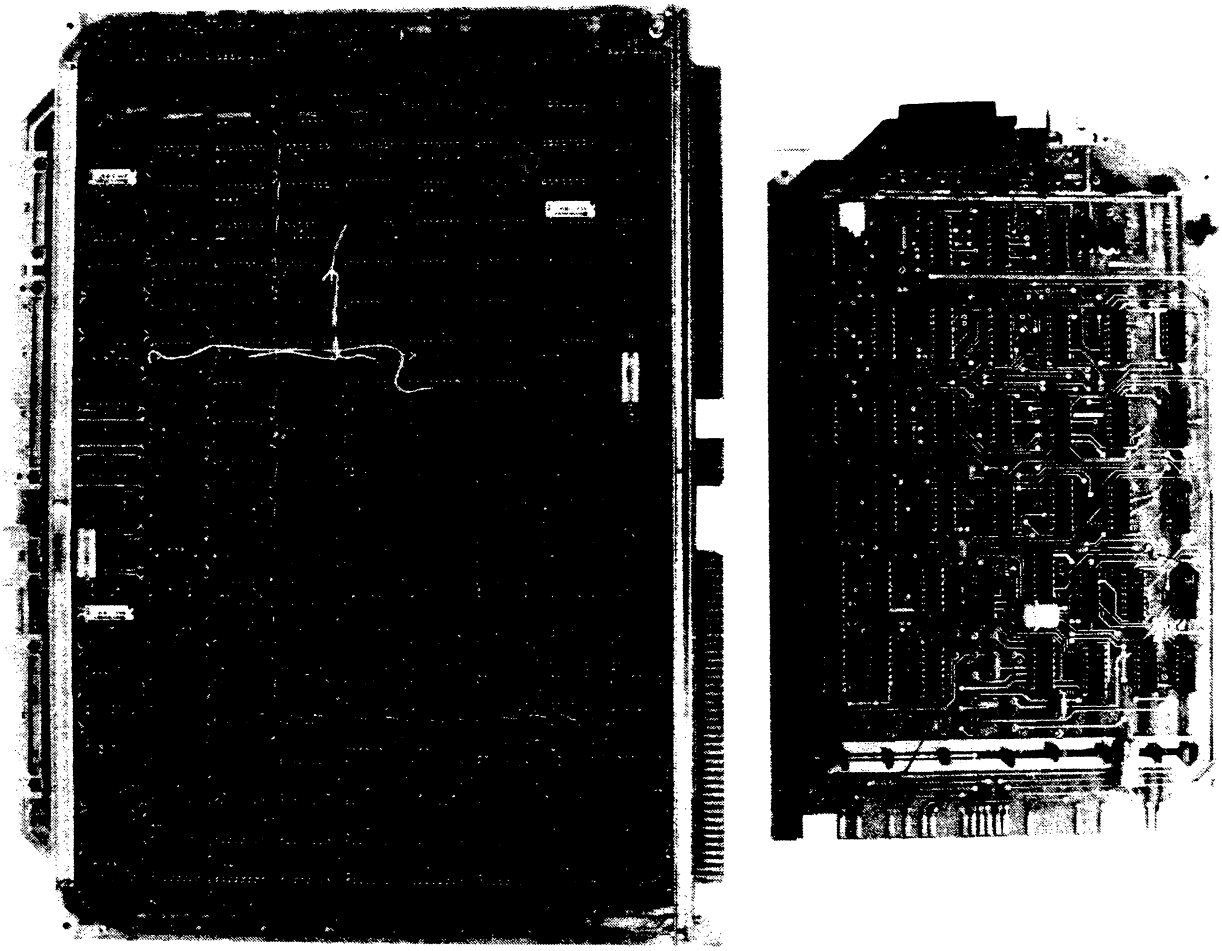
6. Follow the instructions in the board installation and operation manual to connect the other end of the cable.

2.8.2 Conventional Logic Boards

Conventional logic boards have small ejector tabs and no shield on the outer edge, as shown in Figure 2-18. A variety of cable connector types appear on conventional logic boards. Some of these connectors have exposed pins under the connector. These pins are no problem if your chassis contains only conventional boards.

CAUTION

Exposed pins on a conventional module can short to the shield of a shielded module installed in the slot below. An insulator sleeve, described with the shielded boards, is required to protect the conventional board.



2283006

Figure 2-18. Conventional Logic Boards

2.8.2.1 Installing Conventional Boards.

CAUTION

Do not remove or insert any circuit board while operating power is applied.

NOTE

The following procedure requires complete removal of power, including standby power. Any data in computer memory will be lost. Save any critical memory data to disk or tape before turning off the power.

To install a conventional logic board:

1. Set the rear panel ON-1/OFF-0 switch to the OFF-0 position.
2. Disconnect the ac line cord from the rear of the chassis.
3. If a standby power supply is installed, ensure that standby power is off.
4. Extend the chassis on its slides, or otherwise gain access to the right side as viewed from the front.
5. Make sure that you have done all the logic board preparations (switch settings, jumper settings) specified in the manual for the logic board.
6. Check the chassis configuration chart to identify the correct slot for the logic board. Verify that all necessary chassis preparation is complete (TILINE access-granted jumper installed/removed, center card guide installed for half-size board).
7. If a shielded board is located in the slot directly below, ensure that an insulator sleeve is installed on the shielded board.
8. Orient the board component side up with the edge connector(s) facing the mating connector(s) on the backpanel.
9. Carefully slide the board into the slot. As the board reaches the backpanel connectors, apply gentle pressure on both ejectors to push the board home.

2.8.2.2 Cabling Conventional Boards.

CAUTION

Do not connect or disconnect cables while operating power is applied to either the chassis or any device connected to the cable.

NOTE

The following procedure requires complete removal of power, including standby power. Any data in computer memory will be lost. Save any critical memory data to disk or tape before turning off the power.

A variety of cable connectors appear on conventional logic boards. These connectors are not compatible with the connectors on shielded boards. To cable a conventional board:

1. Ensure power is off in the chassis and in any device connected to the cable.
2. Verify that you have the correct cable as described in the manual for the logic board.
3. Dress the cable toward the rear of the chassis and through a cable clamp. Leave the cable clamps loose at this time.
4. Ensure that the cable connector is correctly oriented to the board connector (pin 1 to pin 1). Orienting procedures are given in the manual for the logic board.
5. Gently insert the cable connector in the corresponding board connector and press to mate firmly. If screws or other locking devices are provided, secure the connector.
6. After all cables are installed, dress all cables to the rear and tighten the cable clamps. Use cable ties, wraps, retractors, or cable trays to control excess cable.

CAUTION

Excess cable can interfere with the exhaust from the 990A13 chassis or from other air-cooled equipment.

7. Follow the instructions in the board installation and operation manual for connecting the other end of the cable.

2.8.3 Connecting the Control and Display Panel (Computer Chassis)

In a computer chassis, the control and display panel connects to a central processor board in slot 1. If enabled (by a concealed switch), the control and display panel provides operator control of the computer as well as status and data displays. The external test connector also works through the control and display panel cable.

The control and display panel cable is a flat cable feeding through a hole in the front grillwork by slot 1. The 20-pin flat connector is not keyed, so you must use care to assure that the connector polarity is correct. Orient the connector with the pin 1 side (red stripe) to the right and insert it into the matching connector on the central processor board. Figure 2-19 shows how to verify the cable polarity.

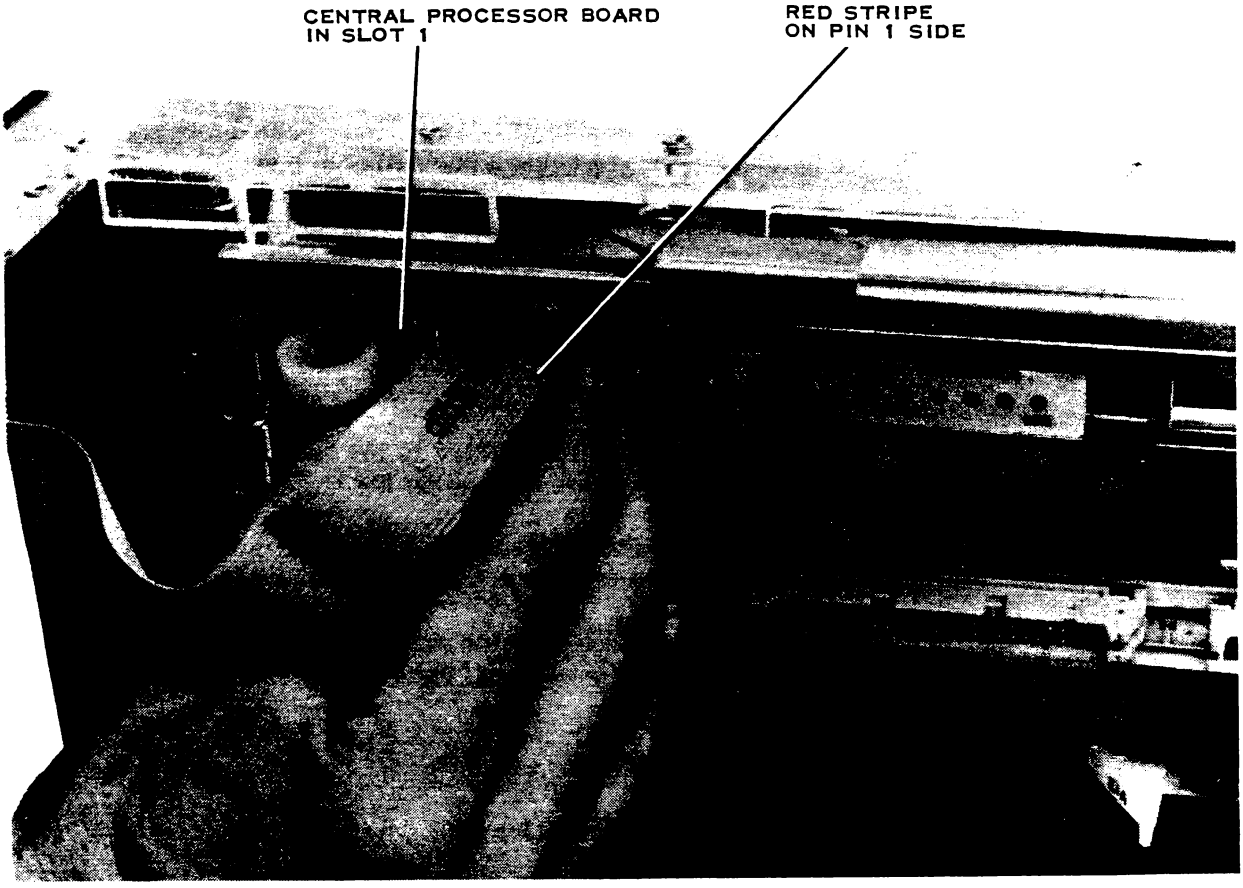
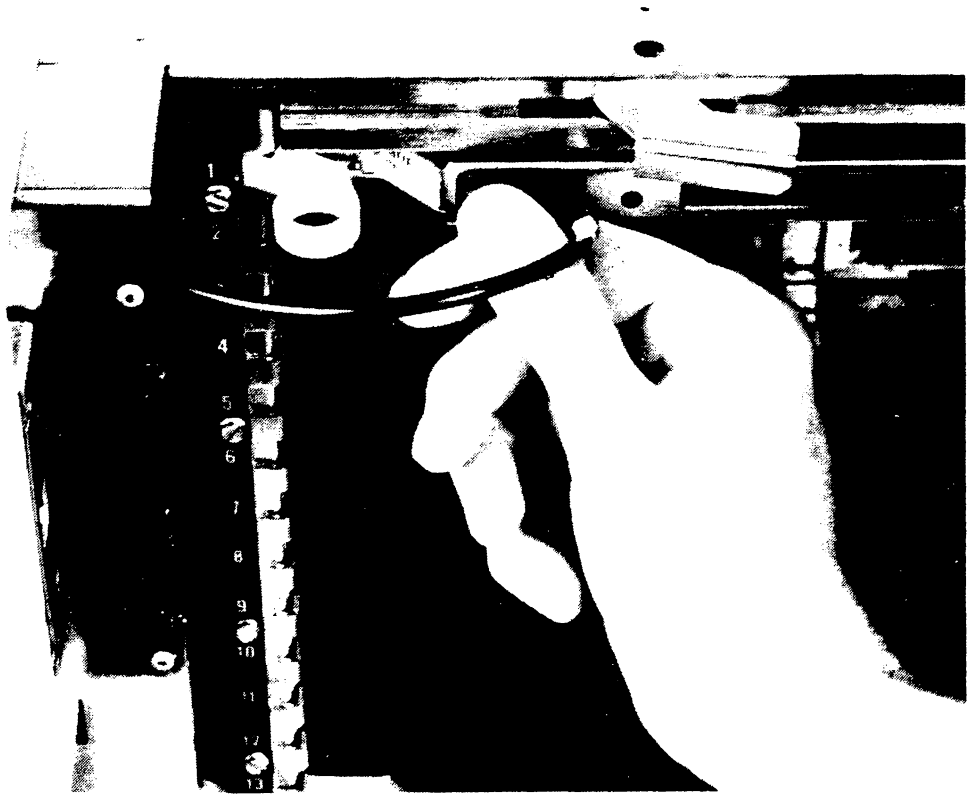


Figure 2-19. Connecting the Control and Display Panel

2.8.4 Connecting the Display Panel (Expansion Chassis)

In an expansion chassis, a display panel connects to a CRU buffer board in slot 1 or to a TILINE coupler board (slot 2 preferred). The display panel cable is a two-wire round cable with a 15-pin right-angle connector. A plastic polarity tab on the connector body protects against accidental reversal.

Orient the cable with the polarity tab on the top and the cable pointed toward the chassis front (to the left). This puts the pin 1 end of the cable on the right. Insert the cable connector into the matching 15-pin connector on the CRU buffer or TILINE coupler, as shown in Figure 2-20.



2284408

Figure 2-20. Connecting the Display Panel

2.9 LINE POWER CONNECTION

To connect ac power to the chassis:

1. Verify that the ac line voltage is within ratings for your chassis. Chassis ratings labels are located on the fan/control assembly.

CAUTION

Applying high voltage (greater than 132 volts ac) to a low voltage chassis can blow internal fuses or cause other internal chassis damage.

2. Set the ON-1/OFF-0 switch on the rear of the chassis to OFF-0.

3. Insert the female end of the ac line cord into the CEE (22) VI three-prong connector at the rear of the chassis. Line cords and power requirements are described at the beginning of this section.

4. Connect the male end of the line cord into the matching supply socket.

2.10 INITIAL POWER UP

To apply operating power:

1. Set the ON-1/OFF-0 switch to ON-1.

2. Verify that the fans are running. If the fans do not run, check the ac source and the chassis fuse.

2.11 VERIFICATION OF OPERATION

For an expansion chassis, an illuminated POWER light and operating fans are the only immediate ways to verify operation. For a computer chassis, remove the upper trim panel and set the 1-S-2 switch to 1, the local mode. This gives the control and display panel control over the computer. Press HALT, followed by ALT LOAD, and observe the 4-digit display. The sequence of displays differs between central processor models, but there is a pattern of displays during central processor self-test.

Replace the upper trim panel on the chassis. This step completes the installation of your Model 990A13 Chassis.

3

Operation

3.1 INTRODUCTION

This section describes operator procedures for the Model 990A13 chassis, including:

- Power-up/power-down control
- Standby power control
- Control and display panel operations
- Operator preventive maintenance

Additional operating information for specific central processors, operating system software, or standard computing systems is provided in other Texas Instruments manuals. This manual is limited to operations inherent to the chassis.

3.2 POWER-UP/POWER-DOWN PROCEDURES

A 990A13 chassis is designed to operate continuously, 24 hours a day, and the power switch is located on the rear panel. If the chassis is to be turned off as a normal procedure, it is more convenient to provide a separate cabinet power on/off switch. There are restrictions on turning off the chassis if a standby power supply is installed.

3.2.1 Power-Up Procedure

To apply operating power:

1. Operating power is controlled by the power switch (ON-1/OFF-0) at the rear of the chassis. Set the ON-1/OFF-0 switch to ON-1.
2. Verify that the fans start running. If all fans fail to start, make sure that ac power is available to the chassis.

CAUTION

Do not operate the chassis unless all fans are working. Operation with one or more failed fans can lead to overheating and damage to the chassis electronics.

3.2.2 Power-Down Procedure

Batteries in the optional standby power supply begin to supply power and to discharge when main power is turned off. If a standby power supply is installed and turned on, do not turn off the main power for periods exceeding 45 minutes.

Do not turn off the power to a standby-equipped chassis at the end of a shift or for a weekend without also turning off the standby power supply. Repeated deep-discharge cycles shorten battery life. A fully-discharged battery requires about eight hours of power-on time to recover full backup capability. A real power failure before the battery recharges can lead to loss of data.

To turn the power off, set the ON-1/OFF-0 switch to the OFF-0 position.

CAUTION

If a standby power supply is installed, turning off the ON-1/OFF-0 switch does not remove all voltages from the chassis interior.

NOTE

Both standby power and main ac power must be turned on to charge the battery.

3.3 STANDBY POWER CONTROL

The ON/OFF switch for the optional standby power supply is concealed behind the lower trim panel and the intake air filter. To gain access to the standby power switch:

1. Remove the lower trim panel by grasping the outer edges and pulling straight away from the chassis.

2. The standby power supply switch is visible behind a cutout in the lower left corner of the air filter. Use a pencil or short screwdriver to switch the standby power supply ON (switch up) or OFF (switch down). Labels for the standby power switch positions are molded into the air filter, adjacent to the switch cutout.

3. Replace the lower trim panel. Detailed instructions are given at the end of this section.

3.4 CONTROL AND DISPLAY PANEL OPERATION

An expansion chassis has a single green POWER indicator which lights when operating power is on. A computer chassis has a small control and display panel that offers significant operating capability. Figure 3-1 is a closeup view of the control and display panel, and Table 3-1 describes the displays and control switches.

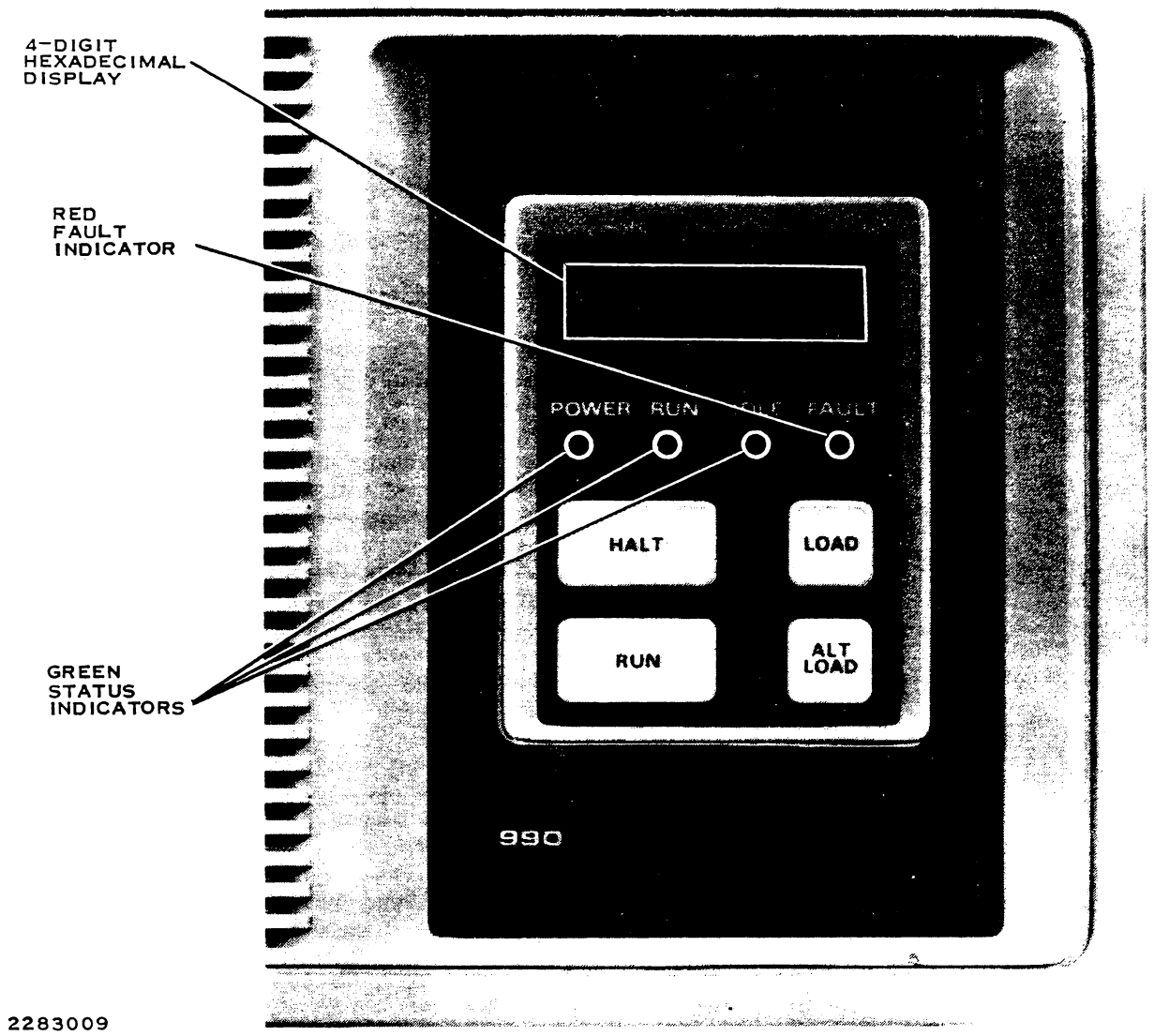


Figure 3-1. Control and Display Panel

Table 3-1. Control and Display Panel Functions

Control or Indicator	Function
Numeric display	A 4-digit display that gives the contents of a 16-bit computer word in the form of hexadecimal digits. The display is on unless the panel is in the remote (2) mode. Display contents are determined by the central processor and the software executing in the central processor.
POWER indicator	A green light-emitting diode (LED) that lights when operating power is on.
RUN indicator	A green LED that lights while the central processor is executing instructions (not halted).
IDLE indicator	A green LED that lights each time the central processor executes an idle instruction. Depending on how much activity is in progress, the IDLE indicator may stay off, flicker, or appear to remain on.
FAULT indicator	A red LED that may indicate a failure. Diagnostic self-tests built into a central processor execute prior to a load cycle. These self-tests turn on the FAULT indicator as they start, and turn it off upon successful completion. It is normal for the FAULT indicator to remain on for a few seconds as part of a load operation. If the FAULT indicator remains on, a failure has occured.
HALT control	With the panel in local mode (1), pushing HALT stops the operation of the computer at the next instruction and enables the RUN, LOAD, and ALT LOAD controls. The computer program counter (PC) value is displayed while the computer is halted. Pressing HALT repeatedly steps the computer through its instructions, one instruction each time HALT is pressed.
RUN control	Pressing RUN after HALT restarts computer operation at normal speed.
LOAD control	Pressing LOAD after HALT causes the loader on the central processor to clear any hardware errors with a TILINE reset and to start a normal system software load. LOAD is the standard control for loading from the designated system disk, as well as clearing hardware errors.
ALT LOAD control	Pressing ALT LOAD (alternate load) after halt causes the loader on the central processor to clear any hardware errors with a TILINE reset and to start a power-up load of system software. An alternate load searches through a sequence of TILINE tape and disk devices looking for one that is available for loading. However, this is a different sequence than the sequence started by the LOAD control. ALT LOAD is normally used when loading from some device other than the designated system disk, as well as for clearing hardware errors.

Table 3-1. Control and Display Panel Functions (Continued)

Control or Indicator	Function
1-S-2 control	The three-position slide switch marked 1-S-2 is concealed during normal operation by the upper trim panel. This is the local—secure—remote (1-S-2) control and display panel control. In the local (1) position, controls and indicators on the chassis control and display panel are enabled. If a remote panel is connected, the remote panel displays operate, but the controls are disabled. In the secure (S) position, the computer is secure from any operator control. The displays continue to operate. In the remote (2) position, the chassis control panel is dark, with no indicators or controls enabled. If a remote panel is connected at the test connector, the remote panel is active.

3.5 OPERATOR PREVENTIVE MAINTENANCE

Cooling air for the logic boards and chassis power supplies is drawn in through an intake air filter behind the trim panels. If the filter clogs with dust, air flow is restricted and the electronics can overheat. If the filter loses its filtering ability (through age or repeated cleaning), dust can invade the chassis, decreasing cooling efficiency.

The following preventive maintenance operations are recommended for an office environment:

Operation	Interval
Clean chassis	As needed
Vacuum air filter	3 months (3 cleanings maximum before replacement)
Discard old filter and replace with a new filter	12 months

CAUTION

Carefully monitor the air filter condition and set up a schedule of more frequent cleanings and filter replacements if the filter collects excess dust between scheduled cleanings/replacements. Dust buildup can lead to overheating, accelerated aging, and reduced reliability.

3.5.1 Cleaning the Chassis

Keep the chassis clean and dust-free by wiping down the chassis exterior with a damp (not wet) cloth and mild detergent. A gentle liquid dishwashing detergent is recommended for exterior cleaning.

CAUTION

Do not use strong detergents, cleaners, or solvents to clean chassis trim panels.

3.5.2 Vacuuming the Air Filter

To vacuum-clean the air filter:

1. Turn the chassis power off (ON-1/OFF-0 to OFF-0 position) to prevent the fans from pulling accumulated dust into the chassis.

2. Remove the upper and lower trim panels by grasping the outer edges and pulling straight away from the chassis front.

3. Use the vacuum cleaner with a brush tool to remove the accumulated dust from the air filter front. Do not tear the filter. If you accidentally damage the filter or cannot get it clean, go on the the filter replacement procedure at the end of this section.

4. Reinstall the upper and lower trim panels:

   a. Select the upper trim panel (with the logo and cutout). Each end of the panel has two protruding posts: a barbed nylon locking post and a smooth plastic alignment post.

      Orient the panel with the cutout to your right and the panel rear pointing toward the chassis front. Slip the two smooth alignment posts into mating holes in the outer rim of the chassis sheet metal. The cutout portion of the panel must frame the control and display panel.

   b. Press the panel home so that the barbed locking posts lock into the white nylon latches on the chassis outer rim. Do not use excess force. Note that the trim panel covers the switch and test connector at the left edge of the control and display panel.

   c. Select the lower trim panel and orient it with the rear of the panel pointing toward the chassis front. The smooth plastic alignment posts must be below the barbed nylon locking posts; otherwise the panel is upside down.

      Slip the two alignment posts into mating holes in the chassis.

   d. Press the panel home so the nylon locking posts lock into the latches. Do not use excess force.

3.5.3 Replacing the Air Filter

Two spare air filters are shipped with the chassis. Additional air filters are available from Texas Instruments:

Quantity	Part Number
6	2310376-1
12	2310376-2

To replace the air filter:

1. Turn off the chassis power (ON-1/OFF-0 to OFF-0 position) to prevent the fans from pulling accumulated dust into the chassis.

2. Remove the upper and lower trim panels by grasping the outer edges and pulling straight away from the chassis front.

3. Use the vacuum cleaner to remove the accumulated dust from the air filter front. This prevents accumulated dust from falling into the chassis when you remove the filter.

4. Grasp the air filter along the outer plastic rim and pull straight away from the metal grillwork.

5. Install the new filter:

   a. Locate the two filter mounting holes on either side of the chassis front grillwork.

   b. Turn the filter so the four protruding posts point toward the chassis front grillwork, oriented to the filter mounting holes (Figure 3-2). The filter cutout should be at the lower left corner.

   c. Press the filter into place, flush against the grillwork. An interference fit between the rectangular pegs and the round holes keeps the filter in place.

6. Replace the upper and lower trim panels:

   a. Select the upper trim panel (with the logo and cutout). Each end of the panel has two protruding posts: a barbed nylon locking post and a smooth plastic alignment post.

      Orient the panel with the cutout to your right and panel rear pointing toward the chassis front. Slip the two smooth alignment posts into mating holes in the outer rim of the chassis sheet metal. The cutout portion of the panel must frame the control and display panel.

   b. Press the panel home so that the barbed locking posts lock into the white nylon latches on the chassis outer rim. Do not use excess force. Note that the trim panel covers the switch and test connector at the left edge of the control and display panel.

c. Select the lower trim panel and orient it with the rear of the panel pointing toward the chassis front. Make sure that the smooth plastic alignment posts are below the barbed nylon locking posts; otherwise the panel is upside down.

   Slip the two alignment posts into mating holes in the chassis.

d. Press the panel home so the nylon locking posts lock into the latches. Do not use excess force.

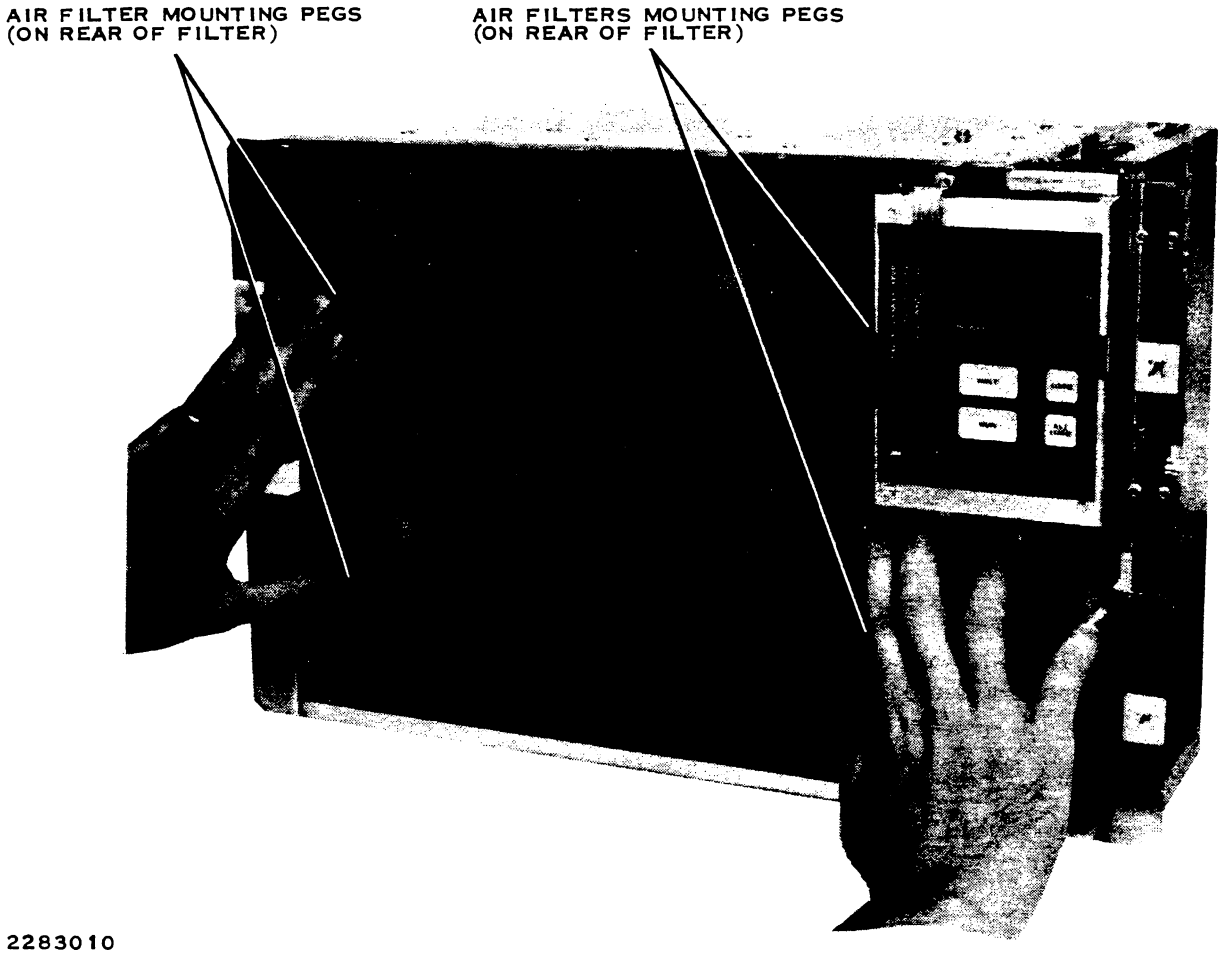


Figure 3-2. Replacing the Air Filter

4

Nonstandard and OEM Installation Data

4.1 INTRODUCTION

Section 2 of this manual describes the physical details of chassis and logic board installation. Section 2 assumes that the details of CRU addressing, slot assignments, interrupt level assignments, and TILINE access-granted jumpers have been previously determined.

This section provides technical information needed if you determine these details for yourself. This information is needed if you are:

- An OEM (original equipment manufacturer) adding custom logic boards to a Texas Instruments computer
- A systems house, integrating hardware and software from various sources into custom computing systems
- Expanding an existing computer system that is not a standard configuration

In all cases, you need the installation and operation manuals for the logic boards being added, and the manuals for the software you are using.

NOTE

Hardware configurations and operating software are related through a system generation operation. The result is an operating system that operates on a specific hardware configuration. If you plan to use special system configurations, you must have the capability to do a system generation operation.

4.2 COMMUNICATIONS REGISTER UNIT

The communications register unit (CRU) is one of two communication buses that run through the chassis backpanel. The CRU is a serial bus able to transfer 1 to 16 bits with a single computer instruction. Because the transfer is serial, CRU operations are limited to low-speed and medium-speed devices such as printers, video display terminals, and the control and display panel.

4.2.1 CRU Addressing

Each bit transferred on the CRU bus has its own unique address. For convenience, address decoding for most CRU devices is split between the central processor (or CRU buffer) in slot 1 and the logic boards. Each of the 24 connectors in slots 2 through 13 is assigned a block of 16 CRU addresses by a module select signal from slot 1. This has three practical results:

1. CRU boards can be built in half-slot sizes.

2. CRU boards that need 16 to 32 bits tie up a full chassis slot, even if physically they are half-size boards. Any half-sized board that requires 16 or more bits must be installed in the right side of the slot (P2).

3. Slot location determines CRU addresses.

Slot size requirements for a logic board are provided in the installation and operation manual for the board. Refer to Figure 4-1 for the CRU addresses assigned to each half-slot location in the 990A13 chassis. All addresses are hexadecimal, based on the digits 0 through 9 and A through F representing the numbers zero through fifteen.

Each CRU base address shown is the lowest-numbered address assigned to that half-slot. For example, a CRU device in slot 10, connector P1 (10P1) can respond to any CRU address in the range 00E0 to 00FE.

For an expansion chassis, you must add (by hexadecimal addition) an offset number to every CRU base address given in the chart. Each expansion chassis (one through seven) is assigned a different offset:

Expansion Chassis No.	CRU Offset
1	0400
2	0800
3	0C00
4	1000
5	1400
6	1800
7	1C00

As an example, slot 10, connector P1 in the first expansion chassis has a CRU base address of 0400 + 00E0 = 04E0 (hexadecimal).

SLOT NUMBER	P1 (CHASSIS FRONT) FIXED CRU BASE ADDRESS	CIRCUIT BOARD	INTER-RUPT LEVEL	P2 (CHASSIS REAR) FIXED CRU BASE ADDRESS	CIRCUIT BOARD	INTER-RUPT LEVEL
1	N/A		N/A	N/A		N/A
2	02E0			02C0		
3	02A0			0280		
4	0260			0240		
5	0220			0200		
6	01E0			01C0		
7	01A0			0180		
8	0160			0140		
9	0120			0100		
10	00E0			00C0		
11	00A0			0080		
12	0060			0040		
13	0020			0000		

13-SLOT CHASSIS

2283011

Figure 4-1. CRU Base Address Assignments by Slot Location

4.2.2 CRU Expansion

Extending the CRU bus into one or two expansion chassis requires a CRU expander in the computer chassis and a CRU buffer in slot 1 of each expansion chassis. A CRU buffer extends both the CRU bus and the interrupt system throughout the expansion chassis. Both of these functions require special wiring provided only at slot 1. Expansion results in some delays in interrupt processing for the expansion chassis. Logic boards that require fast interrupt response should be located in the computer chassis.

4.3 TILINE

The TILINE is a parallel bus linking the central processor, the memory boards, and the high-speed disk and tape controller boards. Unlike the CRU, the TILINE does not depend on the central processor as a main bus control. Disk controllers and tape controllers can also act as TILINE masters to control data transfers to and from memory.

4.3.1 TILINE Access-Granted Jumpers

A priority system based on slot location prevents two masters from getting access to the TILINE at the same time. Slot 13 has the highest priority with slot 1 having the lowest priority. The TILINE access-granted signal goes through all TILINE masters, and must be jumpered around every slot that does not have a TILINE master. TILINE access-granted jumpers are removed only from those slots containing TILINE-based controller boards.

By convention, slot 7 is usually chosen for the system disk controller, and the TILINE access-granted jumper is removed from that location.

4.3.2 TILINE Expansion

Extending the TILINE into an expansion chassis requires a TILINE coupler in both the computer chassis and expansion chassis. This coupling system introduces some delay, so memory boards should not be installed in an expansion chassis. For best results, memory boards must be in the same chassis with the central processor, in the adjacent slots.

Most high-speed disk and tape controllers have internal data buffers which allow them to operate from an expansion chassis. However, it is preferable to keep all the TILINE devices in the computer chassis if possible. Refer to the *990 CRU/TILINE Expansion Maintenance Manual, General Description*, part number 2272075-9701, for information on TILINE expansion.

4.4 INTERRUPTS

Interrupt outputs from each connector in slots 2 through 13 are wired to an 80-pin connector above slot 1. Wired to the same connector are 24 input interrupt levels lines from slot 1. Connections between slot 2 through 13 interrupt outputs and the central processor (or CRU buffer) interrupt inputs are made by a plug-in interrupt board.

Two versions of the interrupt board are currently available:

Interrupt Board	Part Number
Type 13-1	2310380-1
Programmable Interrupt Kit	2309085-1

4.4.1 Standard Interrupt Assignments

Figure 4-2 shows the standard interrupt level assignments with the type 13-1 interrupt board. If at all possible, follow these standard interrupt assignments; they are based on extensive operating experience with 990 computers.

SLOT NUMBER	P1 (CHASSIS FRONT) FIXED CRU BASE ADDRESS	CIRCUIT BOARD	INTER-RUPT LEVEL	P2 (CHASSIS REAR) FIXED CRU BASE ADDRESS	CIRCUIT BOARD	INTER-RUPT LEVEL
1	N/A		N/A	N/A		N/A
2	02E0		6	02C0		15
3	02A0		10	0280		8
4	0260		11	0240		12
5	0220		7	0200		3
6	01E0		11	01C0		11
7	01A0		9	0180		13
8	0160		8	0140		9 OR 14
9	0120		8	0100		10
10	00E0		12	00C0		11
11	00A0		3	0080		7
12	0060		14	0040		4
13	0020		15	0000		6

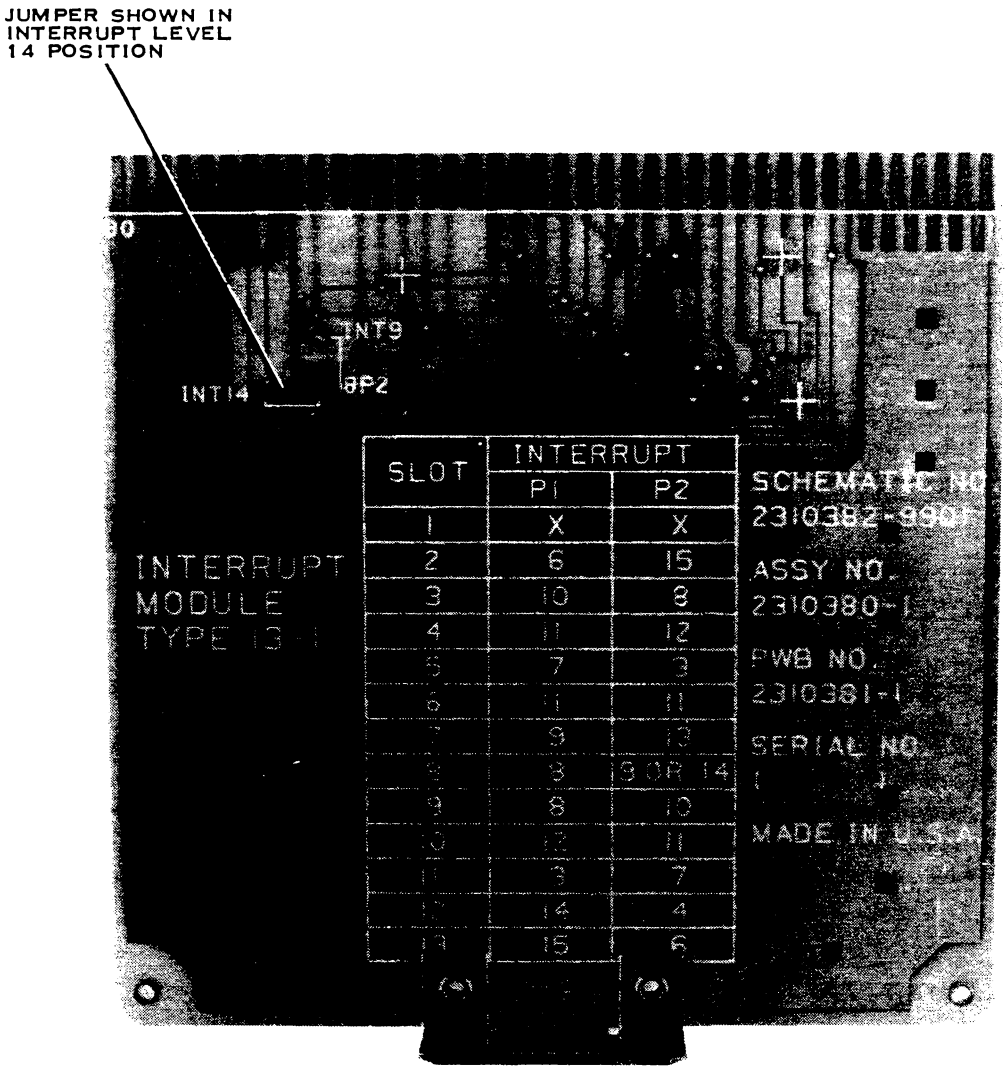
13-SLOT CHASSIS
WITH INTERRUPT MODULE
TYPE 13-1 BOARD

2283025

Figure 4-2. Interrupt Assigments — Type 13-1 Interrupt Board

Notice that the interrupt level for slot 8, P2 side may be either interrupt 9 or interrupt 14. A jumper on the type 13-1 board (Figure 4-3) allows you to select between these interrupts.

White lines painted on the board show the two jumper positions. With the jumper parallel to the interrupt connector, interrupt 14 is selected (8P2 to INT14). With the jumper perpendicular to the connector, interrupt 9 is selected (8P2 to INT9). If the jumper is removed entirely, interrupts generated at the P2 side of slot 8 cannot be recognized. The jumper should always be installed.



2283012

Figure 4-3. Interrupt Jumper — Type 13-1 Interrupt Board

Interrupt 9 is available for use at slot 8 only if it is not used at slot 7, P1 side. Many of the full-size 990 logic boards do not generate interrupts at the P1 connector, making interrupt 9 available for use at slot 8. Refer to the installation manual for the logic board installed at slot 7 for this information.

Interrupt 14 is available for use at slot 8 without such restrictions.

4.4.2 Programmable Interrupt Kit

You can set up the interrupts to meet your own special requirements with a programmable interrupt kit, part number 2309085-1, as shown in Figure 4-4.

A programmable interrupt kit includes an interrupt circuit board with cold-contact terminals, a length of Teflon*-insulated #26 AWG solid wire, and a small plastic adapter tool for inserting wires into the terminals.

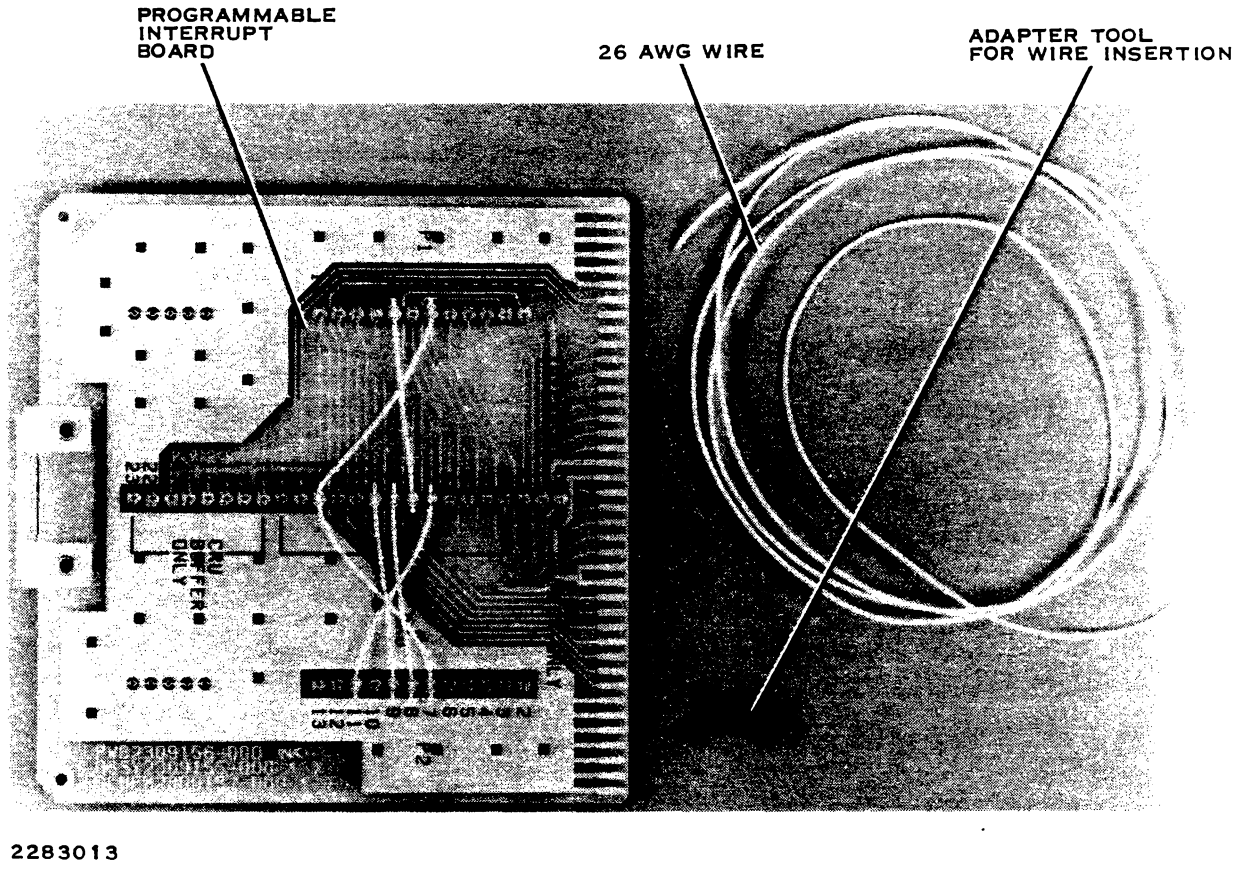
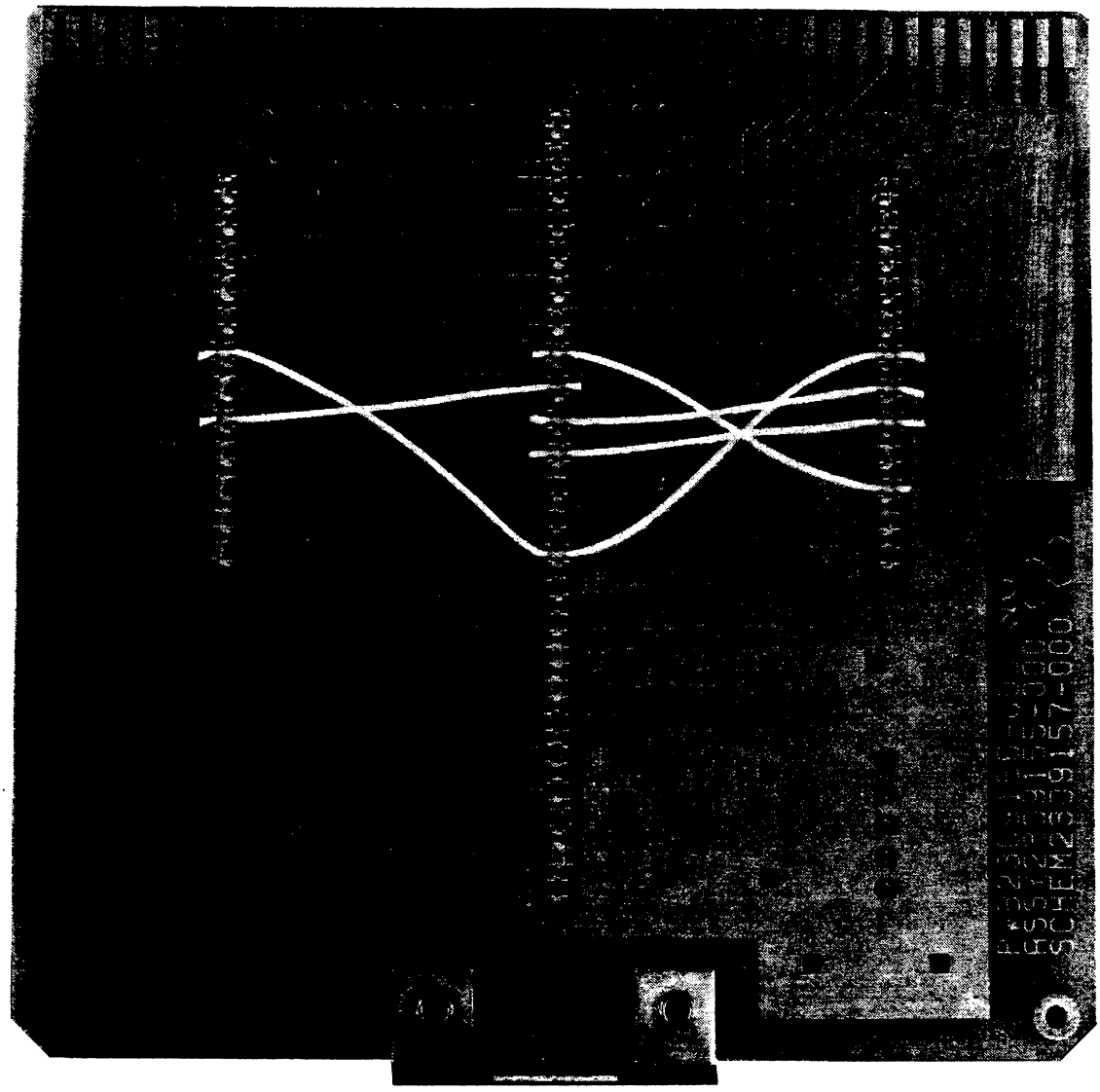


Figure 4-4. Programmable Interrupt Kit

* Teflon is a trademark of El duPont De Nemours & Co.

Figure 4-5 shows the pattern of terminals on the programmable interrupt board. Interrupt outputs from all the P1 connectors in slots 2 through 13 are on the left side, and the P2 interrupts are on the right side. The middle row of terminals are the interrupt level inputs to slot 1. Interrupt levels 3 through 15 are the only levels available in a computer chassis. Do not make any connections to levels 0 through 2 or 16 through 23 except in an expansion chassis.

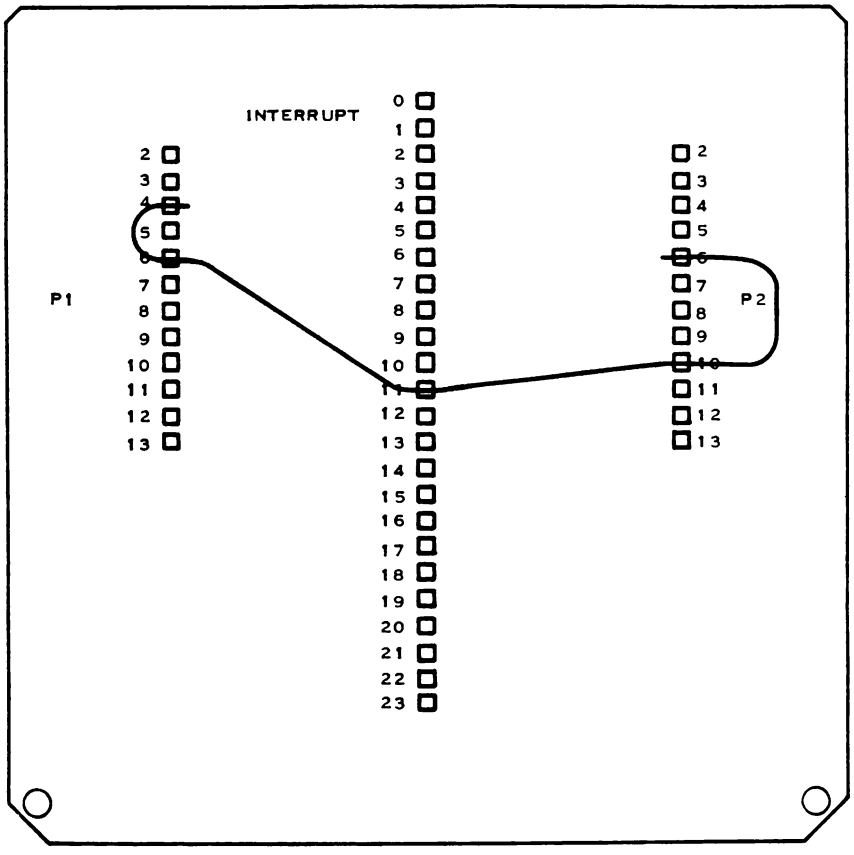


2283014

Figure 4-5. Programmable Interrupt Board

A terminal cannot hold more than a single wire. Do not attempt to connect two wires to the same terminal. Instead, run a single longer wire in a continuous daisy chain from the terminal through the other terminals.

Figure 4-6 shows how a single daisy-chain wire can connect multiple interrupts to the same interrupt level without violating the one-wire-per-terminal rule. A single strand of wire runs through 4P1 and 6P1, interrupt level 11, 10P2 and 6P2. This connection allows four half-size CRU boards to share one interrupt level.



2283015

Figure 4-6. Daisy-Chain Connection to One Interrupt Level

4.4.2.1 Interrupt Planning. Figure 4-7 is a blank set of charts for planning interrupt assignments and wiring the progammable interrupt board. Use the upper half of the figure to record chassis slot assignments and the interrupt levels you choose for each half-slot. Rules to remember include:

1. High-numbered interrupt levels have low priority; low-numbered levels have high priority. Assign higher priority interrupts (lower numbered interrupt levels) to devices that cannot wait for service.

2. All TILINE boards occupy a full slot, and send interrupt outputs through the P2 connector.

3. In a computer chassis, levels 3 through 15 are the only levels available. Some central processors have internal interrupt assignments in the range 3 through 15. Check the manuals for your central processor before assigning interrupt levels.

4. TILINE boards cannot share an interrupt level with any other board.

5. CRU boards can occupy either a half or a whole slot.

6. Several CRU boards can share a single interrupt level.

7. Standard Texas Instruments computing systems include a planned growth path and standard interrupt wiring. Model your slot and interrupt assignments on these standards wherever possible.

   Operating system software is sensitive to slot assignments and interrupt assignments. The basic Texas Instruments system generation programs can customize an operating system to your configuration.

The bottom chart in Figure 4-7 is organized by interrupt levels. You transfer the information from the upper chart, converting the information into an easy-to-wire form. Figure 4-8 is a filled-out example showing how to use the charts. If an interrupt level is connected to more than one slot, you must use a daisy-chain wire, identified by D on the chart. A single wire is identified by an S. There is a row of boxes to check as each wire is installed. This chart helps ensure that the wiring is right the first time.

If you have a manufacturing facility that is programming large numbers of identical interrupt boards, you may want to use schematic drawings to show the wire layout. Figure 4-9 is a schematic that shows the wire layout for the sample of Figure 4-8, and Figure 4-10 is a blank template for your use.

A. INTERRUPT PLANNING

	P1 (LEFT SIDE)		P2 (RIGHT SIDE)	
SLOT	CIRCUIT BOARD	INTERRUPT LEVEL	CIRCUIT BOARD	INTERRUPT LEVEL
1		X		X
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

TRANSFER DATA FROM PLANNING CHART TO WIRING CHART

B. INTERRUPT WIRING

INTERRUPT LEVEL	3	4	5	6	7	8	9	10	11	12	13	14	15
SLOTS													
DAISY/ SINGLE (D/S)													
COMPLETED													

2283016

Figure 4-7. Interrupt Planning and Wiring Charts

A. INTERRUPT PLANNING

	P1 (LEFT SIDE)		P2 (RIGHT SIDE)	
SLOT	CIRCUIT BOARD	INTERRUPT LEVEL	CIRCUIT BOARD	INTERRUPT LEVEL
1	990/10A	x	990/10A	x
2		6		15
3		10		8
4		11		12
5		7		3
6		11		11
7		9		13
8		8		9
9		8		10
10		12		11
11		3		7
12		14		4
13		15		6

TRANSFER DATA FROM PLANNING CHART TO WIRING CHART

B. INTERRUPT WIRING

INTERRUPT LEVEL	3	4	5	6	7	8	9	10	11	12	13	14	15
SLOTS	11P1	12P2	—	2P1 13P2	5P1 11P2	3P2 8P1 9P1	7P1 8P2	3P1 9P2	4P1 6P1 6P2 10P2	4P2 10P1	7P2	12P1	2P2 13P1
DAISY/ SINGLE (D/S)	S	S	—	D	D	D	D	D	D	D	S	S	D
COMPLETED	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

2283017

Figure 4-8. Sample Interrupt Planning and Wiring Charts

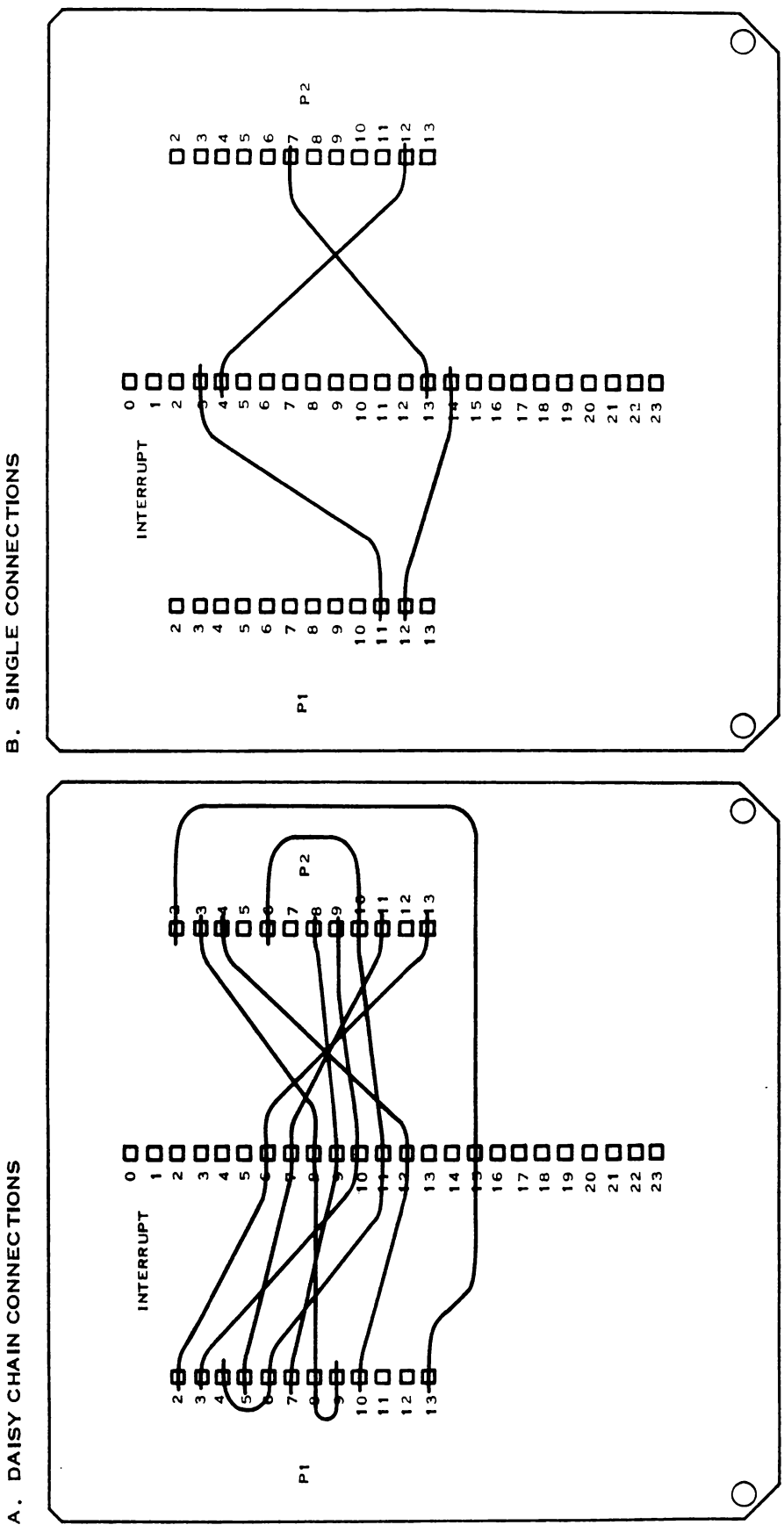


Figure 4-9. Sample Interrupt Wiring Schematic

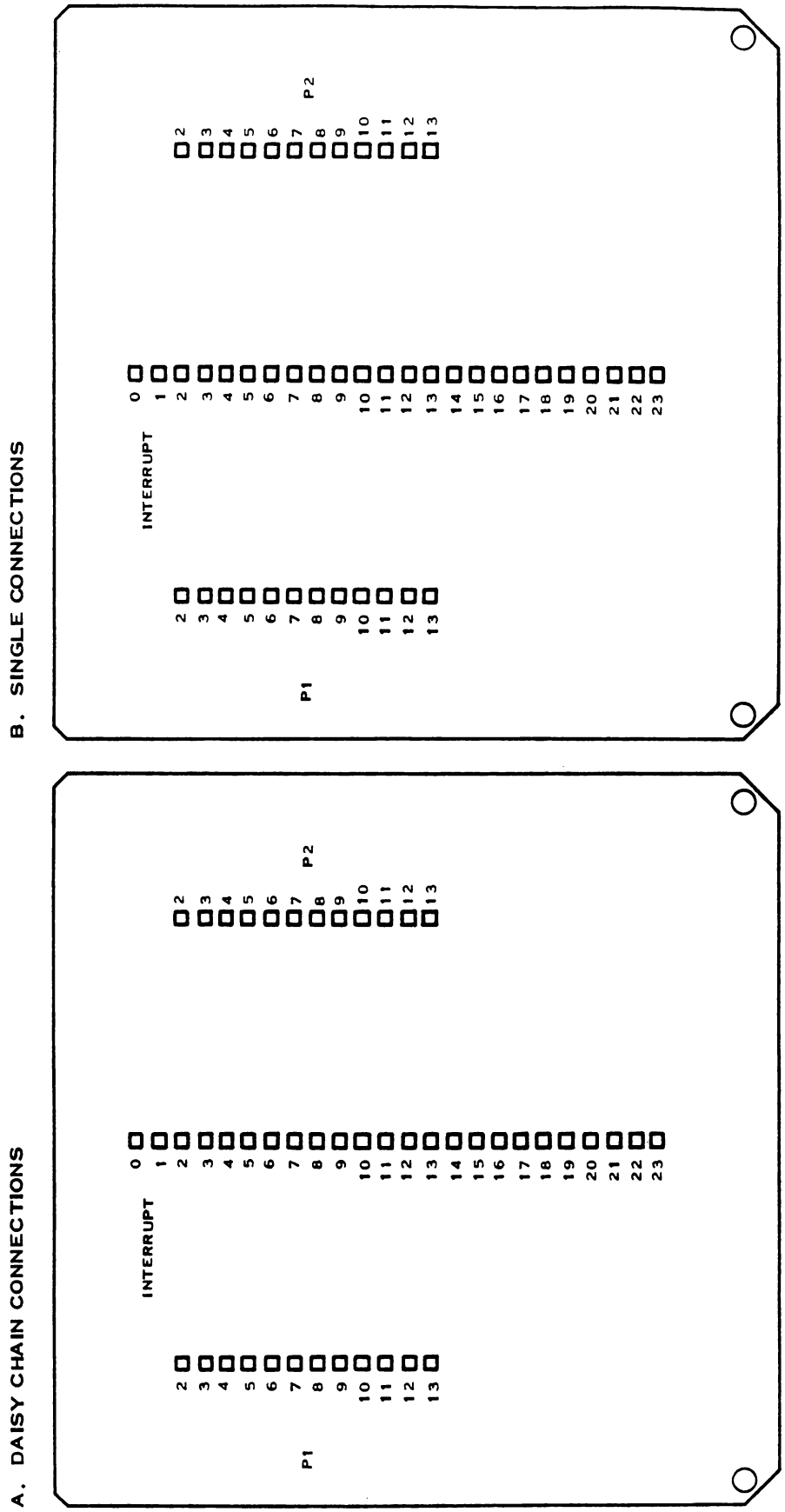


Figure 4-10. Template for Interrupt Wiring Schematic

4.4.2.2 Interrupt Wiring. Cold-contact terminals, when properly used, make strong and reliable connections without the need for soldering. As you press the insulated wire into the terminal, sharp edges penetrate the insulation and make firm electrical contact. Spring loading holds the contact together. Follow these rules for best performance:

1. Use the special adapter tool (on the end of a phillips screwdriver) to press the wire into a terminal. Figure 4-11 shows correct wire insertion. Do not use bare fingers, flat-blade screwdrivers or anything other than the correct wire insertion tool.

CAUTION

Do not use any other size or type of wire. Cold-contact terminals are designed for a specific wire size, core type, and insulation type. A change in any of these factors can make the connection unreliable or ruin the terminal.

2. Do not strip the insulation from the wire. The insulation thickness is an integral part of the terminal design.

3. A terminal cannot hold more than a single wire. Do not attempt to connect two wires to the same terminal. Instead, run a single longer wire in a continuous daisy chain from the terminal through the other terminals.

4. If you change your mind about a connection after the wire is already installed, remove the entire wire and use a new length of wire. During removal, the copper wire could be nicked and might fail later due to fatigue.

5. Trim the wires close to the terminal to prevent the possibility of short circuits.

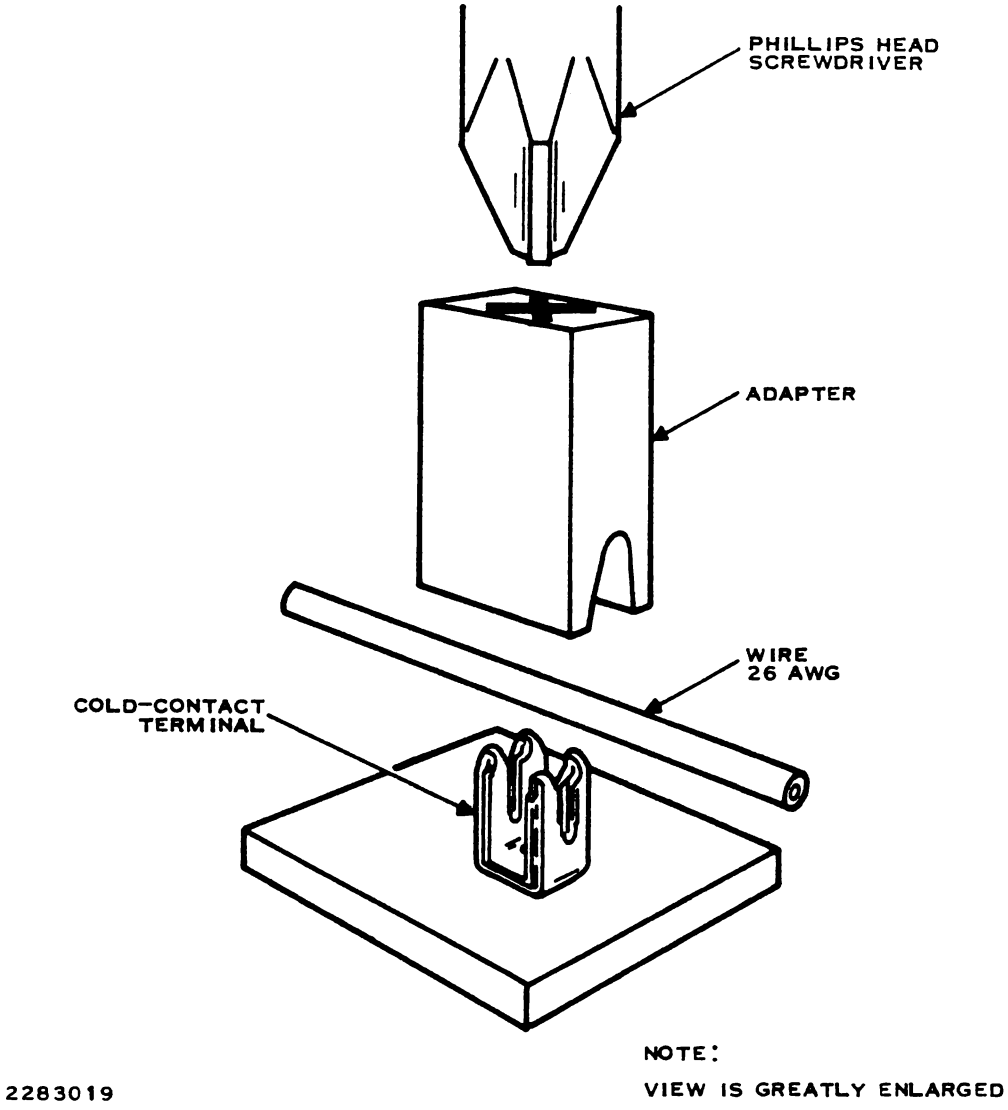


Figure 4-11. Inserting a Wire with the Adapter Tool

4.5 CHASSIS POWER PLANNING

Exceeding the power supply ratings of a 990A13 chassis with standard Texas Instruments logic boards is very unlikely. However, if you have non-TI boards with heavy current requirements, an expansion chassis may be required to carry the extra current.

The power supply output specifications (Section 1) state how much power is available in a single chassis. The *Texas Instruments Computer Family Catalog* has power consumption data for all standard logic boards. By adding up the total current drain for each supply voltage, you can determine if your planned set of boards exceeds the power supply specifications.

NOTE

Texas Instruments does not assume responsibility for non-TI logic boards installed in a 990A13 chassis. If you use non-TI boards, it is your responsibility to assure that these boards do not radiate or conduct electrical noise, do not result in localized heating problems, and do not degrade overall performance.

Texas Instruments service is not provided for non-TI equipment except on special contractual agreement. Also, any service required or damage encountered as a consequence of using non-TI boards is the responsibility of the user.

Appendix A

Standby Power Supply Installation

A.1 INTRODUCTION

The following procedure describes how to add a standby power supply kit, part number 2309088-1, to a 990A13 chassis. A standby power supply can be installed either before or after installing chassis slides. If you have a choice, install the standby power supply first, because the slides reduce the available space.

A.2 INSTALLATION PROCEDURE

To install a standby power supply:

1. Take an inventory of the standby power supply kit to ensure that you have all the parts.
2. Set the rear panel ON-1/OFF-0 switch to the OFF-0 position.
3. Remove ac input power from the chassis by unplugging the ac line cord from the fan/control assembly (rear panel).
4. Remove the left side panel (as viewed from the front) to expose the main power supply. Eight screws hold the side panel in place.

CAUTION

A short cable links the fan/control assembly (rear panel) to the main power supply, and a push-on jumper attaches to the chassis frame. Do not stress these wires when removing the fan/control assembly in step 5.

5. Remove the eight screws that hold the fan/control assembly. Carefully remove the fan/control assembly while supporting the assembly until the wires are disconnected.
6. Disconnect the fan/control assembly cable at power supply connector J2. This five-pin connector with locking tabs is the second connector from the top edge of the main power supply board. Release the locking tabs by squeezing them together and pulling straight back on the connector body.
7. Disconnect the push-on ground jumper at the lower corner of the chassis frame, then set the fan/control assembly aside.

8. Refer to Figure A-1 for assembly of the standby battery hardware. The battery pack is held between two identical battery retaining cups. Two 89-millimeter (3.5-inch) thumbscrews go through fender washers into the upper battery retaining cup. The thumbscrews go through the battery pack to the holes in the lower battery retaining cup. The thumbscrews barely reach the hole in the lower cup.

   Assemble the battery hardware as shown in Figure A-1 and hold the assembly together with hand pressure. Make sure that none of the battery cable is curled up within the battery assembly.

9. At the rear of the chassis, locate the two threaded inserts protruding from the chassis floor. The battery assembly slips onto these inserts. Thumbscrews secure the battery assembly.

   Turn the battery assembly so that the cable exits to your right, toward the power supply side of the chassis. Lower the battery assembly onto the threaded inserts, and tighten the thumbscrews finger-tight.

10. Dress the battery cable along the floor of the chassis toward the ground lug, and then forward toward the large aluminum heatsink at the front of the main power supply.

11. Refer to Figure A-2 for the approximate locations to install stick-on cable clamps for the battery cable. The floor of the chassis must be clean and dry, or the cable clamps will not stick.

    Peel the protective backing from the three cable clamps and install them as shown in Figure A-2.

12. Route the battery cable through the cable clamps. You can make final cable path adjustments after installing and connecting the standby power supply. Do not connect the battery cable to the standby power supply.

13. A wide, flat 15-conductor cable from the backplane connects to the main power supply, just below the large finned aluminum heatsink. Carefully disconnect the cable from the power supply, revealing the pin header.

14. Turn the standby power supply ON/OFF switch to the OFF position and verify that the battery cable is not connected to the standby power supply.

CAUTION

A battery shorting hazard exists if the battery cable is connected to the standby power supply before it is mounted on the main power supply heatsink. Do not attempt the installation with the battery cable connected.

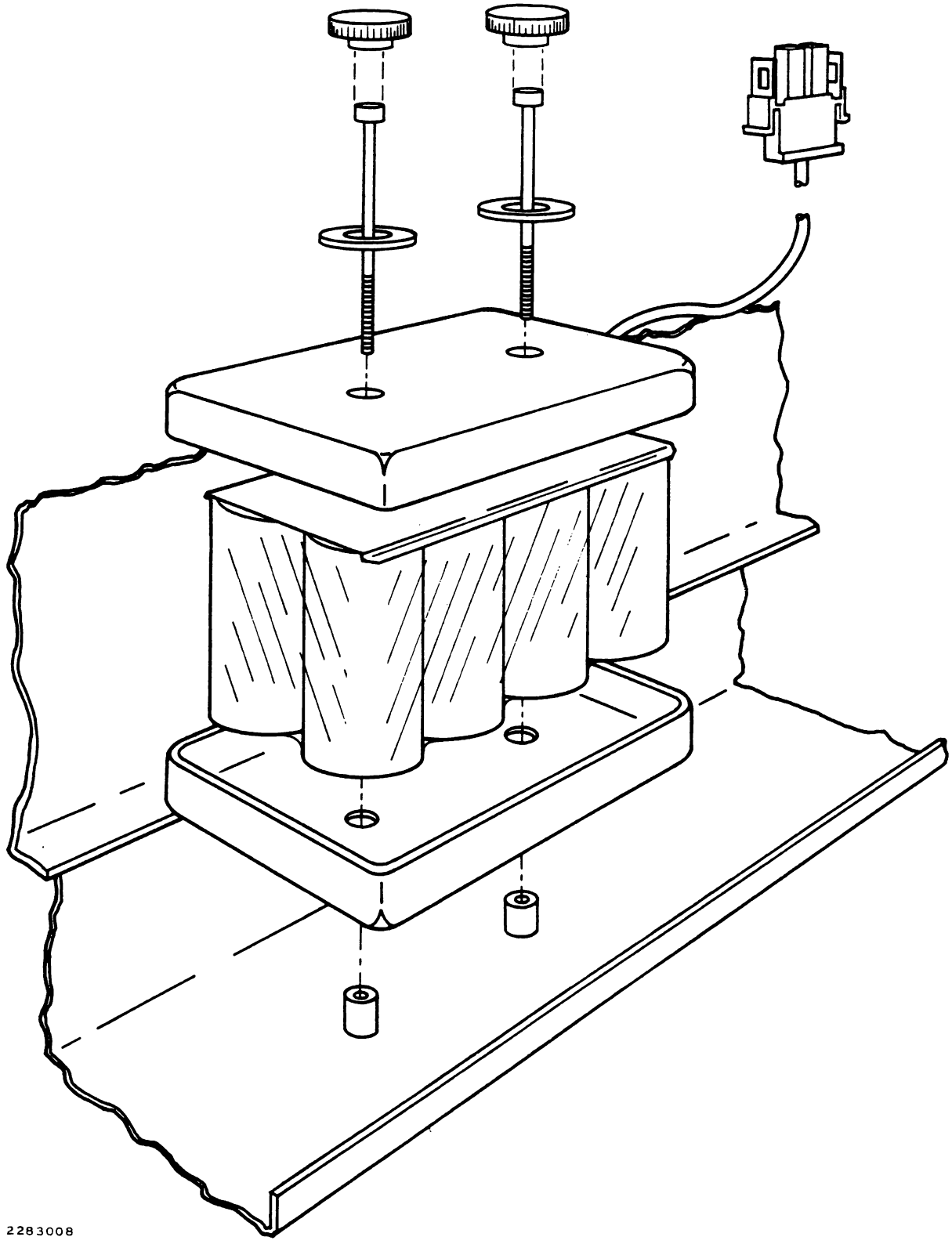


Figure A-1. Standby Battery Assembly

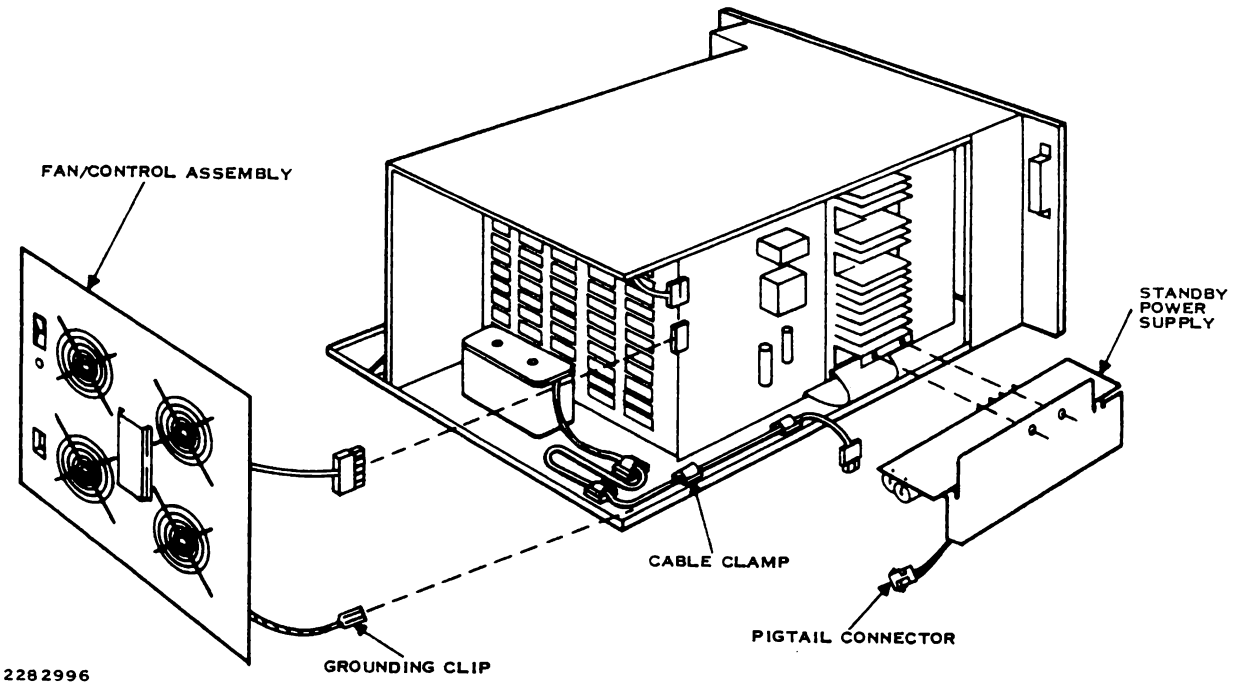


Figure A-2. Battery Cable Clamp Locations

15. Orient the standby power supply as shown in Figure A-3 and plug the flat cable into the 15-pin header on the standby power supply board.

16. Orient the standby power supply as in step 15 and carefully plug the standby power supply onto the 15-pin header of the main power supply. Make sure that the standby power supply mounting bracket is aligned and flush with the main power supply heatsink. Do not force-fit.

17. Install the two 6-32 retaining screws that hold the standby power supply bracket to the main power supply heatsink. Use only moderate tightening force to prevent damage to the threaded inserts.

18. Connect the two-pin battery cable connector to the standby power supply. Check that the connector latches firmly. Readjust the cable dress if necessary.

CAUTION

Do not turn on the standby power switch at this time unless all logic boards are installed, all chassis preparations are complete, and you are ready to begin immediate operation. Leaving the chassis on the shelf with standby power on will discharge the batteries.

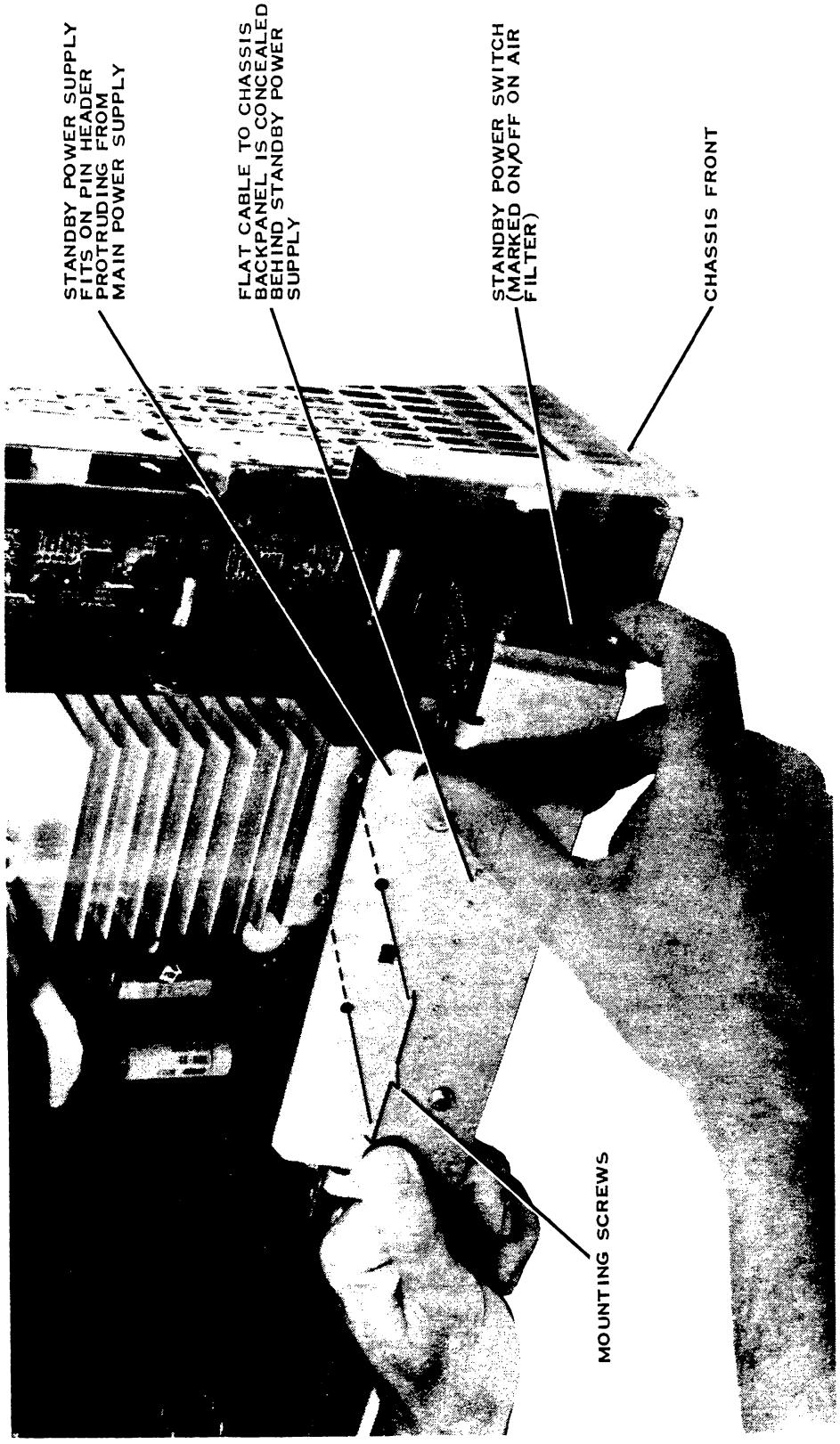


Figure A-3. Standby Power Supply Mounting

19. Position the fan/control assembly in place at the rear of the chassis.

    Reconnect the five-pin connector from the fan/control assembly to J2 on the main power supply.

    Reconnect the push-on ground strap to the lug in the corner of the chassis (behind the power supply).

20. Reinstall the fan/control assembly, using the original hardware. Make sure that the ground wire and the power supply cable do not interfere with fan rotation.

21. Reinstall the side panel on the power supply side of the chassis.

22. Once the chassis is returned to the desired location, reinstall the ac input line cord at the rear of the chassis.

23. Operational control of the standby power supply is behind the lower trim panel and the air filter. Refer to Section 3 when you are ready to operate with standby backup.

Alphabetical Index

Introduction

HOW TO USE INDEX

The index, table of contents, list of illustrations, and list of tables are used in conjunction to obtain the location of the desired subject. Once the subject or topic has been located in the index, use the appropriate paragraph number, figure number, or table number to obtain the corresponding page number from the table of contents, list of illustrations, or list of tables.

INDEX ENTRIES

The following index lists key words and concepts from the subject material of the manual together with the area(s) in the manual that supply major coverage of the listed concept. The numbers along the right side of the listing reference the following manual areas:

- Sections — Reference to Sections of the manual appear as "Sections x" with the symbol x representing any numeric quantity.

- Appendixes — Reference to Appendixes of the manual appear as "Appendix y" with the symbol y representing any capital letter.

- Paragraphs — Reference to paragraphs of the manual appear as a series of alphanumeric or numeric characters punctuated with decimal points. Only the first character of the string may be a letter; all subsequent characters are numbers. The first character refers to the section or appendix of the manual in which the paragraph may be found.

- Tables — References to tables in the manual are represented by the capital letter T followed immediately by another alphanumeric character (representing the section or appendix of the manual containing the table). The second character is followed by a dash (-) and a number.

  Tx-yy

- Figures — References to figures in the manual are represented by the capital letter F followed immediately by another alphanumeric character (representing the section or appendix of the manual containing the figure). The second character is followed by a dash (-) and a number.

  Fx-yy

- Other entries in the Index — References to other entries in the index preceded by the word "See" followed by the referenced entry.

Model 990A 13 Chassis Maintenance Manual, General Description Customer Response

Your comments and suggestions
help us improve our products.

Your computer type_____ Date_____

Your name_____

Company name/department_____
Telephone ( )_____ Address_____

City_____ State_____ Zip_____

ABOUT YOUR SYSTEM. . .

Size of memory (RAM)_____ Type of display_____

Type of graphics_____

_____

Check if you have:

☐ One diskette drive ☐ Two diskette drives ☐ Winchester disk

YOUR RESPONSE CONCERNS. . .

☐ Software TI Part No._____

☐ Manual Version No._____

Did you run diagnostics? ☐ Yes ☐ No Serial No. (if any)_____

Error code or message_____

YOUR COMMENTS. . .

If your comments concern a manual, please include applicable page numbers.

Have you attached additional comments? ☐ Yes ☐ No

Date received by TI_____

TAPE EDGE TO SEAL

FOLD

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS PERMIT NO. 7284 DALLAS, TX

POSTAGE WILL BE PAID BY ADDRESSEE

TEXAS INSTRUMENTS INCORPORATED
DATA SYSTEMS GROUP
ATTN: PC SUSTAINING
P.O. Box 2909 M/S 2234
Austin, Texas 78769-9990

FOLD

Data Systems Group – Austin
Documentation Questionnaire

Model 990A 13 Chassis Maintenance Manual, General Description

Do you use other TI manuals? If so, which one(s)?

_____ _____

_____ _____

_____ _____

How would you rate the quality of our manuals?

	Excellent	Good	Fair	Poor
Accuracy	_____	_____	_____	_____
Organization	_____	_____	_____	_____
Clarity	_____	_____	_____	_____
Completeness	_____	_____	_____	_____
Overall design	_____	_____	_____	_____
Size	_____	_____	_____	_____
Illustrations	_____	_____	_____	_____
Examples	_____	_____	_____	_____
Index	_____	_____	_____	_____
Binding method	_____	_____	_____	_____

Was the quality of documentation a criterion in your selection of hardware or software?

☐ Yes ☐ No

How do you find the technical level of our manuals?

☐ Written for a more experienced user than yourself

☐ Written for a user with the same experience

☐ Written for a less experienced user than yourself

What is your experience using computers?

☐ Less than 1 year ☐ 1-5 years ☐ 5-10 years ☐ Over 10 years

We appreciate your taking the time to complete this questionnaire. If you have additional comments about the quality of our manuals, please write them in the space below. Please be specific.

_____

_____

_____

_____

_____

Name _____ Title/Occupation _____

Company Name _____

Address _____ City/State/Zip _____

Telephone _____ Date _____

Manual Part No. 2308774-9701

TAPE EDGE TO SEAL

FOLD

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS PERMIT NO. 7284 DALLAS, TX

POSTAGE WILL BE PAID BY ADDRESSEE

TEXAS INSTRUMENTS INCORPORATED
DATA SYSTEMS GROUP
ATTN: PUBLISHING CENTER
P.O. Box 2909 M/S 2146
Austin, Texas 78769-9990

FOLD

TEXAS INSTRUMENTS

2308774-9701*B

Printed in U.S.A.