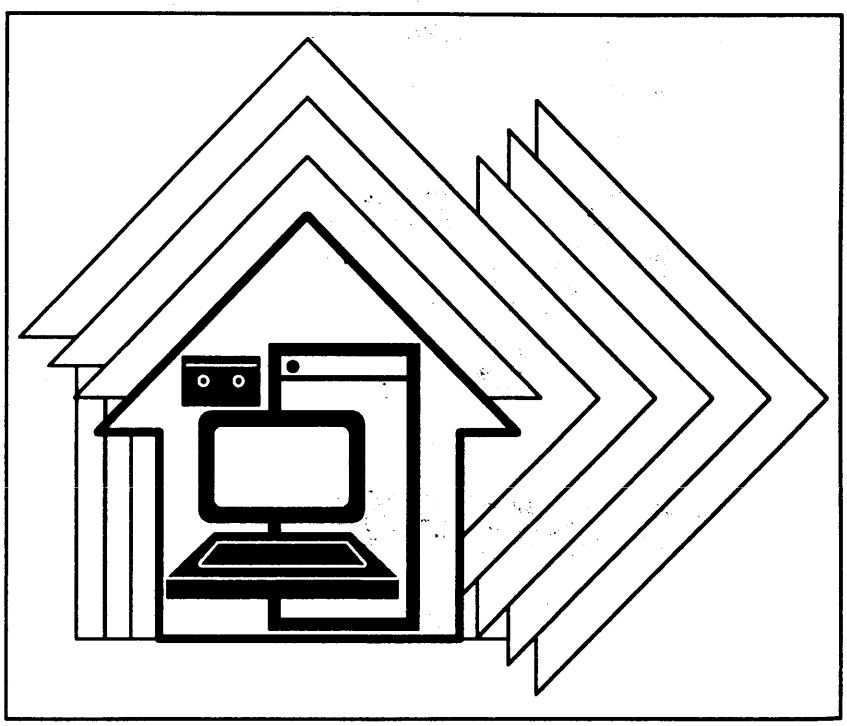
SYSTEMS 1505/1507 COMPUTER

INSTALLATION AND OPERATION



TEXAS INSTRUMENTS

SYSTEMS 1505/1507 COMPUTER INSTALLATION AND OPERATION

NOTICE TO U.S.A. USERS: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

NOTICE TO CANADIAN USERS: This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioéléctriques dépassant les limites applicables aux appareils numériques de la classe A préscrites dans le Réglement sur le brouillage radioélectrique édicté par le ministere des Communications du Canada.

MANUAL REVISION HISTORY

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ABOUT THIS MANUAL

Purpose

This manual provides installation and operation information for the Texas Instruments Systems 1500/1507 Computers and their associated accessories and optional devices. This information is intended for system users, system administrators, maintenance personnel, and value-added resellers (VARs).

Contents of This Manual

This manual is organized into six major modules, each of which is identified by a title page. Each module contains a detailed table of contents and one or more sections. Also, where appropriate, each module contains an index. A general outline of the manual is as follows:

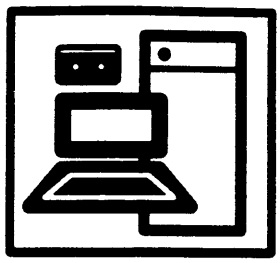
Title	Contents	
Site Preparation (SP)	Section 1	Overview
	Section 2	Power Distribution and Safety Requirements
	Section 3	Space and Cabling Requirements
	Section 4	Environmental Requirements
	Section 5	Communication Requirements
	Section 6	Receiving Your System
	Section 7	Customer Support Services
System Enclosure (ENCL)	Section 1	Overview
	Section 2	System 1505 and System 1507 Main Logic Boards
	Section 3	Unpacking the System Enclosure
	Section 4	Installing the System Enclosure
	Section 5	Operating and Testing Your Computer
	Section 6	Preventive Maintenance
SBC Option Boards (Boards)	Section 1	Installing SBC Option Boards
	Section 2	Communication Processor Option
	Section 3	Eight-Channel Async Communication Option
	Section 4	Local Area Network Communication Option
	Section 5	Multidrop Communication Option
	Section 6	Multifunction Communication Option
SCSI Mass Storage Devices (SCSI)	Section 1	Overview
	Section 2	Disk Drives
	Section 3	1/4-Inch Tape Cartridge Drives
	Section 4	8-mm Tape Cartridge Drives
Error Codes (Errors)	Section 1	Error Codes
Product Safety Information (Safety)	Section 1	Product Safety Information

References

The following documents contain additional information of interest to Systems 1505/1507 computer users:

Title	TI Part Number
Introduction	2579746-0001
Mass Storage Unit (MSU IIA) Installation and Operation	2557935-0001
System 1500 Mass Storage Tower Installation and Operation	2579752-0001
Terminal Concentrator Installation and Operation	2557938-0001
Terminal/Printer Information	2557939-0001
Diagnostics User's Guide	2534850-0001
TI System V Administrator's Guide	2540539-0001

SITE PREPARATION



CONTENTS

1 OVERVIEW

Introduction

1.1 This module provides detailed information about properly preparing a facility for installation of a computer system. Although this module addresses site preparation for Texas Instruments (TI) computers in particular, the requirements listed are broadly applicable to similar computer systems of other manufacturers. TI offers a wide range of computers and related products; the installation requirements may vary from one product to another but the minimum requirements described in this module must be satisfied to achieve a successful installation and reliable computer operation.

Your particular system may have special power, space, and environmental requirements in addition to those described in this module. For this information, refer to the applicable installation and operations manual, user's manual, or options guide. If special circumstances require you to deviate from any of the requirements contained in this module, or if you have any questions concerning these requirements, contact the TI Facility Management Consulting Services at toll free number 1-800-847-5757.

CAUTION: Do not attach any non-TI-supplied peripherals, cables, or other equipment to your TI computer system unless doing so is specifically described in a TI publication or unless you first consult with TI Facility Management Consulting Services personnel.

Site Preparation Checklists

1.2 The specifications for any computer system impose power, space, and environmental requirements on the installation site. Close adherence to these requirements is essential to ensure reliable system performance. A well-planned installation increases the productivity of your system. For large or multiple systems, a dedicated computer room provides many benefits, such as increased environmental control and easier access to the system.

Your intended system application can impose additional requirements, such as the need for local area networks (LANs) or leased or switched communication lines. Also, you will need such necessary supplies as printer paper, special printer forms, and magnetic tapes after your system is installed.

To prepare your site, you must coordinate the work of several skilled people, such as a facility engineer, an electrician, an air-conditioning specialist, a data communication specialist, a receiving supervisor, and a telephone company representative. You must provide these people with the technical information necessary to perform their parts in the site preparation.

The following paragraphs provide checklists to ensure that your site meets the necessary power, space, and environmental requirements. Each of the checklists provides references to applicable sections of this module. Do not begin installation until all items of these checklists have been satisfied.

Power Requirements

1.2.1 The specific source power required for your system depends upon the country or geographic location of the computer site and the requirements of the system itself. The following checklist provides items that you must check to ensure that your installation site meets the general power requirements of your system:

- ☐ You have proper wiring, either conventional or prewired, installed in compliance with national and local electrical codes (Section 2).
- ☐ You have a dedicated power system (paragraph 2.1).
- ☐ You have a properly wired ground for each receptacle that is to be used for your computer equipment (paragraph 2.1.2).
- ☐ Your site conforms to power safety standards (paragraph 2.1.4).
- ☐ All power outlets are specification-grade (paragraph 2.1.3).
- ☐ Each system component has a separate power outlet (paragraph 2.1.3).
- ☐ Any power cut-off switches required by local or national standards are installed (paragraph 2.1.4).
- ☐ You have protected against the sources of power problems described in paragraph 2.2.
- ☐ You have arranged for correct installation of all cables that exit the building, and lightning protection devices have been installed on these cables. (Section 3).

NOTE: Standard cables purchased from TI are not suitable for use outside of buildings.

Space Requirements

1.2.2 The specific space requirements for your system depend upon the physical size of the system and its components, and other factors such as cabling requirements. The following checklist provides items that you must check to ensure that your installation site meets the space requirements of your system:

- ☐ You have considered traffic patterns and the physical dimensions of components in determining your system location (paragraph 3.1).
- ☐ You have arranged for cables to be clear of pedestrian paths (paragraph 3.2).
- ☐ You have reviewed the guidelines for installing cables (paragraph 3.2.2).

Environmental Requirements

1.2.3 For optimum and reliable performance of your computer system, you must ensure that the installation site meets the environmental requirements outlined in the following checklist:

- ☐ Your site temperature and humidity ranges meet the requirements prescribed by paragraph 4.1.
- ☐ You have arranged to minimize static electricity (paragraph 4.3).
- ☐ You have arranged to minimize the presence of dust at the computer installation site (paragraph 4.4).

CAUTION: If your system is to be placed above a concrete floor, you must seal the concrete before you install the system, even if you have a raised floor above the concrete. Concrete dust is extremely harmful to disk drives.

- ☐ Storage is available to protect magnetic tapes from electromagnetic radiation, fire, dust, and humidity (paragraph 4.5).

Additional Requirements

1.2.4 Before beginning installation, you must unpack your equipment, inspect it for shipping damage, and identify any special communication requirements at your computer site. Check the following items before preceding with the installation:

- ☐ You have identified the required communication networks and equipment for support of your system (Section 5).
- ☐ You have reviewed the applicable unpacking and inspection procedures (paragraphs 6.1 and 6.2).

Recording Your System Components

1.3 The following system inventory sheets provide a convenient place for you to record your system components. This information will serve as a future reference to help you determine your system hardware configuration. As you unpack your computer and any accessory items that you have ordered, record each item on the inventory sheet. For items that have a serial number (such as the system enclosure) include the serial number as part of the description. If you add options at a later date, update the inventory sheet to include information about the options.

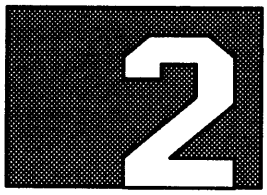
Figure 1-1 System Inventory Sheet

Item	Description	Part Number	Date Installed

Figure 1-1 System Inventory Sheet (Continued)

Item	Description	Part Number	Date Installed

POWER DISTRIBUTION AND SAFETY REQUIREMENTS



Power Distribution

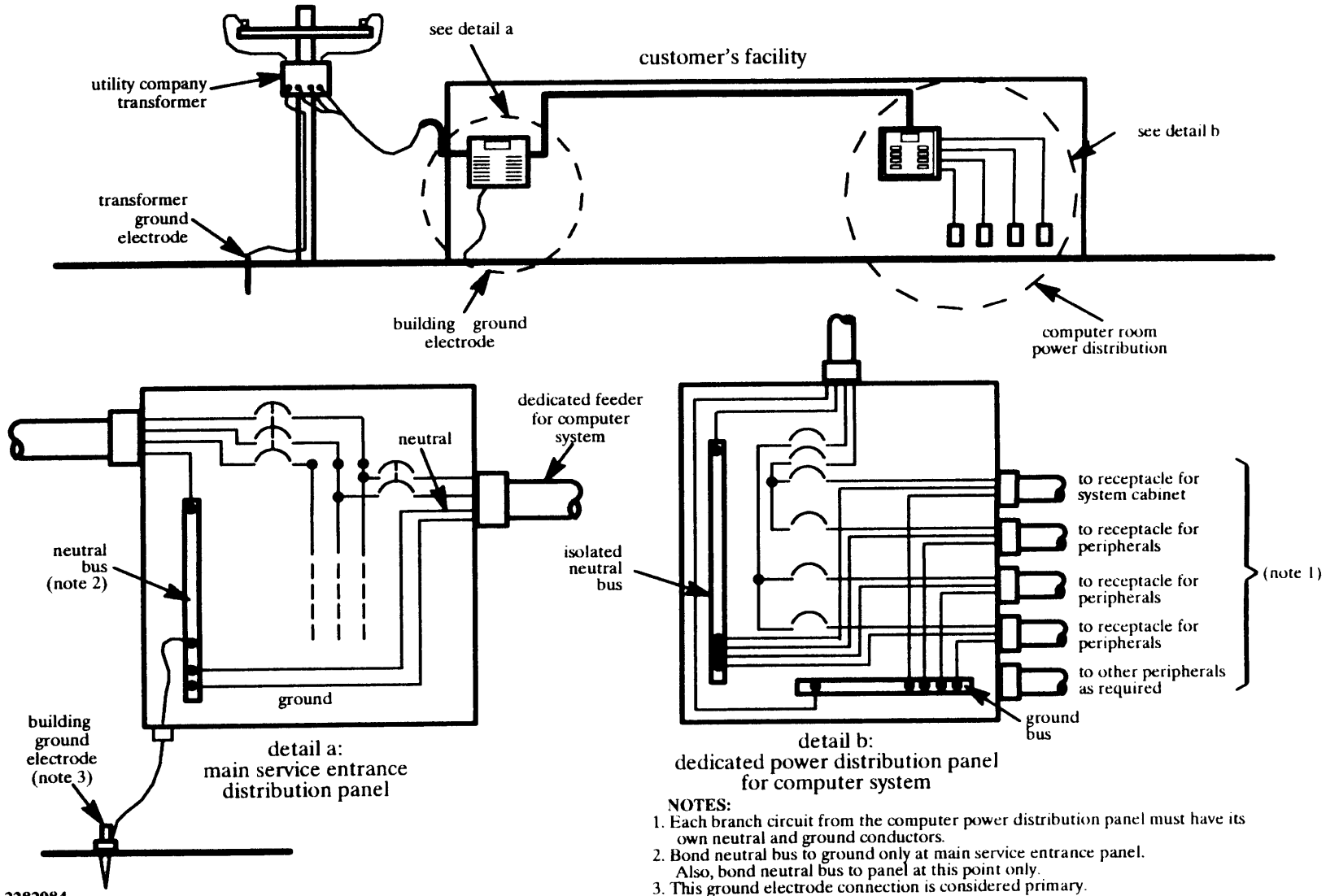
2.1 To ensure safe, reliable operation of your computer, a dedicated power system is required. Computer equipment power requirements often exceed ordinary office wiring capabilities. Equipment such as disk drives, printers, and tape drives require large starting currents, thus necessitating additional attention to the computer electrical wiring.

Figure 2<#106>1 shows a typical recommended wiring scheme. The required configuration is a dedicated ac power source with a dedicated power distribution panel for the computer equipment. It is best for all system components to be fed from a single power source. However, remote peripherals may be fed from other dedicated feeder branch circuits. Install all electrical wiring in compliance with national and local electrical codes. Do not install any extension cords.

NOTE: A dedicated power source consists of a hot conductor, a neutral conductor, and an insulated equipment grounding conductor, all of which connect directly from the main service panel to the computer room subpanel.

Figure 2<#106>2 shows the recommended power service for the domestic 208-volt
system.

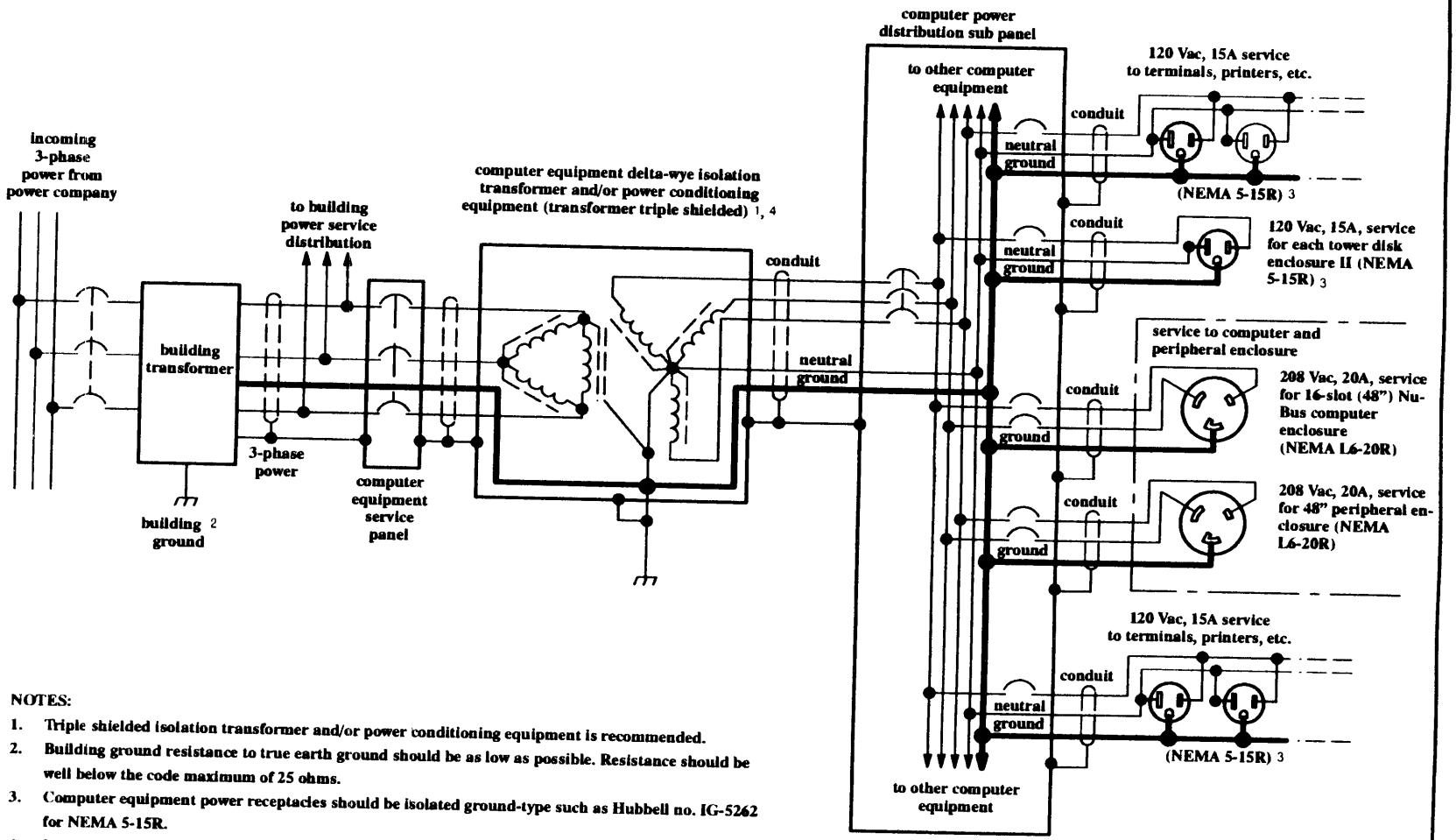
Figure 2-1 Typical Recommended Facility Wiring Scheme



NOTES:

1. Each branch circuit from the computer power distribution panel must have its own neutral and ground conductors.
2. Bond neutral bus to ground only at main service entrance panel. Also, bond neutral bus to panel at this point only.
3. This ground electrode connection is considered primary.

Figure 2-2 Recommended Power Service for a Domestic 208-Volt System



NOTES:

1. Triple shielded isolation transformer and/or power conditioning equipment is recommended.
2. Building ground resistance to true earth ground should be as low as possible. Resistance should be well below the code maximum of 25 ohms.
3. Computer equipment power receptacles should be isolated ground-type such as Hubbell no. IG-5262 for NEMA 5-15R.
4. Locate isolation transformer in computer room or as close as possible to computer equipment.

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Uninterruptible Power Supply

2.1.1 Computer systems are designed to operate from regular commercial ac power. But like all sensitive electronic equipment, computers must be protected from any power sags, surges, and impulses. Computers subjected to any of these power anomalies will often produce data errors, lost files, and possible hardware damage.

Although power utility companies attempt to provide consistent high-quality power to their customers, factors such as inclement weather, accidents, and other adverse conditions can interrupt or otherwise corrupt the quality of the power that they provide. Other electrical loads within a building (such as elevator motors, compressors, copiers, and so on) can also corrupt the power service.

Commercially available power line treatment devices (such as the one shown in Figure 2<#106>3) can be added to isolate your computer system from power anomalies. These devices range from simple power conditioners to uninterruptible power supplies (UPSs). Power conditioners connect between the power source and your computer system and provide clean, trouble-free, regulated power to the system.

An online UPS provides the same functions as a power conditioner, but it also functions as an instantaneous battery backup device in the event of a power failure. Another class of UPS, called a standby UPS, provides battery backup service, but does not provide the functions of a power conditioner.

Many competing technologies provide different categories of line treatment devices, each of which treats a specific power line problem. Therefore, to ensure that you choose the line treatment device suitable for your system, you must exercise care when selecting these devices. TI, through its TI-EXPRESS catalogue, offers a complete line of power conditioners and UPSs uniquely suited for use with the TI computer system family. For additional information, or to order a line treatment device, contact TI-EXPRESS by calling 1-800-TI-PARTS.

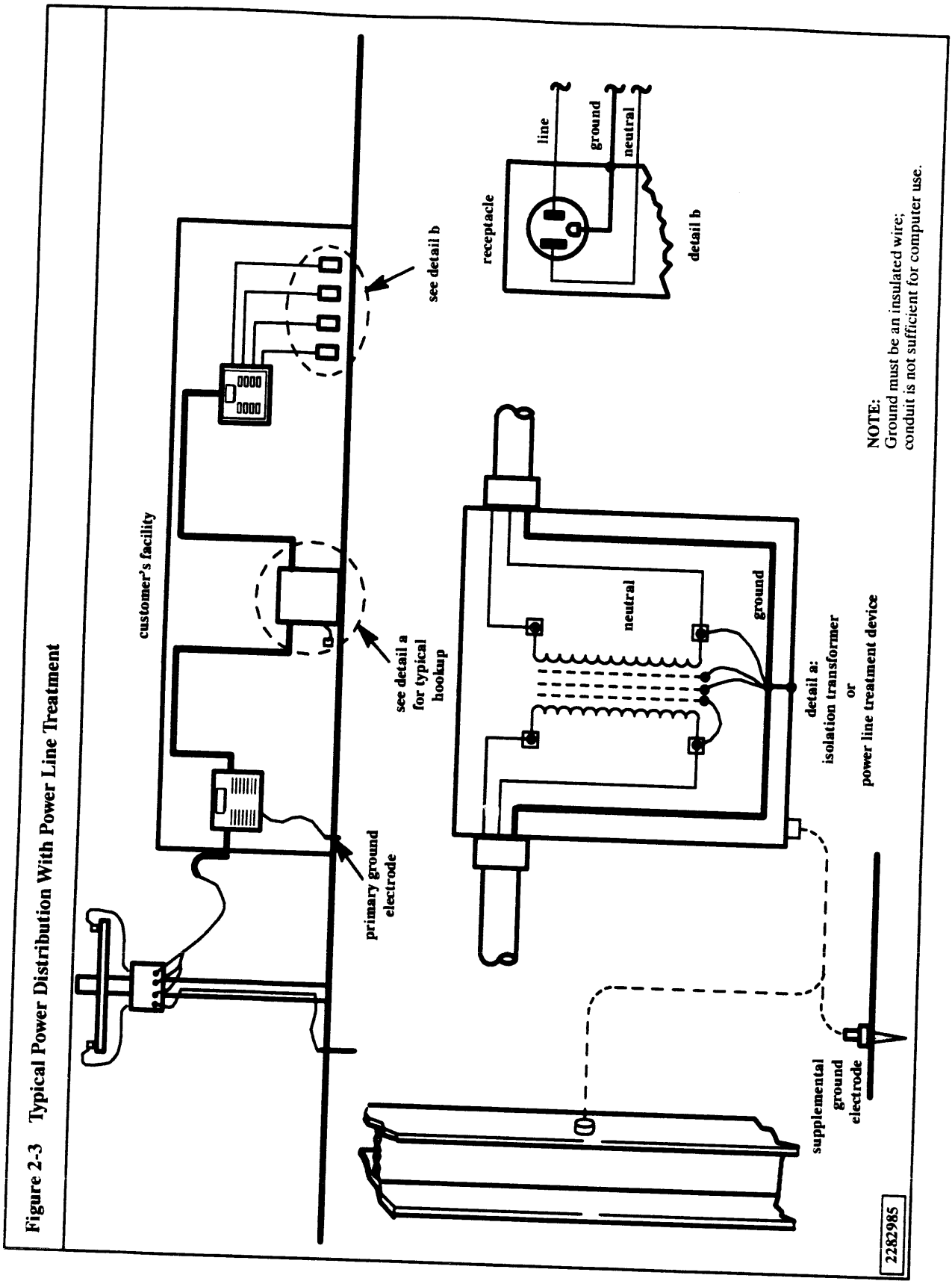


Figure 2-3 Typical Power Distribution With Power Line Treatment

Grounding

2.1.2 The primary consideration when planning a power system for electrical and electronic equipment is personnel and equipment safety. The National Electrical Code (NEC) establishes rules for electrical wiring and *grounding*. These rules are enforced by local jurisdictions and must be followed in all cases. However, because these rules primarily apply to low-frequency (60 Hz) power distribution lines, they do not fully meet the requirements of computer systems, which typically operate in the high megahertz frequency ranges.

The high megahertz frequency ranges present unique grounding problems that must be resolved in order to ensure the reliable operation of the computer system. However, do not interpret the word *unique* as being contrary to the NEC rules. The primary objective is safety above all else.

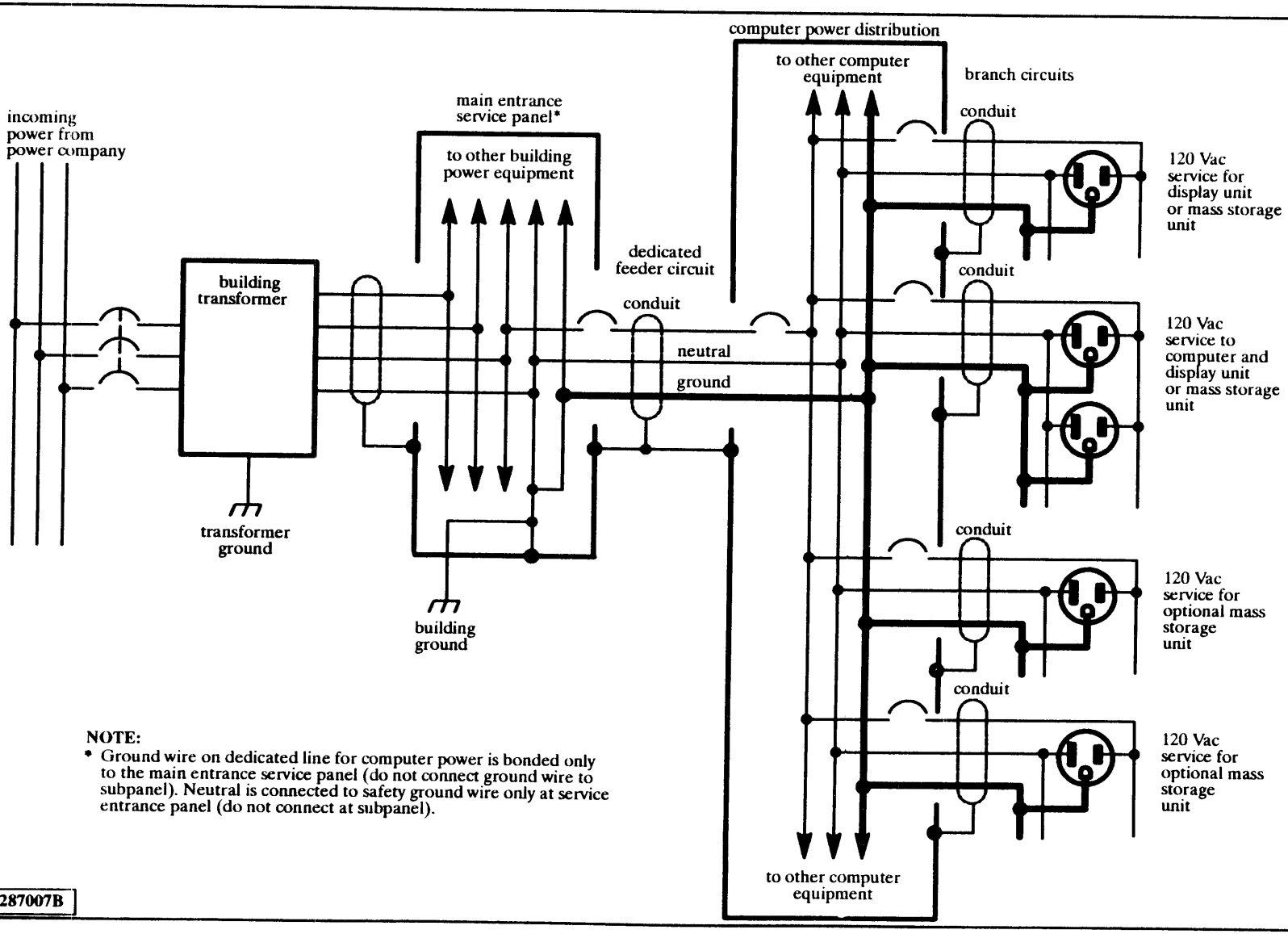
The NEC allows the use of a continuous metal conduit as a ground return path for electrical circuits. Although conduits, as well as all other exposed metal parts, should be grounded, they do not provide sufficiently stable grounds for computer systems. Therefore, in addition to the conduit, a grounding system must be established by routing an insulated ground wire from each power outlet through the conduit to the main electrical service.

Figure 2-4 shows a typical properly grounded power distribution system. A standard distribution system requires a ground wire for all safety ground connections. The equipment ground conductors must be equal or larger in size than the current carrying conductor. Integrity of systems that use standard power distribution should also be verified by a competent professional.

It is important that each power outlet for the computer equipment has a properly wired ground. This ground wire (not conduit) must be connected to the subpanel ground bus. The ground bus wire from the subpanel must then be routed to the main service panel.

At the main service panel, the ground and neutral wires are bonded and connected to an earth ground electrode. This connection point is the single-point ground and is the primary point at which the ground electrode should be connected.

Figure 2-4 Properly Grounded Power Distribution System



NOTE:

* Ground wire on dedicated line for computer power is bonded only to the main entrance service panel (do not connect ground wire to subpanel). Neutral is connected to safety ground wire only at service entrance panel (do not connect at subpanel).

Power Outlets and Wires

2.1.3 Several grades and types of power outlets are available. In a power distribution system, each simplex or duplex power outlet must have its own set of wires, including a ground wire, a neutral wire, and one or more hot wires.

Power outlets are of two grades: standard-grade and specification-grade. When selecting power outlets for your computer and related equipment, choose only the specification-grade outlets. These outlets provide positive contact for both feeder wires and plugs. They also have a greater life expectancy than standard-grade receptacles.

Site Safety

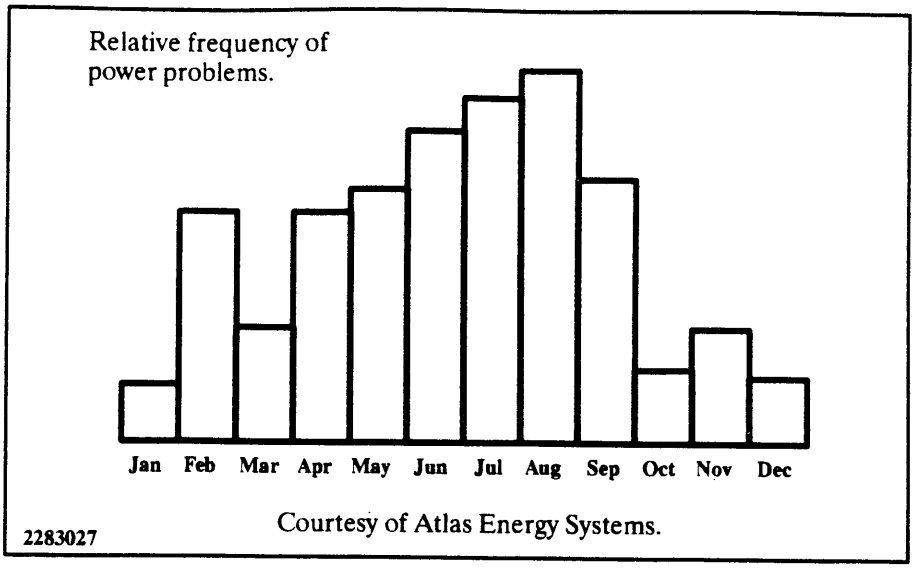
2.1.4 Follow safety standards that apply to your site. Safety standards in some areas require power breakers and air conditioning shutoff switches to be located adjacent to each exit from the computer room. Some government agencies and corporations in the United States require at least one central power shutoff point in a computer facility. Be sure to check these requirements before wiring your site. Even if formal standards do not apply, a single-point power shutoff with additional breakers for safety and maintenance convenience is recommended.

Sources of Power Problems

2.2 When evaluating the quality of power in your locality, examine the potential sources of ac power problems. These sources are both nature-related and man-made and can include any of the following conditions:

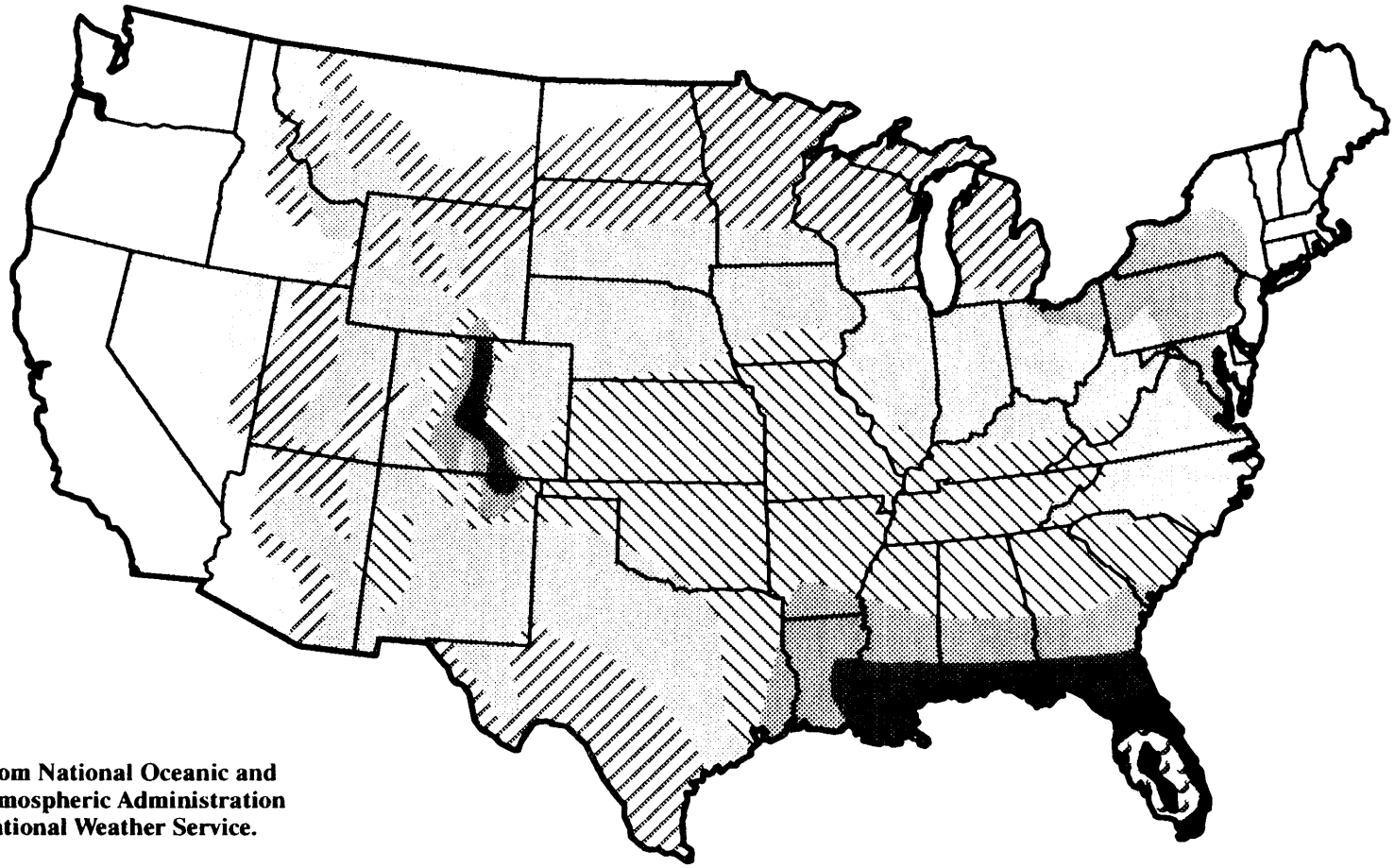
- Faulty wiring — Faulty wiring within a facility is one of the major causes of power problems. Have a competent specialist verify the wiring integrity prior installing your system. You should have a specialist check the wiring integrity annually.
- Improper grounding — Improper grounding frequently causes problems in computer power sources. A single-point ground is essential for minimizing logic problems caused by ground loops.
- Power distribution systems — Conditions such as construction accidents, ice storms, wind, lightning, and other adverse conditions can affect power delivered via overhead power distribution systems. Underground power distribution systems are far more reliable but are not as common as overhead systems.
- Time of the year — Seasonal changes influence power usage and availability. Increased use of air conditioning during the summer months creates a large power drain and taxes electric utility company reserves. Brownouts and low-voltage conditions are common problems during the summer months, especially in the months of July and August. Figure 2-5 graphically depicts the power problem frequency relative to the time of the year.

Figure 2-5 **Frequency of Power Problems Relative to Time of Year**

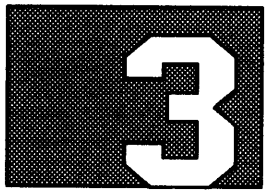


- Lightning — In areas of the country subject to numerous thunderstorms, lightning causes considerable damage to electrical equipment. A lightning storm emits pulses of electrical energy that are induced into power distribution and data communication lines, affecting electrical equipment operating in plants miles away from the storm. The annual thunderstorm frequency map of Figure 2-6 shows the average number of thunderstorms occurring annually in each United States geographical area.

Figure 2-6 Annual Thunderstorm Frequency Map



SPACE AND CABLING REQUIREMENTS



Equipment Placement

3.1 The actual placement of various components depends upon such factors as the size of the equipment, airflow requirements, required maintenance area, and the lengths of the power and data cables.

Most TI computer systems are designed for office environments. In planning your system layout, consider the work flow in your computer area and ensure that work stations are out of traffic patterns. Arrange your system components to allow optimum working convenience with the least possible movement between devices. Consider physical security and fire protection when planning storage and service accessibility. Include convenient storage space for necessary system supplies.

System Cables

3.2 If your purchase agreement with TI includes installation, TI will connect all standard cabling as a part of the installation process. You must install any optional extension cables and cables that pass through walls, plenums, or conduits. Allow a service loop of approximately 6 feet (1.8 meters) at each end of each cable for easy installation and removal.

WARNING: Using improper cables can result in personnel and equipment safety hazards. All user-fabricated cables must conform to TI specifications. For cabling information, call TI Facility Management Consulting Services at 1-800-847-5757.

To ensure personnel and equipment safety, all cables must be kept out of pedestrian paths. The ideal solution for large computer systems is to construct a raised floor with all cabling beneath the raised floor. This method provides maximum flexibility in placing equipment and reduces the hazard of tripping on cables. The raised floor should consist of rugged, removable tiles supported by a metal framework permanently mounted to the subfloor or foundation. The tiles should contain holes that allow the cables to be routed beneath the raised floor.

NOTE: Raised computer flooring represents a significant investment. Do not install it in a temporary computer location.

Suspended cable trays offer an alternate method of keeping cables out of the way. Plastic cable trays, if allowed by local building and fire codes, are lightweight and easy to install. Cable drops from the trays need support and must allow room for cabinet doors to swing open freely.

For equipment placed adjacent to a wall, a cable trough can be mounted along the wall near the floor. For installations not involving bulky cables or large numbers of cables, use cable ties, tape, or lacing material to suspend cables from existing pipes or supports. If the only solution to a cabling problem is to run a cable across the floor, install cable ramps to guard the cables against damage and to reduce the hazard of tripping.

Lightning Protection for Signal Cables

3.2.1 If the signal cables associated with your computer system must be routed outside buildings, they must be protected from lightning. You can order data line and telephone line lightning surge suppressors from the TI EXPRESS catalogue by calling 1-800-TI-PARTS.

NOTE: For information about surge protectors offered by TI, call the TI Facility Management Consulting Services at 1-800-847-5757.

To ensure protection from the outside environment, signal cables routed between buildings should be buried at least three feet underground in conduit. While installing the cables in the conduit, route a number 12 American wire gauge (AWG) insulated conductor along with the signal cables, and ground it at both ends. Keep outdoor cables away from vertical structures. Avoid vertical runs until the cable bundle is well inside the building. (Cables must enter the building at the same depth at which they are buried outdoors.)

NOTE: Standard cables purchased from TI are not suitable for use outside of buildings.

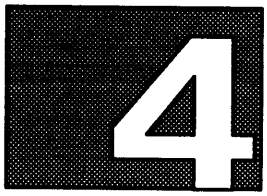
Interconnecting Cables

3.2.2 Interconnecting cables between the computer system and the peripheral devices are very susceptible to physical damage if they are not properly installed. Use the following guidelines to install these cables:

- Route signal cables well away from electrical noise sources or induction fields. Power lines in the proximity of signal lines may induce errors; keep power lines and signal lines well separated.
- Do not route data cables through elevator shafts, air ducts, or plenums.
- Do not route cables outside buildings unless local electrical codes and the lightning protection guidelines of paragraph 3.2.1 are met; also, over-current protection devices must be installed to protect the computer system and the building wiring.
- Keep signal cables together with sleeving, tape, or ties.
- Keep cables off the floor. They present a safety hazard to personnel and can be damaged by foot traffic and cleaning solvents.
- Avoid flexing the cables excessively or bending them in tight loops.

- Support cables at short intervals; make maximum use of existing support structures.
- Dress cables and tie them away from door closures that could pinch or cut them.
- Provide a protective bushing wherever cables must pass through a metal cut-out, such as an entry or exit hole in a raised floor tile.

ENVIRONMENTAL REQUIREMENTS



Heating/Cooling Recommendations

4.1 System specifications allow operation over wide temperature and humidity ranges. However, to ensure maximum reliability and system performance, try to keep the environment as near as possible to the following ideal levels:

- Temperature — 70°F ±5° (21° C ±2.7°)
- Relative humidity — 50% ±5%

CAUTION: Operating the computer system in a marginal environment reduces system reliability and can result in system downtime.

Drastic changes in the temperature or humidity during short time periods can affect your system reliability. Do not expose your computer to temperature changes greater than 5.0° F (2.7° C) per hour. Also, try to maintain the humidity as nearly as possible to the ideal range to avoid either extremely dry or extremely damp conditions.

Avoid placing your computer equipment in the direct path of cooling and heating vents that frequently cycle on and off. Pay special attention to the number of cooling and heating vents in your computer area to ensure an even temperature distribution. Sunlight shining through a window can overload your air-conditioning system and cause hot spots that exceed the specified temperature limits of your equipment environment. Also, avoid creating hot spots by grouping too much equipment too far away from cooling vent(s).

The air conditioning system must maintain a constant room temperature 24 hours a day. Avoid oversized air-conditioning systems that rely on power rather than on constant flow; such systems can cause thermal stress and shock on your computer system because of wide variances between high and low temperatures. Select an air conditioning system that can meet your cooling needs with a constant flow (system on at least 45 minutes out of each hour).

If the computer equipment is to be placed in a large open space, consider installing a separate temperature control (thermostat) for the computer. By using floor-to-ceiling room partitions and separate thermostats, the air-conditioning design can be simplified, and capacity requirements can be reduced.

Verify that the heat created by your system configuration can be handled by the air-conditioning system in the selected site, and that you have sufficient airflow in the computer area. If the system is enclosed in a small room without adequate local airflow, the ambient temperature in the computer area can increase regardless of the overall cooling capability of the facility. Cooling calculations must include allowances for heat-loading due to personnel, lighting, and windows as described in standard air-conditioning or mechanical engineering handbooks.

Airflow Considerations

4.2 When planning your system layout, ensure that the air intake and exhaust outlets on the computer equipment are not restricted or blocked. Air intake vents are generally at the front or rear of the equipment. Exhaust vents may be at the rear or top. Provide adequate clearance to allow unobstructed air flow to or from these vents. Arrange your system in such a way that the cleanest equipment is upwind and the dust-producing equipment is downwind. For example, a tape drive demands clean air and a printer produces dust.

Static Electricity Suppression

4.3 Low relative humidity increases the potential for static discharge into the equipment or for a static charge to build up on or within the equipment itself. Static charges can cause paper-handling problems in high-speed printers and electrical noise problems in rotating machinery, such as disk drives. Static charges attract dust particles from the air and can cause faulty system operation.

Equipment supplied by TI has been tested to verify a reasonable level of immunity to the effects of electrical discharges to the equipment or in the vicinity of the equipment. However, to ensure reliable operation, you should be aware of the problems associated with static electricity and ways to avoid these problems.

Static charges generated by an individual walking across the floor and touching the equipment can cause problems ranging from electronic equipment malfunctions to complete system shutdowns. The degree of static buildup depends upon shoe sole material, the type of floor covering, and the relative humidity. Maintaining the relative humidity at 50 percent or higher reduces problems associated with static electricity.

If it is not practical to regulate humidity and prescribe the proper shoe sole material, the most effective way to control static electricity is by selecting tile, wood, or sealed concrete as the flooring material in the computer room. Carpet can be used if it is treated with static-suppression spray, covered with antistatic mats, or made of material that does not promote static charge build-up. Ease of cleaning is also an important consideration in selecting flooring material.

Equipment problems can occur without the operator being aware of a static electric discharge. The average human threshold of sensitivity to static discharge events is approximately 3.5 kilovolts, but some electronic equipment can begin to malfunction at lower levels. In a low relative humidity environment, static charges in excess of 30 kilovolts are possible, greatly increasing the likelihood of equipment reliability problems.

For assistance in avoiding static electricity problems, call TI Facility Management Consulting Services at 1-800-847-5757.

Computer Area Cleanliness

4.4 A clean computer system environment can greatly enhance the reliability of your equipment, especially such devices as printers, tape drives, and disk drives. Use the following guidelines to maintain an adequately clean environment for your computer system:

CAUTION: If your system is to be placed above a concrete floor, you must seal the concrete before you install the system even if you have a raised floor above the concrete. Concrete dust is extremely harmful to disk drives.

- Dust accelerates wear on tape drives and the tapes used in them. Providing a clean environment increases system reliability, reduces maintenance cost, and reduces the loss of data. Ensure that the computer area air-conditioning equipment includes adequate dust filtration systems.
- Food, drink, and smoking within the computer area present unnecessary hazards to equipment performance. Smoking also represents a fire hazard to the paper around the printers. Ban smoking in the computer area, especially in the vicinity of the disk drives and tape drives. If the terminals are located in an area separate from the computer and the printers, smoking at the terminals does not represent an unusual hazard to the equipment.

Storage Facilities and Fire Considerations

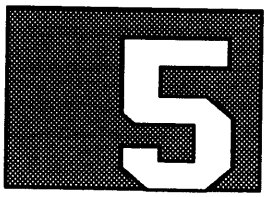
4.5 You will need a storage facility to protect your magnetic tapes from electromagnetic radiation, fire, dust, and extreme humidity conditions. When designing a fire protection system for the computer area and storage area, consult building, fire, and safety codes that your system must meet at corporate, local, state, and national levels. Some jurisdictions are legally empowered to immediately shut down a noncomplying system and to keep the system shutdown until the site is in compliance.

A fire protection system can include smoke detectors, manual or automatic extinguisher systems, and warning devices. Automatic extinguisher systems should provide at least a 10-second audible warning before they activate. In choosing fire protection options, carefully evaluate the cost of the protection system against the possible cost of loss due to a fire. In addition to the physical equipment and facility, consider the value of the tape and disk records. Consult your insurance company; the cost of protective measures may be offset by reductions in your insurance rates.

After designing your system, ensure that it is installed properly. It is imperative that all personnel working in the area (including security personnel) know the locations of all fire safety equipment as well as how to operate such equipment. Prominently display all operating instructions.

The National Fire Protection Association (NFPA) publications entitled *National Electrical code (NFPA 70)* and *Standard for the Protection of Electronic Computer/ Data Processing Equipment (NFPA 75)* provide general and specific information about fire safety precautions.

COMMUNICATION REQUIREMENTS



Telephone Networks

5.1 A variety of communication equipment is available for two-way data transfers between your computer system and remote terminals or other computers. Much of this equipment requires the use of leased or switched telephone systems.

If you plan to connect this special communication equipment to your system, you must inform your communication supplier (telephone company) of your installation requirements well in advance. In most areas, a long lead time is required for the installation of telephone communications equipment.

Your system configuration determines the items you must lease or buy. These items include the following:

- Telephone lines and jacks — Must meet code and regulatory standards.
- Modems and/or autocall units — Depend upon the type of communication protocols and data-transfer rates your application requires.
- Data-access arrangement — May be needed to meet telephone company requirements, depending upon the type of installation and system applications.
- Local area networks (LANs) — Refer to your applicable LAN option kit documentation for more information.

CAUTION: All communication items must meet local and national fire and safety codes and must be safety approved.

6 RECEIVING YOUR SYSTEM

Unpacking Your Equipment

6.1 If you purchased installation service with your TI computer system, your only responsibilities are to move the system into the installation area and to inventory the equipment after it is unpacked. TI personnel will unpack the equipment for you.

If you install the system yourself, ensure that the unpacking operation is performed by qualified personnel who have the proper tools and safety equipment. The installation and operation documents supplied with your equipment provide detailed instructions for unpacking, inventorying, and installing the equipment.

Inspecting Your Equipment

6.2 When you receive your system, complete the following steps:

- Check the number of crates and shipping containers at arrival against the carrier bill of lading.
- Inspect all crates and shipping containers for evidence of shipping damage. If any damage is found, note the damage on the bill of lading and file a claim against the carrier, if applicable. Photograph any damages to the crates or equipment.

NOTE: While inspecting crates and cartons for damage, watch for crushed corners, dents, scratches, cracks, and signs of stains from liquids that might have soaked into the containers. Write down any discrepancies, inform the carrier, and file any applicable claims.

- If you purchased service installation with your system, contact TI-CARE℠ at 1-800-572-3300 for installation scheduling. International users should contact the nearest TI Field Service office.

TI-CARE is a service mark of Texas Instruments Incorporated.

CUSTOMER SUPPORT SERVICES

Introduction

7.1 Customer satisfaction is a primary goal of Texas Instruments. To meet this goal, TI has developed and implemented a number of customer support services, including the computerized service network called TI-CARE. This section provides information about the support services, all of which are available for a nominal fee.

Service Requests

7.2 The TI-CARE system is a nationwide, computerized network that facilitates the entry, dispatch, and completion of all customer service requests. To initiate any service request other than installation, use the toll-free, centralized dispatch telephone number, 1-800-572-3300. When the dispatcher answers, you must provide the following information:

- Your name
- The address of the equipment requiring service
- The model and serial number of the product
- A description of the problem
- A purchase order number (if it is purchased equipment and not covered by warranty or a maintenance agreement).

The dispatcher enters the information into the TI-CARE system, and the system automatically transfers the request to the TI service office nearest the equipment requiring service. The dispatcher at that location assigns the request to a customer representative (CR) for the appropriate action. When the CR completes the service request, all pertinent data is entered into the system to maintain a real-time service status.

The TI-CARE system enables TI to provide fast, efficient service to every customer, either locally or nationwide. If you are not satisfied with the service provided by the TI-CARE system, notify the nearest TI region or area manager.

Professional Services

7.3 In addition to the TI-CARE system, TI also offers a wide range of professional services to our customers. The following paragraphs describe these services. (For additional information, contact your local TI reseller or call 1-800-847-5757.)

TI Software Support

7.3.1 TI software support services provide assistance ranging from hotline support of operating systems and application software to on-site consulting. Support services are available for various TI equipment such as professional computers, business systems, System 1000 series, and advanced system products. These services also include software updates and bulletin board services.

Data Recovery

7.3.2 The TI data recovery service lets customers regain access to disk or tape data that, for a variety of reasons, can no longer be accessed by ordinary means. This service can often correct several types of problems, including physical media damage, format errors, and damaged data or file structures.

Depending upon the nature of the problem and the particular customer's requirement, data recovery service is available on site, or remotely via dial-up terminals. You can also send the defective media by mail to a designated TI facility. No charge is assessed if data cannot be recovered.

Disaster Protection

7.3.3 Disaster protection is a custom-designed service that assists customers in the event of a disaster such as fire, flood, earthquake, and so on. The plan provides an alternate computer system to let the customer continue to conduct normal business until a replacement system is available or the damaged system can be restored.

Facilities Management Consulting

7.3.4 This site-preparation service provides a detailed site analysis to identify and recommend cost-effective solutions for all aspects of environmental and power-related problems. At the customer's option, TI will also coordinate and implement the recommended solutions. Contact TI Facilities Management Consulting Services at 1-800-847-5757.

System Optimization

7.3.5 System optimization provides a free analysis of current hardware and software and their parameters, plus comprehensive recommendations on what changes are necessary to improve overall system performance.

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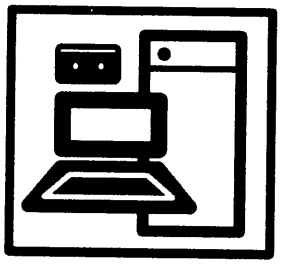
SYSTEM ENCLOSURE



WARNING: An incorrect fuse value or an incorrect setting of the voltage-select switch can damage your computer or cause a possible fire hazard. Always replace the ac line fuse with one of exactly the same rating as the original, and ensure that the voltage-select switch is set to the proper voltage.

ACHTUNG: Für den sicheren Betrieb des Gerätes ist es unbedingt erforderlich, daβ der Spannungswahlschalter auf der geeigneten Betriebsspannung steht, und daβ Sicherungen nur mit Typen gleichen Wertes ausgetauscht werden.

CAUTION: If an emergency situation requires that the computer be disconnected from the ac power source, disconnect the ac power cord from the rear of the system enclosure by pulling it straight out.

HINWEIS: Im Notfall kann das Gerät durch direktes Ziehen des Netzkabels aus dem hinteren Gerätestecker vom Netz getrennt werden.

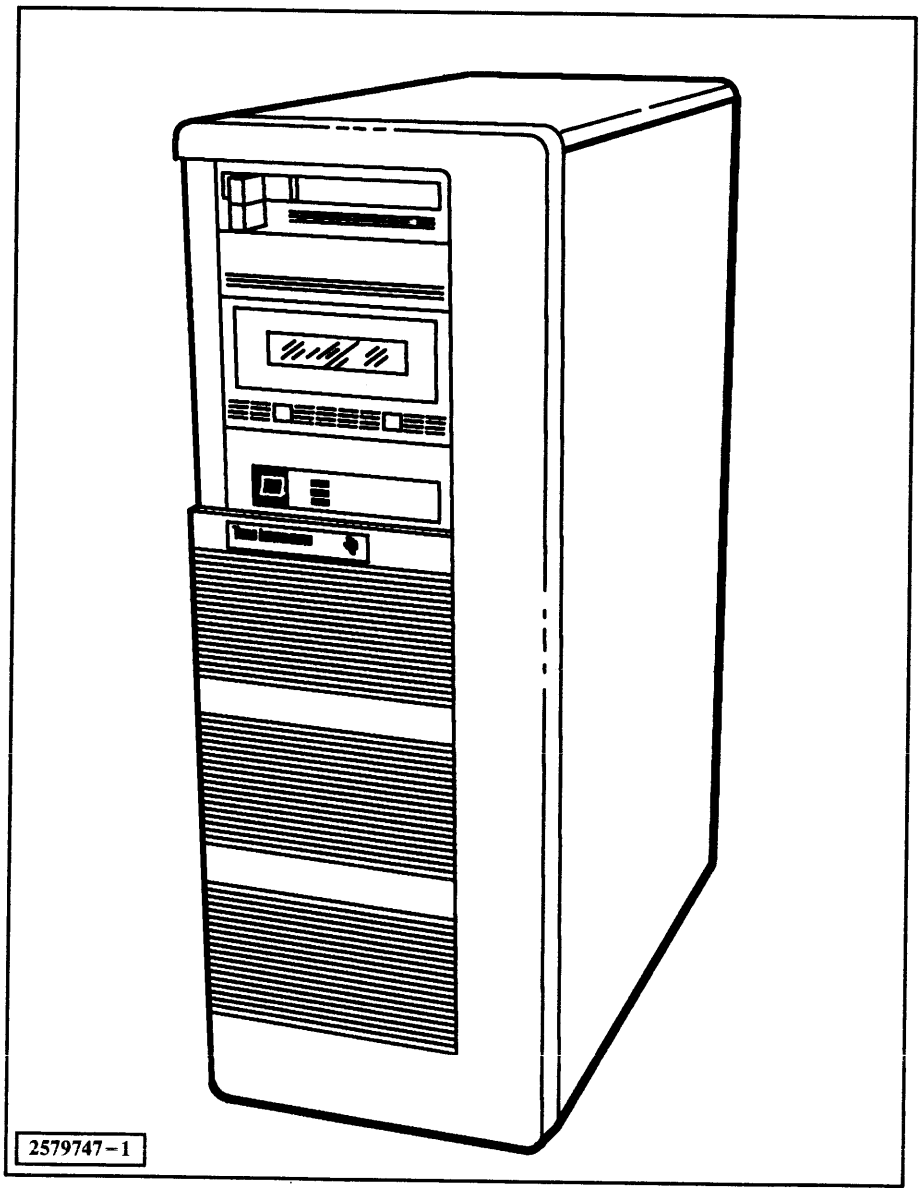
CONTENTS

1 OVERVIEW

Introduction

1.1 The system enclosure houses the main logic board (MLB), the mass storage subsystem, the power supply, and the cooling system. External connectors on the rear of the enclosure provide interfaces to the system maintenance terminal (SMT) and an optional uninterruptible power supply (UPS). Another connector can accommodate external disk drives for mass storage expansion or a terminator for the internal mass storage subsystem. Figure 1-1 shows the system enclosure.

Figure 1-1 **System Enclosure**



The mass storage subsystem contains the system tape drive for disk backup and data transport, and a maximum of six disk drives, depending upon the disk drive configuration you choose. One of these disk drives functions as the system disk drive, which contains the TI System V operating system and provides general data storage for the computer. All additional disk drives also function as general data storage devices.

The standard system configuration is defined as the system that is shipped from the factory when you specify a system part number with no options. This system includes the SMT and the system enclosure with either 4 or 16 megabytes of system memory, the system tape drive, and one or more disk drives, one of which contains the TI System V operating system.

Enclosure Features

1.2 The system enclosure includes two user-removable panels (front panel and main access panel) that provide access to various system components. The input power connector and all peripheral connectors, both standard and optional, are located at the rear of the enclosure. The following paragraphs describe the user-accessible enclosure features.

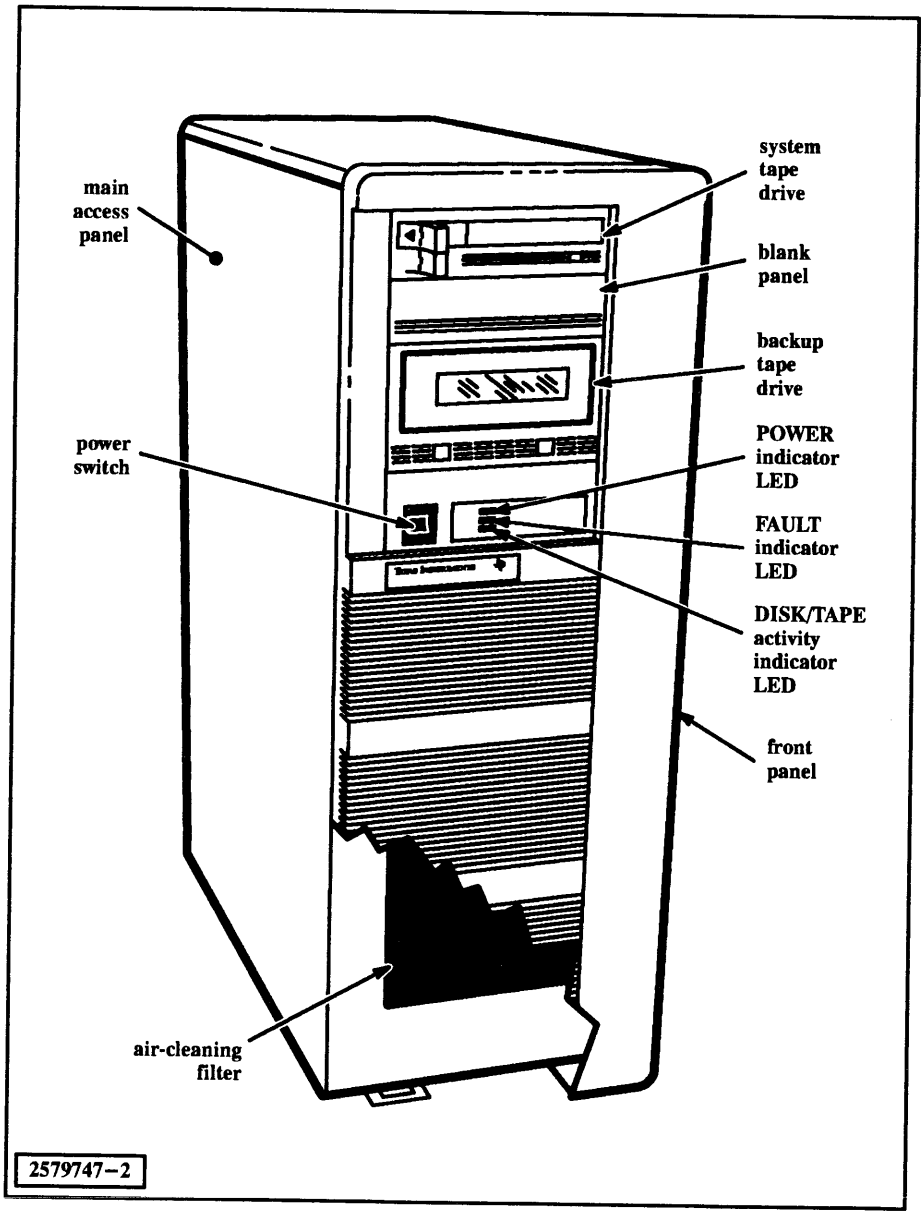
Front Panel

1.2.1 Figure 1-2 shows the system enclosure front panel and the main access panel. The front panel provides access to the system tape drive, the front panel LED assembly, and the air-cleaning filter. The main access panel provides access to the internal components of the system enclosure, including the user-installable option items.

The front panel snaps into the front of the enclosure and can be removed by prying the top of the panel away from the enclosure. You must remove this panel before you can remove the main access panel or gain access to any of the following front panel components:

- Front panel LED assembly — Contains the following components:
  - Computer power switch — Lets you turn the ac line power on (position 1) or off (position 0).
  - POWER indicator LED (green) — Indicates that the computer power switch is on and that the computer is receiving ac line power.
  - FAULT indicator LED (yellow) — Indicates that some part of the system has failed the system self-test. This LED lights during self-test and, if there are no failures, turns off at self-test completion. (Other LEDs, visible through apertures in the rear panel, indicate which part of the system has failed the self-test.)
  - DISK/TAPE activity indicator LED (green) — Indicates that either a disk drive or a tape drive is currently participating in a data-transfer operation, or that a tape cartridge is positioned away from BOT (beginning of tape).

Figure 1-2 **Main Access Panel and User-Accessible Front Panel Components**



- Air-cleaning filter — Prevents dust and other sources of contamination from entering the computer through the air-intake vents. To ensure reliable operation of your computer, you must clean this filter periodically as described in Section 5 of this module.

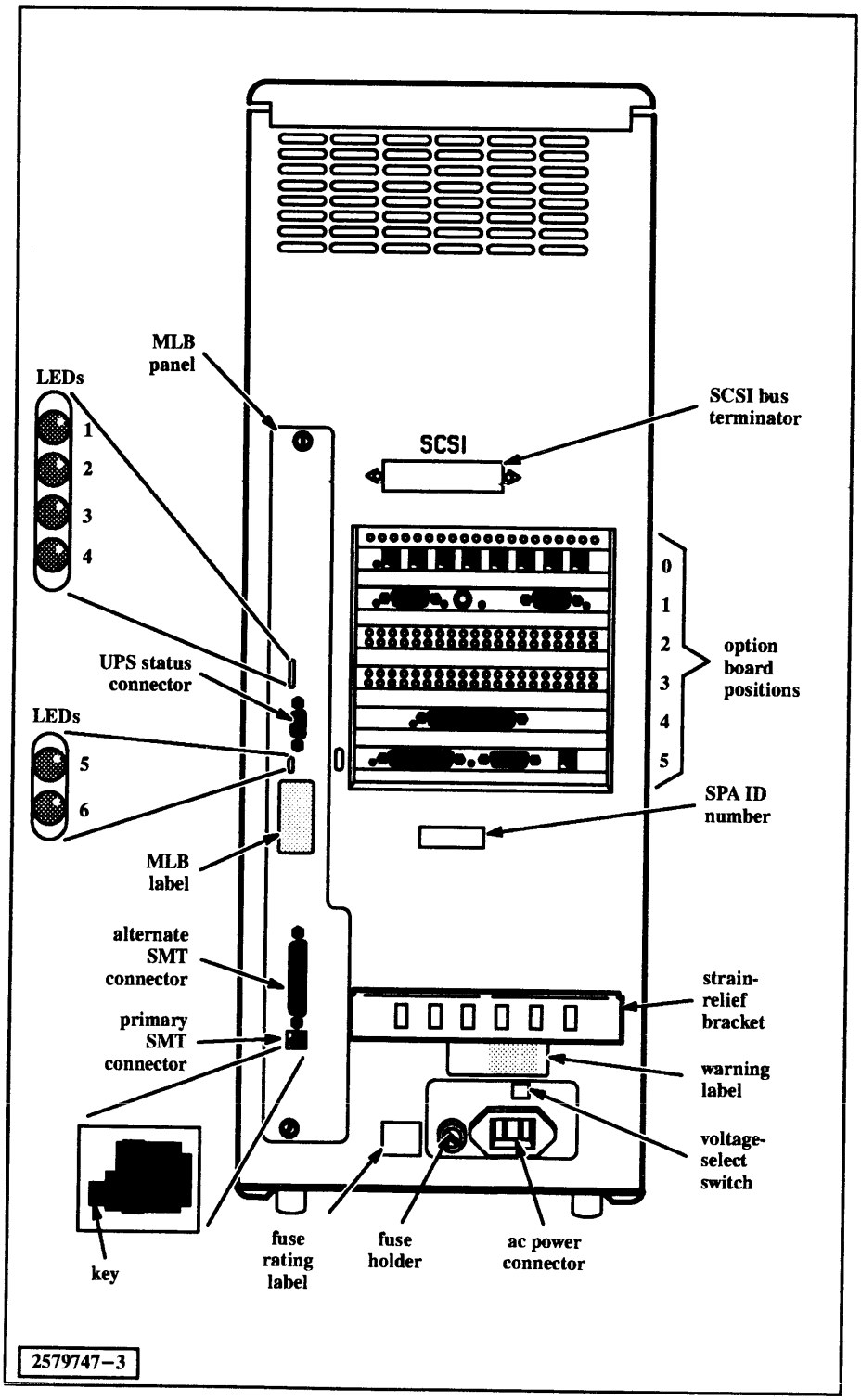
- System tape drive — Provides backup for the mass storage subsystem and a means of transporting data from one computer system to another. For tape drive preventive maintenance procedures, refer to the module entitled SCSI Mass Storage Devices in this manual.

Rear Panel

1.2.2 Figure 1-3 shows a rear view of the system enclosure. The following user-accessible components are located on the rear of the computer:

- SCSI bus terminator — Provides termination for the internal SCSI bus. When you install external SCSI devices, you must remove the terminator and replace it with a SCSI data cable to provide a connection between the external SCSI devices and the internal SCSI bus. A SCSI bus terminator must be installed at the end of the SCSI bus.
- MLB panel — Provides access to the SMT connectors, the optional UPS status connector, and the MLB indicator LEDs.
- UPS status connector — 9-pin, female, D-type connector that provides a status interface to the optional UPS. The UPS functions as a backup power source to maintain operation in case of a power failure. You can order a UPS from TI-EXPRESS by calling 1-800-TI-PARTS.
- Primary SMT connector — 6-pin modified modular jack (MMJ) connector that provides an interface to the SMT. The SMT allows the operator to communicate with the CPU to perform such administrative tasks as system initialization and executing extended system self-tests. (The inset of Figure 1-3 shows the configuration of the MMJ connector.)
- Alternate SMT connector — 25-pin, female D-type connector that provides an alternate interface to the SMT.
- Strain-relief bracket — Provides a means of dressing and securing cables connected to the communication option boards. Reusable cable ties, supplied with your system, let you tie the cables to holes in the bracket. This feature secures the cable connectors in a stable position, thus minimizing the possibility of them becoming loose.
- MLB indicator LEDs (1 through 6 of Figure 1-3) — Indicate the current status of the MLB and subsystems connected to the MLB. The MLB indicator LEDs (from top to bottom) are as follows:
  - LED 1 — SCSI power indicator (green). Indicates that the MLB is providing power, via a fuse on the MLB, to the mass storage devices on the SCSI bus.
  - LED 2 — SCSI bus fault (yellow). Indicates that the SCSI bus or a mass storage device on the SCSI bus has failed.
  - LED 3 — SCSI processor fault (red). Indicates that the SCSI processor on the MLB has failed.
  - LED 4 — Communication processor fault (red). Indicates that the MLB communication processor has failed the self-test.
  - LED 5 — CPU fault (red). Indicates that the CPU has failed.
  - LED 6 — Programmable interrupt timer (green). When lit, indicates proper performance of any software package in current use.

Figure 1-3 **User-Accessible Components on the Rear of the System Enclosure**



- SPA ID number — When the SPA is installed in the system enclosure, this number is visible through a slot beneath the option board slots.

- Fuse holder — Contains the ac line fuse. This fuse protects the computer and the installation site against any unusual overload conditions. The correct fuse rating depends upon the country or geographical location of your computer site. The correct fuse ratings appear on the rear of the system enclosure and are specified as follows:

  - Domestic (USA) model — 5-ampere, 250-volts, 3AG, TI part number 0416434-0001

  - International model — 3.15-ampere, 250-volt, 5.2-millimeter, time delay, TI part number 2220531-0006

  Each of these fuses requires a different fuse holder cap because of the difference in fuse diameter. Your computer is equipped at the factory with one of the following fuse holder caps:

  - Domestic model — 0.25-inch (6.35-mm) diameter, TI part number 2210402-0003

  - International model — 0.20-inch (5.2-mm) diameter, TI part number 2210402-0002

WARNING: An incorrect fuse value or an incorrect setting of the voltage-select switch can damage your computer or cause a possible fire hazard. Always replace the ac line fuse with one of exactly the same rating as the original, and ensure that the voltage-select switch is set to the proper voltage.

- Voltage-select switch — Lets you choose 120-volt ac operation for the domestic model or 220-volt ac operation for the international model. Slide the switch to the left for 120-volt operation or to the right for 220-volt operation. Also verify that the equipment has the proper fuse for the selected voltage, as described above.

- Ac power connector — Provides a three-wire grounded input connection for the ac power cord. One of the following power cords is shipped with your computer:

  - Domestic (USA) model — TI part number 0996289-0001

  - International model — TI part number 2210558-0001

CAUTION: If an emergency situation requires that the computer be disconnected from the ac power source, disconnect the ac power cord from the rear of the system enclosure by pulling it straight out.

WARNING: If it becomes necessary to replace the ac power cord with a different type or to select an ac power cord for use with a domestic 220-volt ac power source, observe the following precautions:

- **For units set for 120-volt ac operation, use an Underwriters Laboratories (UL) listed cord set consisting of type SVT or SJT three-conductor cord with a wire size of at least 18 AWG (American Wire Gauge) and a maximum length of 15 feet (4.57 meters). The cord must be equipped with an ac plug that has a parallel-blade ground connection and is rated at 15 amperes, 125 volts.**

- **For units set for 220-volt domestic operation, use a UL listed cord set consisting of type SVT or SJT three-conductor cord with a wire size of at least 18 AWG and a maximum length of 15 feet (4.57 meters). The cord must be equipped with an ac plug that has a tandem-blade ground connection and is rated at 15 amperes, 250 volts.**

- **For units set for 220-volt international operation, use a UL listed cord set with a wire size of at least 18 AWG. The cord must be equipped with an ac plug that has a ground connection rated at 15 amperes, 250 volts. This cord set must be marked "HAR" and have the appropriate safety approvals for the country or geographic location in which the equipment is to be installed.**

A Word About LEDs

1.2.3 The various LEDs incorporated in your computer aid you and your service representatives in determining whether your computer is functioning properly. They also serve as troubleshooting aids if problems occur. In general, these LEDs can be interpreted as follows:

- Green LEDs — Indicate that some part or feature of the computer is functioning normally. If a green LED fails to light when it should, reboot your system. If the LED still does not light, contact your service representative. (Parahraph 5.2 of this module explains how to boot your system.)

- Yellow LEDs — Indicate that some part of the computer is executing the self-test or has failed the self-test. These LEDs should light at power-up and remain on until the self-test completes. Failure of an LED to extinguish at self-test completion indicates that the part of the computer associated with that LED has failed. You may still be able to operate your computer but with limited capabilities.

- Red LEDs — Indicate that some part of the computer has failed or is performing the self-test. You should not attempt further operation until the fault is corrected. Contact your service representative for assistance.

Typical System Configurations

1.3 A wide range of available options allow you to choose from a variety of configurations or to customize your system to suit your particular application. If you specify these options when you purchase your computer, they are installed at the factory. If you add these options at a later date, you may choose to install them yourself or arrange for TI to install them for you.

If you prefer to have TI install your options rather than installing them yourself, contact the Field Service Communications Center at toll-free telephone number 1-800-572-3300 to schedule the installation. You need to furnish the following information:

- The system serial number from the label on the back of your system enclosure
- Your name and the name of your company
- Your company street address, city, state, and zip code and any special directions for finding the location
- The name and telephone number of the person to contact
- The purchase order number of the options to be installed

The following paragraphs describe the basic computer system and some possible uses of available options to expand your system.

The Basic Computer System

1.3.1 Figure 1-4 shows a block diagram of a basic computer system. The basic system consists of a system enclosure with its standard components and an SMT consisting of a keyboard for operator input to the computer and a visual display unit to display computer output. The system enclosure contains the following standard, factory-installed components:

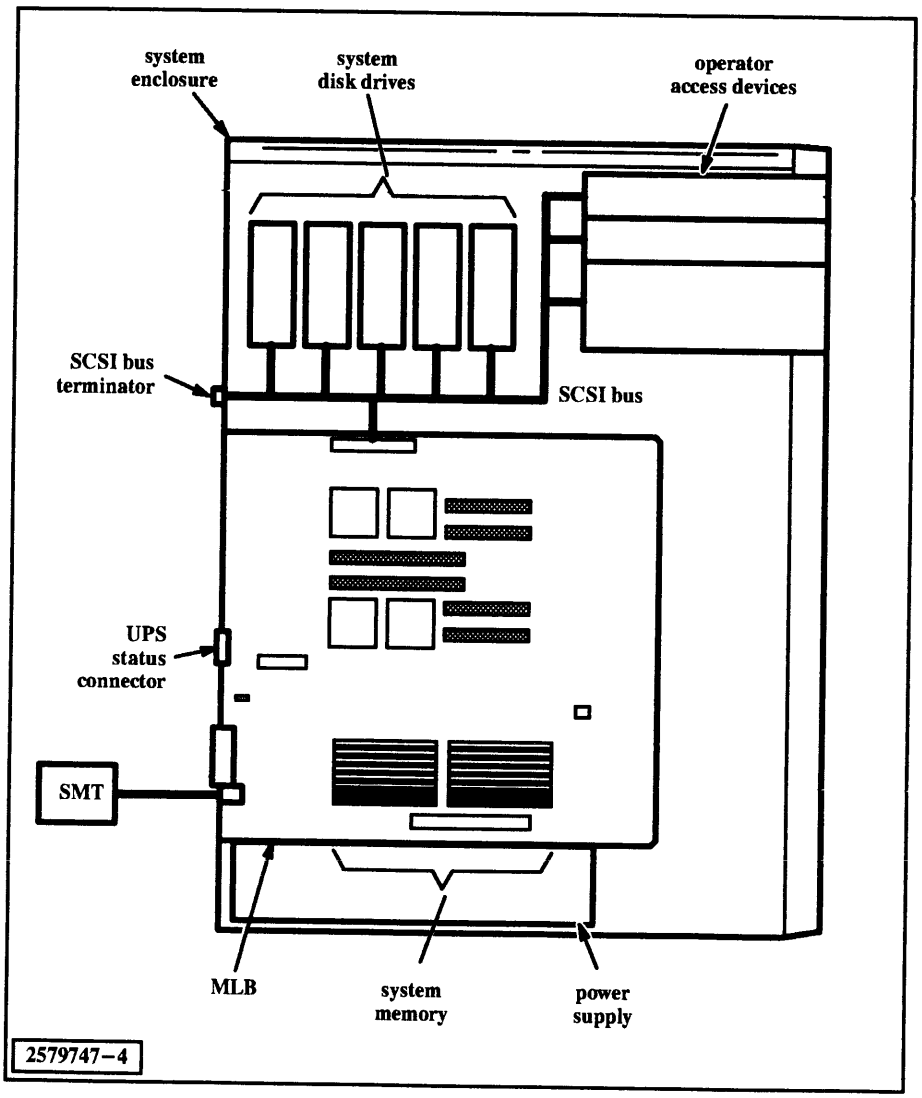
- MLB — Provides the basic elements of the basic computer system including the factory- installed dynamic random-access memory (DRAM), the option connectors for installing the communication option boards, the SMT connectors, the optional UPS status connector, and the SPA. It also contains 12 optional SIMM connectors for expanding the system memory.
- SCSI bus — Provides an interface between the MLB SCSI processor and the system mass storage devices.
- System disk drive — Contains the TI System V operating system and provides general data storage for the system. TI offers a choice of disk drives, including any of those described in the module entitled SCSI Mass Storage Devices in this manual.

  Other disk drives may be offered at a future date. When purchasing a computer system, the customer specifies the disk drive to be installed.

- System tape drive — A SCSI cartridge tape drive that provides backup for the system disk drive and allows data to be transported to and from the computer via a tape cartridge.

NOTE: The module entitled SCSI Mass Storage Devices in this manual provides detailed information about the SCSI disk drives and tape drives.

Figure 1-4 **Basic Computer System**



The basic computer system also includes the following components that are external to the system enclosure:

- SMT — The MLB provides both a primary MMJ connector and an alternate 25-pin D-type connector to support VDTs having either of these type connectors. TI offers a choice of either of the following VDT kits for use with your computer:
  - TI Model 928 — TI part number 2563684-0001. This terminal provides both an EIA-232 (Eelectronic Industries Association) serial interface connector and an MMJ interface connector for connecting the terminal to the computer.
  - TI Model 924 — TI part number 2539024-0001. This terminal provides an EIA-232 interface connector for connecting the terminal to the computer.

  The basic computer system includes a cable with MMJs at each end for connecting the TI Model 928 VDT to the computer. If you purchase a TI Model 924 VDT, you must provide the proper cable. The Model 924 VDT and the Model 928 VDT both provide an interface connector for an auxiliary printer. For more information about the VDTs and the interconnecting cables, refer to the manual entitled *Terminal/Printer Information*, TI part number 2557939-0001. For a list of TI printers and printer cables, see the module entitled Kits and Components in the *Kits and Components Information* manual, TI part number 2571639-0001.
- SCSI bus terminator — Must be connected to ensure proper operation of the SCSI bus. The SCSI subsystem can be expanded by removing the terminator and adding external disk drives in MSU IIA mass storage enclosures or the System 1500 Series Mass Storage Tower. The manuals entitled *Mass Storage Unit (MSU IIA) Installation and Operation*, TI part number 2557935-0001, and the *System 1500 Series Mass Storage Tower Installation and Operation*, TI part number 2579752-0001, describe these mass storage enclosures.

An 8-User System

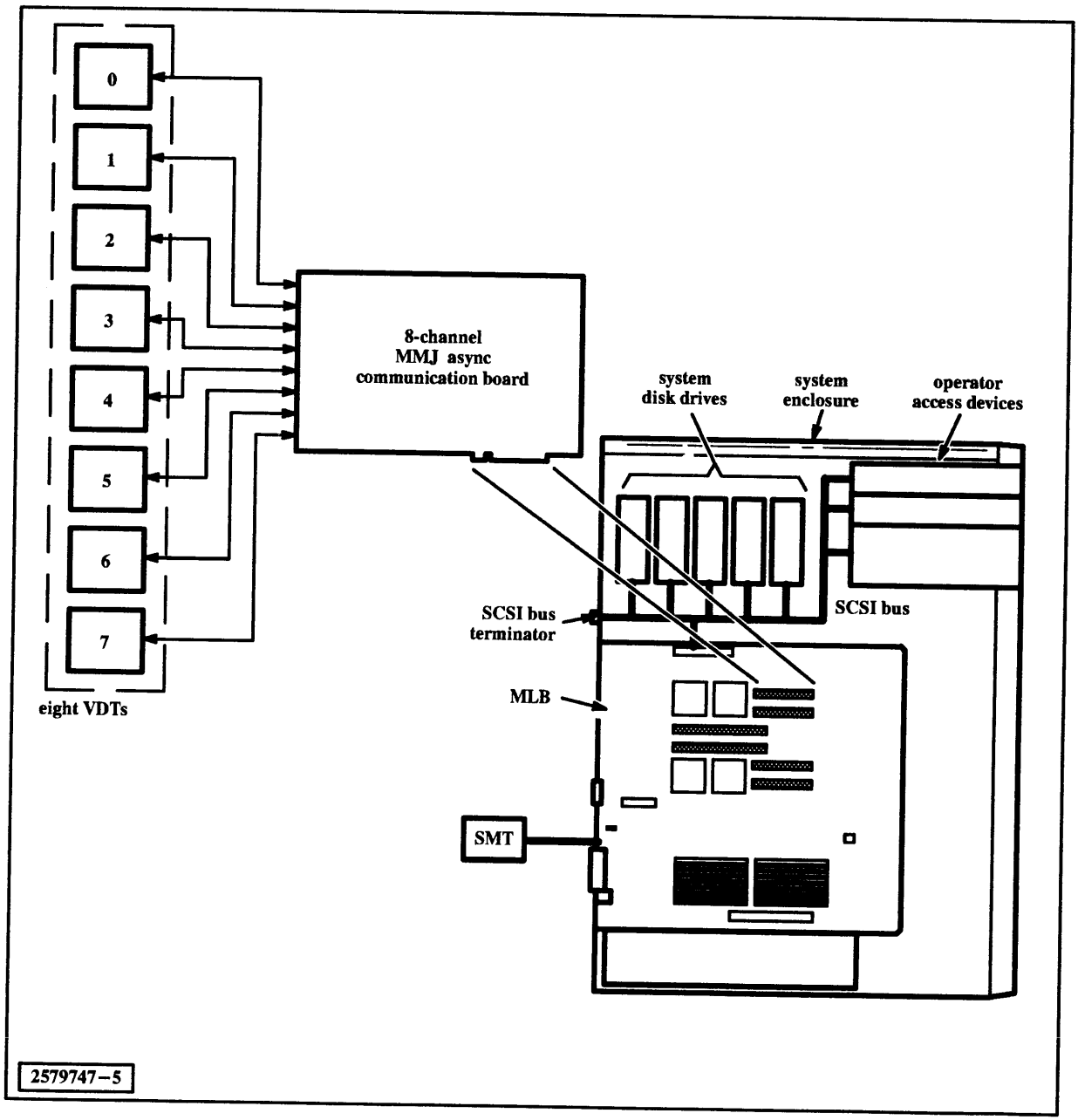
1.3.2 Figure 1-5 shows a block diagram of a typical 8-user system. This example system uses an 8-channel MMJ asynchronous (async) communication board to connect and support eight VDTs. In addition to the components of the basic system listed in paragraph Figure 1-5, this system includes the following components:

- CC801 8-channel MMJ async communication kit, TI part number 2561357-0002, installed in the computer.

NOTE: For detailed information about the communication option boards, refer to the module entitled SBC Option Boards in this manual.

- Eight user terminals (TI Model 928 or 924 VDTs) with the appropriate interface cables in addition to the SMT. These terminals can be either mixed or all of the same type.

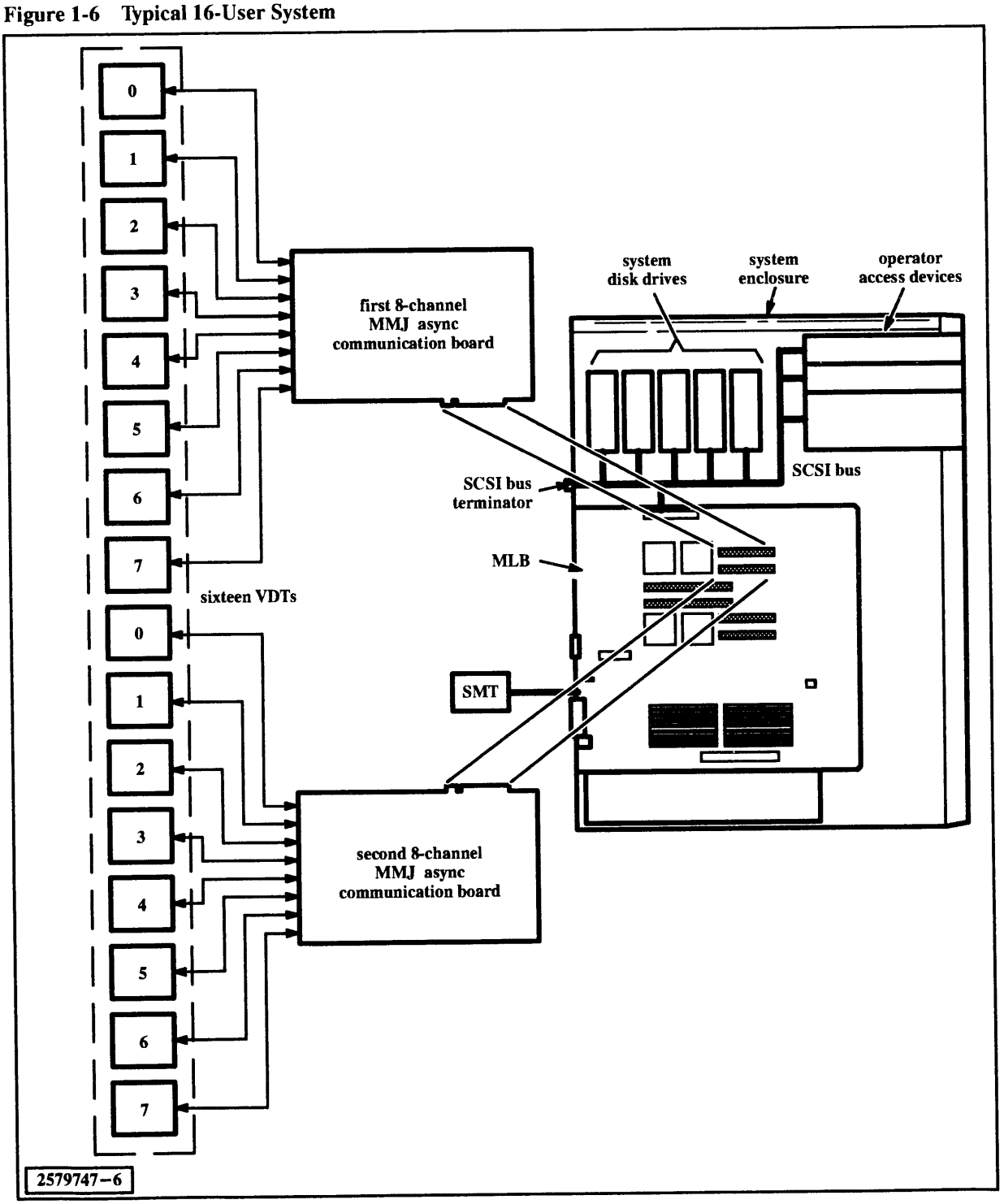
Figure 1-5 Typical 8-User System



A 16-User System

1.3.3 Figure 1-6 shows a block diagram of a typical 16-user system. This example system uses two 8-channel MMJ async communication boards to connect and support sixteen VDTs. A 4-megabyte memory expansion kit, TI part number 2561354-0002, has also been added to expand the system memory to 8 megabytes. This expansion may be necessary to provide sufficient memory to handle the added users, depending upon the tasks being run.

Figure 1-6 Typical 16-User System



Expanding Your System User Capability

1.3.4 The multidrop communication board provides a connection for one or more multidrop terminal concentrators (MTCs). Each of these MTCs can support eight terminals. Thus, you can expand your system to accommodate 32, 64, or 128 user terminals by installing a mutidrop communication option board and connecting the appropriate number of MTCs. The module entitled SBC Option Boards in this manual describes the multidrop communication option board and provides information about connecting the multidrop subsystem.

Enclosure Specifications

1.4 Table 1-1 lists the physical dimensions, mounting requirements, environmental requirements, and power requirements of the system enclosure. The environmental requirements also apply to any devices and components installed within the system enclosure.

Table 1-1 Enclosure Specifications

Item	Specification
Dimensions:	Height — 63.5 cm (25.0 in) Width — 23.6 cm (9.3 in) Depth — 50.8 cm (20.0 in)
Weight (with full complement of drives)	38 kg (85 lbs) (approximate)
Temperature:	
Operating[1]:	50° to 104° F (10° to 40° C)
Nonoperating	−40° to 149° F (−40° to 65° C)
Relative humidity (noncondensing):	
Operating	8 to 80%
Nonoperating	5 to 95%
Altitude (operating and nonoperating)	−984 to 9842 ft (−300 to 3000 m)
Input power to power supply:	
Voltage range (domestic)	90 to 132 Vac
Voltage range (international)	180 to 264 Vac
Frequency	47 to 63 Hz
Power dissipation	300 W (maximum)
Output power from power supply:	
+5Vdc	22.5 A maximum, 6.0 A minimum
+12 Vdc	12 A peak, 8 A continuous
−12 Vdc	1.5 A maximum
EMI[2] conduction/radiation	FCC[3] level A and VDE[4] level A

Notes:

1 The operating requirements listed here are the absolute allowable ranges for the computer. The ideal operating environment is 65° to 75° F(18.3° to 23.9° C) at 50% relative humidity.

2 Electromagnetic interference.

3 Federal Communications Commission.

4 Verband Deutscher Electrotechniker (a West German regulatory organization).

SYSTEM 1505 AND SYSTEM 1507 MAIN LOGIC BOARDS

2

Introduction

2.1 The main logic boards (MLBs) provide processing and control interfcses to all major parts of the system, including the SMT, the mass storage subsystems, the front panel controls, and the optional communication boards. The MLBs also contain the system memory, the capacity of which depends upon the particular system configuration you order.

The System 1505 MLB

2.2 The System 1505 MLB (Figure 2-1) contains the CPU and all other elements necessary to form a basic computer system. Thus, the computer can be called a single-board computer (SBC). This SBC supports a single video display terminal (VDT), called the SMT, and the primary (internal) mass storage subsystem. This basic system can be expanded to support additional mass storage devices and multiple VDTs.

The System 1505 MLB Panel

2.2.1 With the System 1505 MLB installed in the system enclosure, its panel is accessible at the rear of the system enclosure. The panel contains the primary SMT connector, the alternate SMT connector, the UPS status connector, and six light-emitting diodes (LEDs) that provide system status indications. Section 1 describes these connectors and LEDs. The MLB panel also contains the following label that lists the System 1505 MLB part number and revision level, and indicates that the MLB contains a System 1505 processor:

S1505 PROCESSOR
2561080-0001 REV. ___

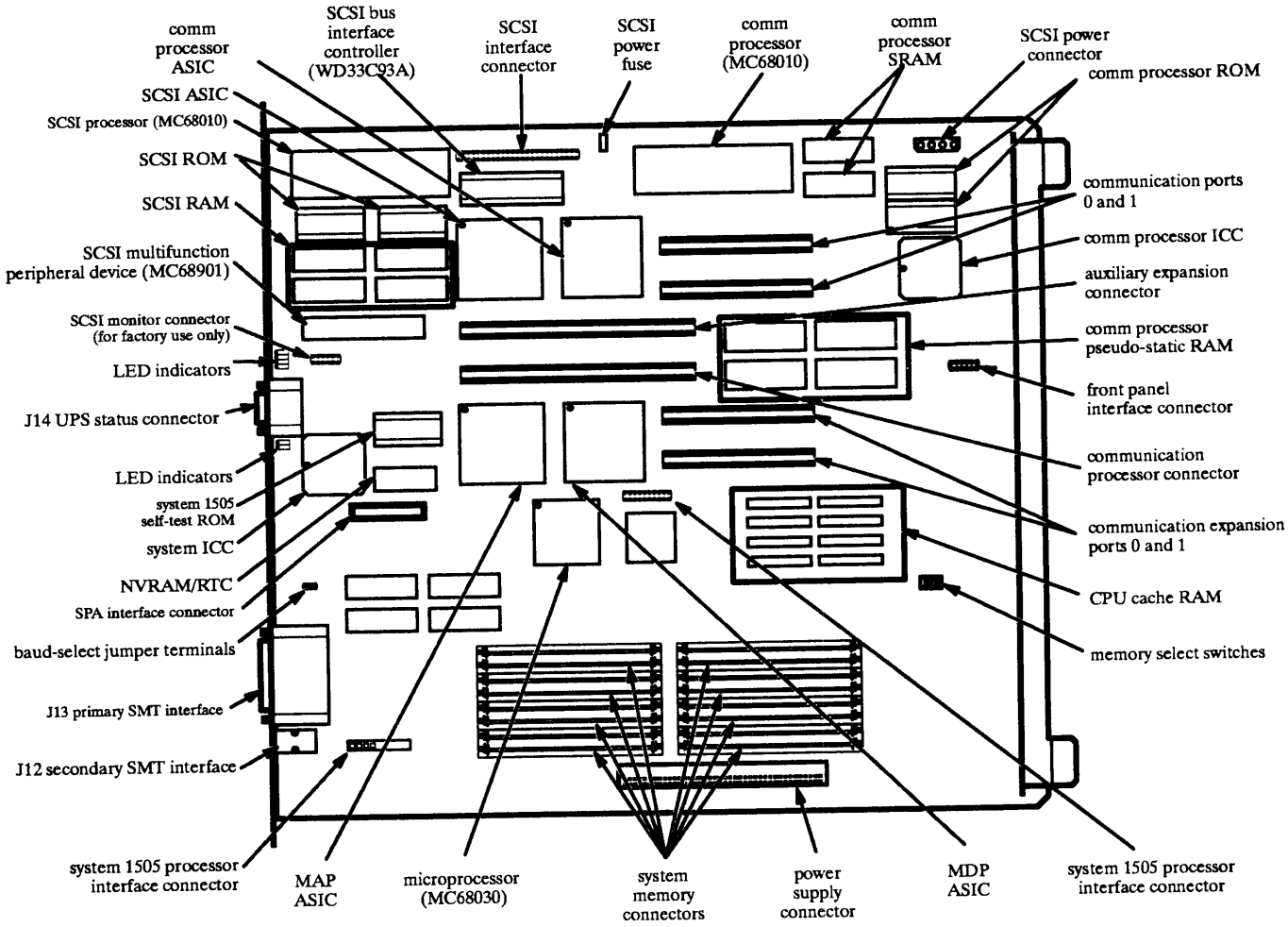
The System 1505 CPU

2.2.2 The System 1505 CPU consists of an MC68030 μP, the MC68882 floating-point coprocessor and all logic necessary to support the functions of these devices. Both the μP and the coprocessor operate at a clock speed of 25 megahertz. A direct-mapped 64-kilobyte cache memory provides the CPU with high-speed access to data and instructions. This cache memory is organized as 32 kilobytes of user cache and 32 kilobytes of supervisor cache to provide efficient context switching between application and operating system code.

System 1505 Self-Test ROM

2.2.3 The System 1505 self-test read-only memory (ROM) is a 64-kilobyte ROM device that contains system configuration data and the firmware instructions that control the system self-test functions. These firmware instructions are compatible with the MC68030 μP and they are executed automatically at system power-up.

Figure 2-1 System 1505 Computer Main Logic Board



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The System 1507 MLB

2.3 The System 1507 MLB (Figure 2-2) contains the CPU and all other elements necessary to form a basic computer system. Thus, the computer can be called a single-board computer (SBC). This SBC supports a single video display terminal (VDT), called the SMT, and the primary (internal) mass storage subsystem. This basic system can be expanded to support additional mass storage devices and multiple VDTs.

The System 1507 MLB Panel

2.3.1 The System 1507 MLB panel is identical to that of the System 1505, except for the processor label. The System 1507 MLB panel contains the following label that lists the System 1507 MLB part number and revision level, and indicates that the MLB contains a System 1507 processor:

S1507 PROCESSOR
2571396-0001 REV. ___

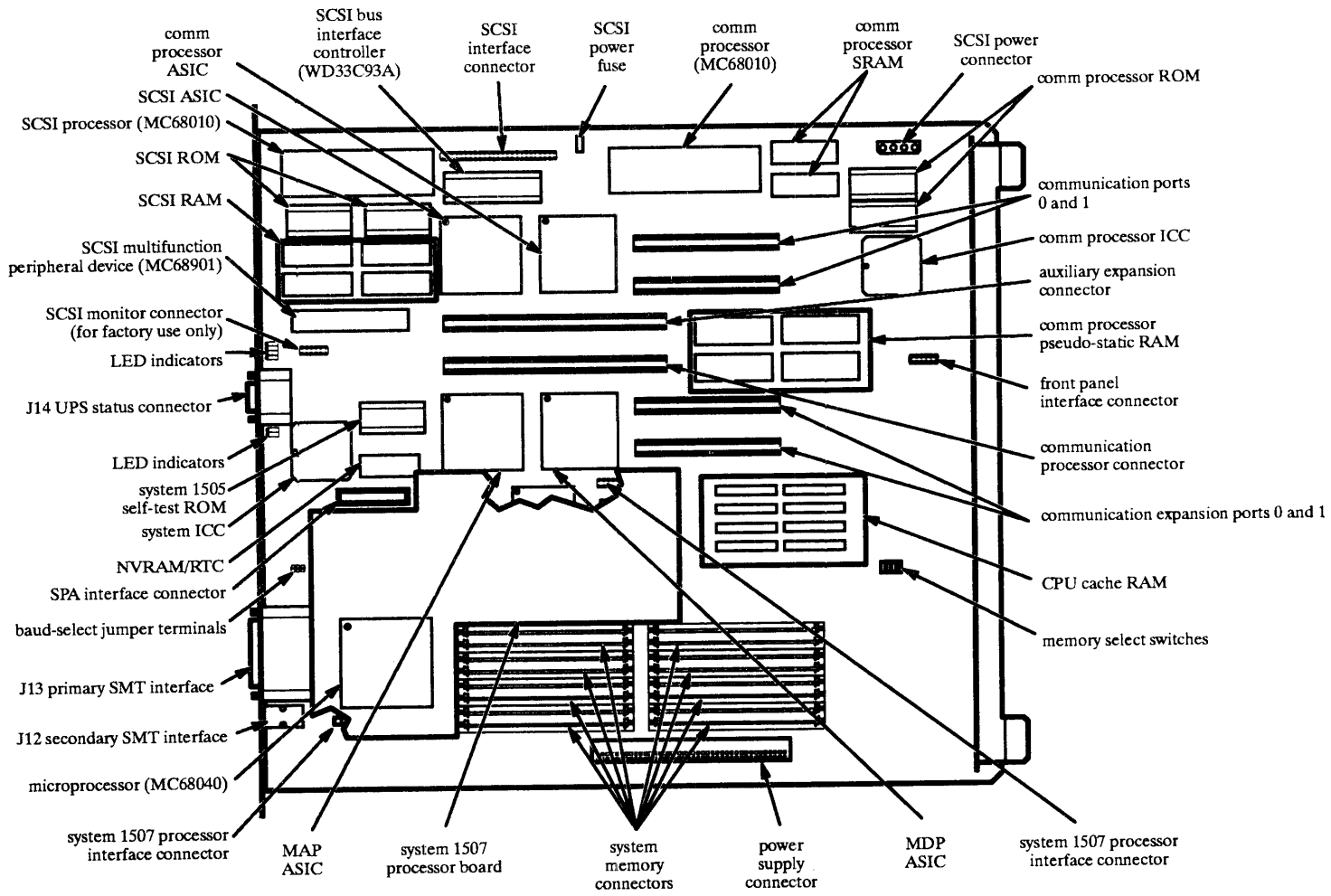
The System 1507 CPU

2.3.2 The System 1507 CPU is identical to the System 1505 CPU except that it incorporates a special board that replaces the MC68030 μP and MC68882 floating-point coprocessor with a single MC68040 μP. The MC68040 μP is a greatly enhanced member of the MC68000 family of microprocessors that integrates the functions of the microprocessor and the coprocessor into a single chip. This and other enhancements to the internal architecture and firmware implementation make the MC68040 much faster and more powerful than the earlier MC68030.

System 1507 Self-Test ROM

2.3.3 The System 1507 self-test ROM is a 64-kilobyte ROM device identical to that of the System 1505 except that its firmware instructions were written specifically for use with the MC68040 μP.

Figure 2-2 System 1507 Computer Main Logic Board



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Common MLB Features

2.4 Both the System 1505 and the System 1507 MLBs provide identical functions and, therefore, have many features in common. Both MLBs incorporate several application-specific integrated circuits (ASICs) that provide functionality superior to that achievable with conventional integrated circuits. Also, the ASICs reduce space requirements, thus making it possible to combine many standard functions on a single board (the MLB).

The following paragraphs provide general descriptions of the major system components, located on the MLB, that are common to the System 1505 and System 1507 computers.

System Memory

2.4.1 The basic system memory consists of either a 4-megabyte random-access memory (RAM) bank or a 16-megabyte RAM bank, depending upon the system part number specified by your purchase order. The 4-megabyte RAM bank consists of four 1-megabyte single-inline memory modules (SIMMs™) and the 16-megabyte RAM bank consists of four 4-megabyte SIMMs. A label near the top of the chassis rear panel indicates the type of SIMMs installed in your system.

Additional SIMM connectors on the MLB let you expand your memory by adding RAM expansion kits that are available from Texas Instruments. If your system contains 1-megabyte SIMMs, you can expand the total memory capacity to 16 megabytes in 4-megabyte increments. If your system contains 4-megabyte SIMMs, you can expand the total capacity to 64 megabytes in 16-megabyte increments. However, you cannot mix 1-megabyte SIMMs and 4-megabyte SIMMs in the same system.

Paragraph 2.5 provides information about the RAM expansion kits and a detailed description of the system memory organization.

Nonvolatile RAM and Real-Time Clock

2.4.2 The nonvolatile RAM (NVRAM) and real-time clock (RTC) device stores system configuration parameters for the MLB and provides date and time information for the operating system. This device has an internal battery that maintains its contents even in the absence of system power.

System Interrupt Controller Chip

2.4.3 The system interrupt controller chip (ICC) provides 112 individually vectored SBC bus-event interrupts and 6 on-board hardware interrupts.

System Memory ASICs

2.4.4 The memory address path (MAP) and memory data path (MDP) ASICs, provide an interface between the CPU local bus and the SBC bus. These ASICs also provide interfaces between the CPU local bus and the SMT port, the system memory, and an auxiliary bus. The auxiliary bus provides interfaces, via the MAP and MDP ASICs, between the CPU local bus and the system interrupt controller, the self-test ROM, the NVRAM and real-time clock, and the SPA.

SIMM is a trademark of Wang Laboratories

Communications Processor

2.4.5 The communication processor controls data transfer operations between the SBC bus and two communication ports (0 and 1), either of which can support any of a number of communication option boards. The communication processor includes the following major components:

- MC68010 μP — This microprocessor provides bus control, status, and data transfer operations for communication ports 0 and 1.
- Communication processor RAM — The processor RAM consists of a 512-kilobyte bank of multi-port pseudo-static RAM and a 64-kilobyte static RAM (SRAM) bank.

  The pseudo-static RAM is shared between the communication processor and option boards plugged into either or both of the communication ports, and arbitration logic allows any of these devices to access this RAM directly. The 64-kilobyte SRAM bank provides scratchpad memory, read/write data buffering, and downloaded command blocks, parameters, and operating software for the communication processor.
- Communication processor ROM — The communication processor ROM is a 64-kilobyte ROM bank that stores the communication processor firmware, self-test code, and configuration data.
- Communication processor ICC — The communication processor ICC provides programmable event and interrupt handling for the communication processor. This ICC encodes and prioritizes events generated by the communication processor and devices connected to communication ports 0 and 1.
- Communication processor ASIC — The communication processor ASIC provides an interface between the SBC bus and the communication processor bus. This ASIC includes miscellaneous timers and registers, and a hardwired initialization input provides the communication processor SBC bus identification (ID).
- Communication port connectors 0 and 1 — These port connectors can accommodate any of the communication option boards described in the module entitled SBC Option Boards in this manual.

The communication processor connector accepts an optional communication processor, which duplicates the functions of the on-board communication processor. With this board installed, the system can support two additional communication option boards in communication expansion ports 0 and 1.

Small Computer System Interface Processor

2.4.6 The small computer system interface (SCSI) processor controls all data transfer operations between the SBC bus and a maximum of seven devices (tape drives and disk drives) in the mass storage subsystem. The SCSI processor includes the following devices:

- MC68010 μP — This processor provides bus control, status, and data transfer operations for the mass storage devices on the SCSI bus.
- MC68901 multi-function peripheral device — This device provides interrupt handling for the SCSI processor and the mass storage subsystem.

- WD33C93 SCSI bus interface controller — This controller supports both synchronous and asynchronous SCSI bus data transfer protocols.
- SCSI processor RAM — The SCSI processor RAM is a 128-kilobyte RAM bank that provides scratchpad memory, read/write data buffering, and downloaded command blocks, parameters, and operating software for the processor.
- SCSI processor ROM — The SCSI processor ROM is a 128-kilobyte ROM bank that stores the processor firmware. This firmware provides execution of mass storage operations invoked by command blocks from the CPU.
- SCSI processor ASIC — The SCSI processor ASIC provides an interface between the SBC bus and the SCSI processor bus. This ASIC includes a direct-memory access controller that handles data transfers between the WD33C93A SCSI bus interface controller and either system memory or the local SCSI processor memory.
- SCSI interface connector — The SCSI interface connector provides an interface to the mass storage subsystem via the internal SCSI bus. The internal SCSI bus provides a connection for a maximum of seven SCSI devices mounted in the system enclosure mass storage compartment. Paragraph 4.2.7 of this module provides a detailed description of the mass storage subsystem.

SPA Interface Connector

2.4.7 The software protection adapter (SPA) connects to the SPA interface connector.

The SPA prevents unauthorized use of protected software. When you purchase your computer, you are issued a unique password that matches a password embedded in both the SPA and the TI System V operating system. During system initialization, you enter this password to verify that the operating system is installed in a properly licensed computer.

Each SPA is labeled with a unique ID number. Any time you replace the SPA or need a new password, you must furnish this ID number and the original purchase order number. For more information about the SPA, refer to Section 5 of this module.

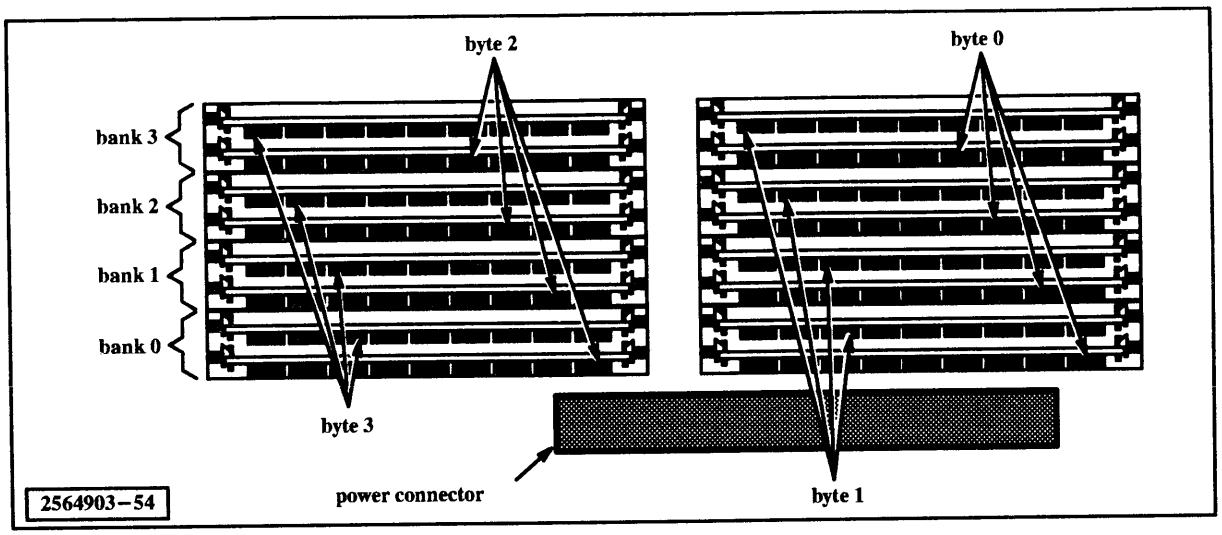
Miscellaneous Connectors and Indicators

2.4.8 The MLB contains a number of miscellaneous connectors and LED indicators that are not described in the foregoing paragraphs. These miscellaneous connectors and indicators are described in the description of the rear panel in Section 1.

System Memory Organization

2.5 Figure 2-3 shows the system memory organization. The memory is divided into four banks (0, 1, 2, and 3), each of which can accommodate either four 1-megabyte SIMMs or four 4-megabyte SIMMs. Bank 0 contains the standard, factory-installed memory that is supplied with your basic computer system.

Figure 2-3 System Memory Organization



Banks 1 through 3 are expansion banks which allow you to expand your memory by adding sets of four 1-megabyte or 4-megabyte SIMMs, depending upon whether you have a System 1505 or a System 1507 computer. These sets are available in the following kits:

- Factory-installed 4-megabyte SIMM kit, TI part number 2561354-0002, for the System 1505 computer. This kit contains four 1-megabyte SIMMs.
- Field-installable 4-megabyte SIMM kit, TI part number 2561354-0001, for the System 1505 computer. This kit contains four 1-megabyte SIMMs.
- Factory-installed 16-megabyte SIMM kit, TI part number 2571453-0002, for the System 1507 computer. This kit contains four 4-megabyte SIMMs.
- Field-installable 16-megabyte SIMM kit, TI part number 2571453-0001, for the System 1507 computer. This kit contains four 4-megabyte SIMMs.

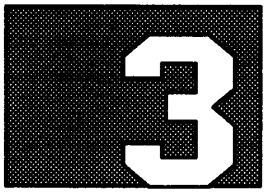
If you specify the factory-installed expansion kits on your original purchase order, they are installed at the factory. If you wish to expand your memory at a later date, you can order the field-installable kits from Texas Instruments.

Each memory bank is organized in 32-bit data words (usually called long words), each of which consists of four 8-bit data bytes (SIMMs). These are designated as byte 0, byte 1, byte 2, and byte 3, as shown in Figure 2-3. In addition to the eight bits that constitute a data byte, each SIMM has an additional bit that provides parity checking of the data integrity.

NOTE: Each memory bank has an associated configuration switch. To avoid memory errors during the power-up self-test or to ensure that your system uses all of the installed memory, these switches must be set to match the amount of memory installed. Paragraph 4.2.5 describes the switches and their relationship to the installed memory.

Paragraph 4.2.5 provides information about checking and expanding the memory configuration. Paragraph 5.2.3 provides information about memory errors and the parity-checking scheme. The *TI System V Administrator's Guide*, TI part number 2540539-0001, provides information about the handling of parity errors that are detected after the system is booted.

UNPACKING THE SYSTEM ENCLOSURE



Introduction

3.1 The system enclosure is shipped in a cardboard carton that also contains the documentation kit, and any optional and accessory items specified in the purchase order. This section provides information about receiving and unpacking your equipment.

WARNING: The system enclosure weighs approximately 38 kg (85 lbs). Attempting to lift or carry the system enclosure alone can result in personal injury. If you must lift or carry the enclosure, get someone to help you.

Receiving Your Equipment

3.2 Upon receiving your computer, perform the following procedures before unpacking the contents of the shipping container:

1. Visually inspect the shipping container for damage. If the shipping container is damaged, contact the carrier agent for instructions on filing a claim. The carrier, not Texas Instruments (TI), is responsible for damage during shipment.

2. If the shipping container has significant damage, contact the traffic department at the TI site that shipped the system. Resolve all problems relating to damage before proceeding with unpacking and installation.

3. Note on the delivery receipt or bill of lading any problems, damage, or shortages that you discover. (You can inventory items against the purchase order later when you unpack the containers.)

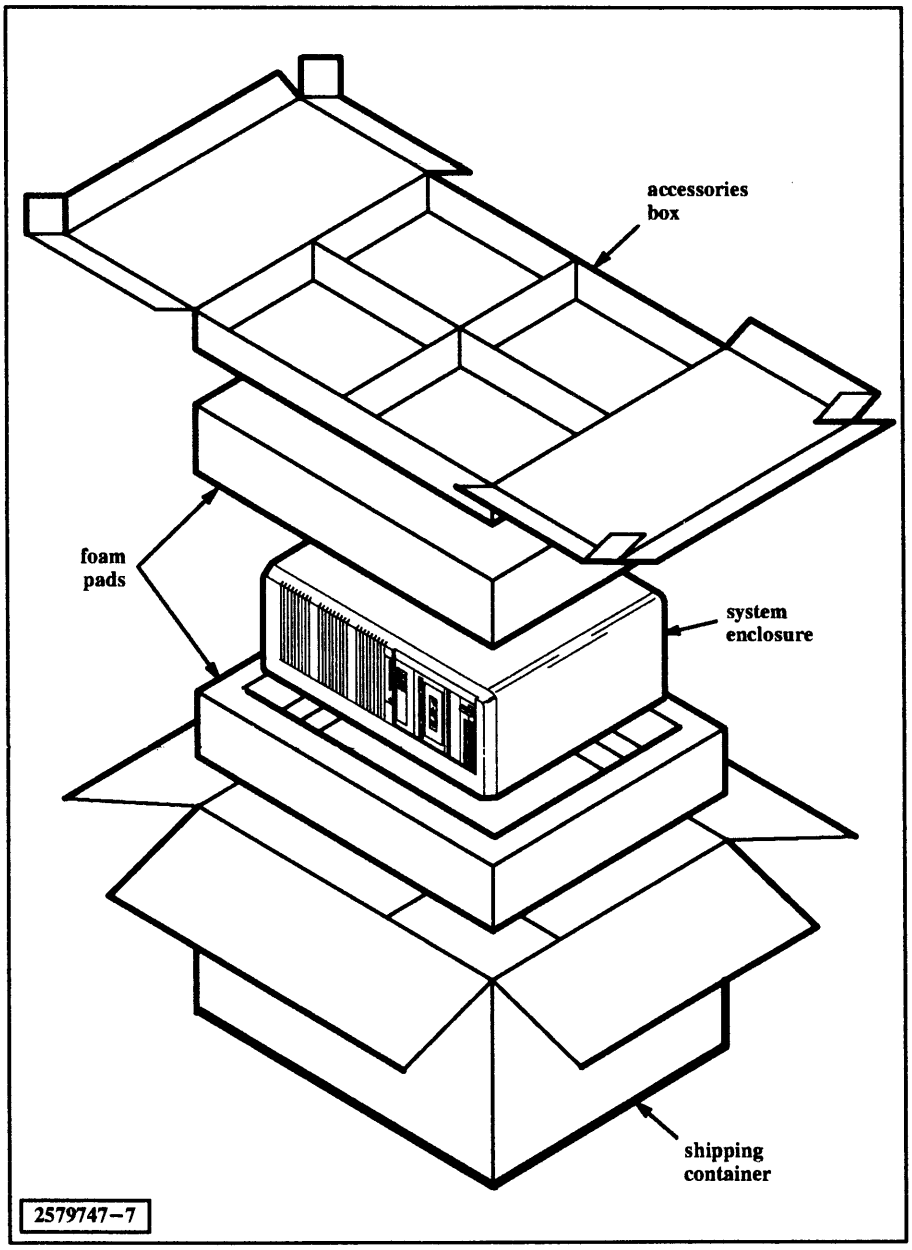
4. Make sure that the driver has signed the delivery receipt before leaving your site. You need to retain all containers, packing materials, and delivery receipts in the event shortages or damages are discovered upon opening the shipping container.

Unpacking the Enclosure

3.3 Figure 3-1 shows the contents of the shipping container. The enclosure fits between two foam cushions. These cushions protect the enclosure against damage and lend rigidity to the cardboard shipping container. An accessories box holds manuals, releasable cable ties, cables, and other accessories.

As you unpack the enclosure and other components, visually inspect each item for shipping damage. If the inspection reveals any significant damage, stop unpacking the system and contact the carrier agent. After the carrier agent inspects the damage, contact a TI field service office. Save all of the packing material until you finish taking an inventory of the shipment.

Figure 3-1 **Shipping Container Contents**



Use these steps to unpack the contents of the system enclosure shipping container:

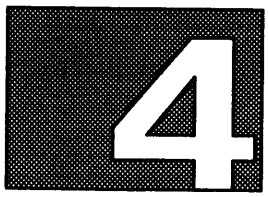
1. Carefully cut the tape that secures the top flaps of the shipping container.
2. Open the shipping container and remove the accessories box.
3. Open the accessories box and remove its contents. Inspect each item as you remove it to ensure that it has no visible damage. Ensure that the box contains the following items:
   - The documentation kit
   - The ac power cord
   - The SMT interface cable
   - Six releaseable cable ties
   - All other accessory items specified by the purchase order
4. Lift the top foam pad out of the shipping container.

WARNING: The following step requires a minimum of two people, due to the weight of the system enclosure. Use proper lifting techniques to avoid injury.

---

5. With one person on each side of the enclosure shipping container, carefully lift the enclosure from the container.
6. Remove the top foam cushion and then lift the enclosure out of the other foam cushion.
7. Set the system enclosure upright and move it to near its final installation location.

INSTALLING THE SYSTEM ENCLOSURE



Introduction

4.1 Your system enclosure is fully configured at the factory in accordance with your specifications at the time of purchase. Therefore, the installation procedure consists of verifying the hardware configuration, positioning the enclosure, and connecting peripheral devices. This section provides the installation procedures.

If you purchase memory expansion kits, disk drive update kits, or other field-installable options at a later date, you will need to install them yourself or arrange for TI to install them for you. To arrange for installation by TI, follow the procedure described in paragraph 1.3 of this module.

Verifying the Hardware Configuration

4.2 Verification of proper enclosure configuration includes checking the communication option boards, the system random-access memory (RAM), and the mass storage subsystem to ensure that these items comply with the specifications of your purchase order. To check these items, you need to remove the enclosure front panel and the main access panel.

The following paragraphs describe the procedures for removing these panels and checking the hardware configuration. If your system is not configured in accordance with your purchase order specifications, notify your computer supplier.

NOTE: Although it is not absolutely necessary to verify your hardware configuration, it is a good way to familiarize yourself with the computer system. If you choose not to actually perform the verification procedures, it is still a good idea to read the information in order to fully understand the system hardware architecture.

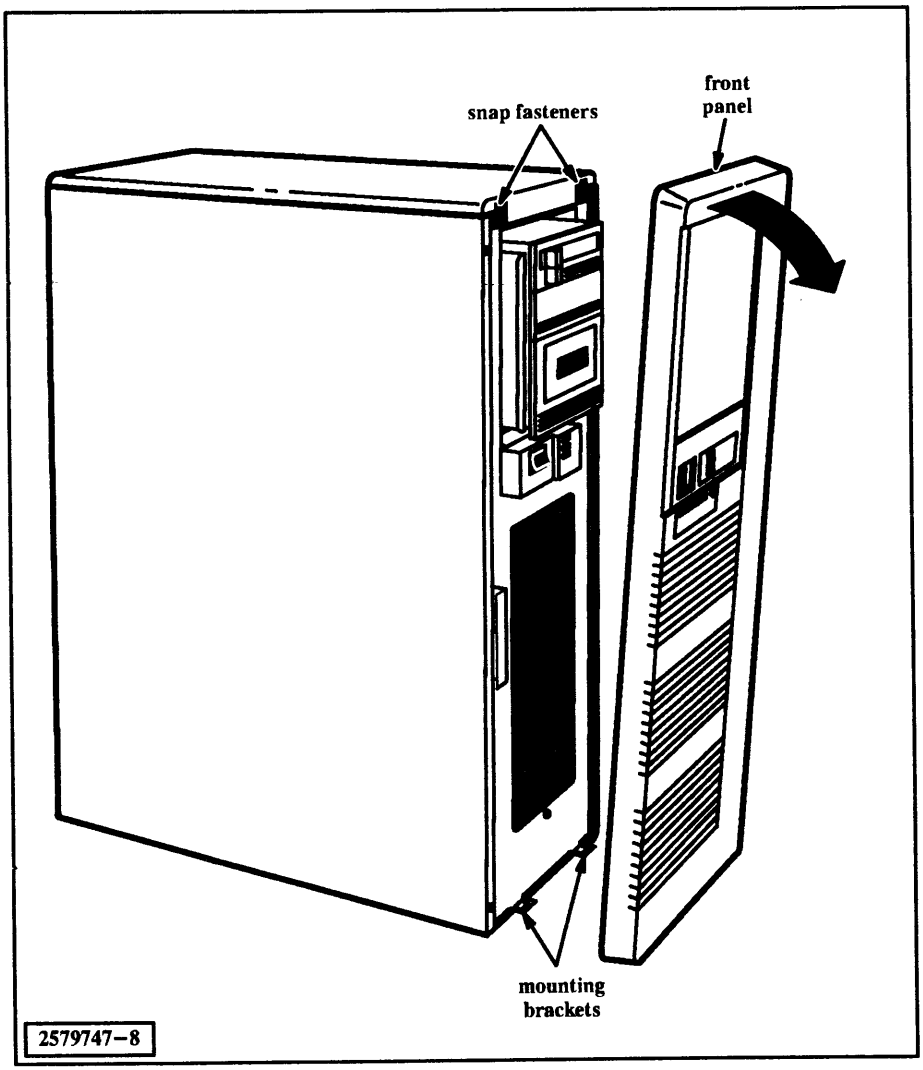
WARNING: Some of the procedures in this section require that you remove the front panel and main access panel. To avoid possible damage to the equipment or a possible shock hazard to personnel, always set the computer power switch to its off position and disconnect the ac power cord before performing these procedures.

CAUTION: All boards, options, and peripherals contain components that are sensitive to static electricity. When handling any of these items, protect against static electricity by using wrist grounding straps and grounded working mats. When moving or storing items, use the antistatic bags supplied with the items.

Removing the Enclosure Front Panel

4.2.1 Figure 4-1 shows how to remove the computer front panel. The panel is secured to the front of the enclosure by two snap fasteners near the top of the enclosure and two mounting brackets at the bottom. To remove the front panel, carefully pry the top of the panel away from the enclosure as shown by the arrow and lift the panel out of the mounting brackets. To reinstall the panel, reverse the procedure.

Figure 4-1 **Removing the Enclosure Front Panel**



Removing the Main Access Panel

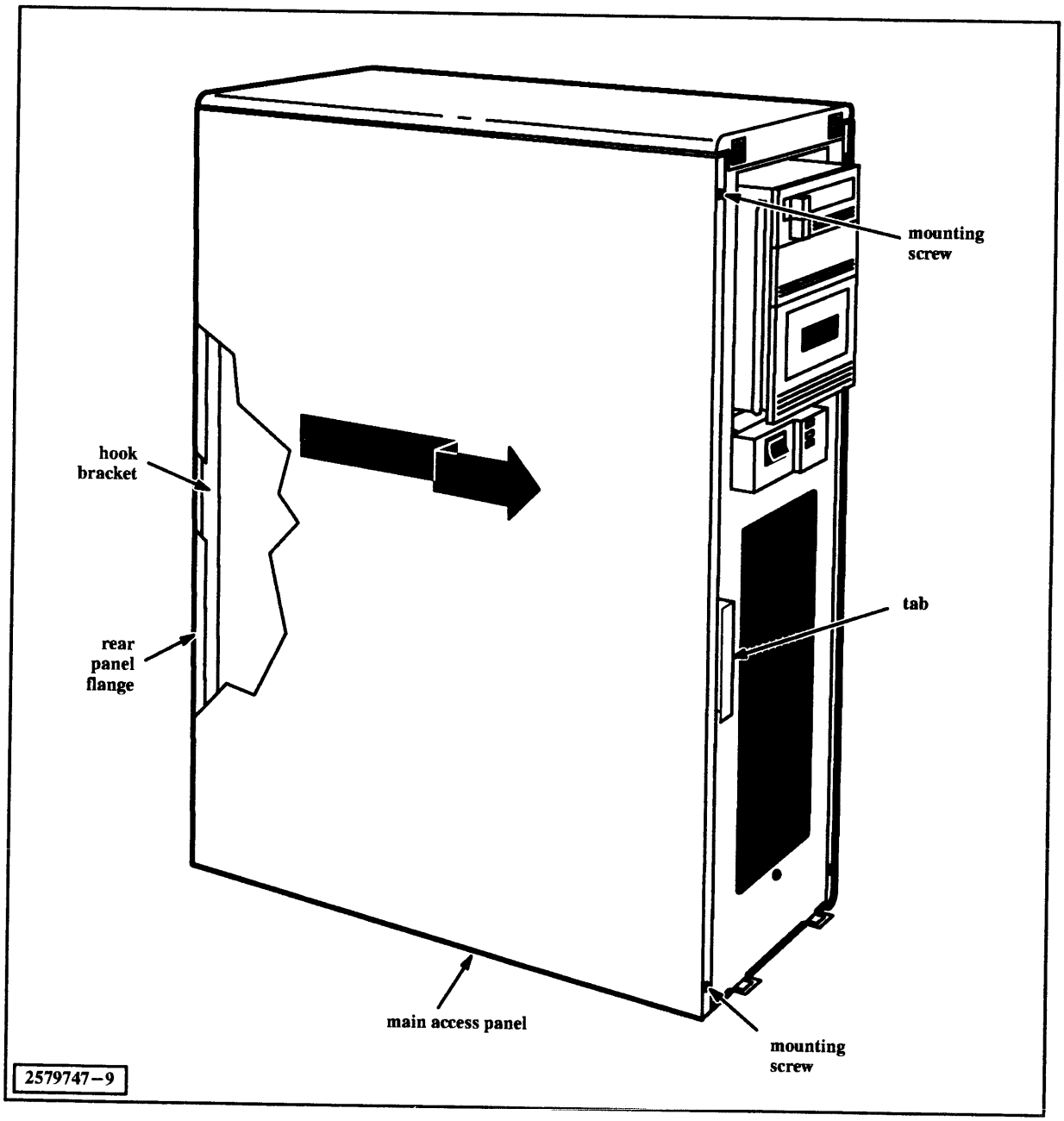
4.2.2 Figure 4-2 shows how to remove the main access (left side) panel. A hook bracket attached to the inside rear of the panel secures it to the rear panel flange. A tab at the front of the panel provides a convenient place to pull the main access panel from the enclosure. Two mounting screws secure the panel to the front of the enclosure. Use these steps to remove the main access panel:

1. Verify that the computer power switch is off and that the ac power cord is disconnected.

2. Remove the front panel as described in paragraph 4.2.1.

3. Remove the two main access panel mounting screws.
4. Slide the panel forward approximately one inch and lift it away from the enclosure as shown by the heavy black arrow.
5. To reinstall the main access panel, follow the removal steps in reverse.

Figure 4-2 Removing the Main Access Panel



Option Board Positions

4.2.3 The computer contains six option board positions numbered (from top to bottom) 0 through 5. The option board positions are classified as follows:

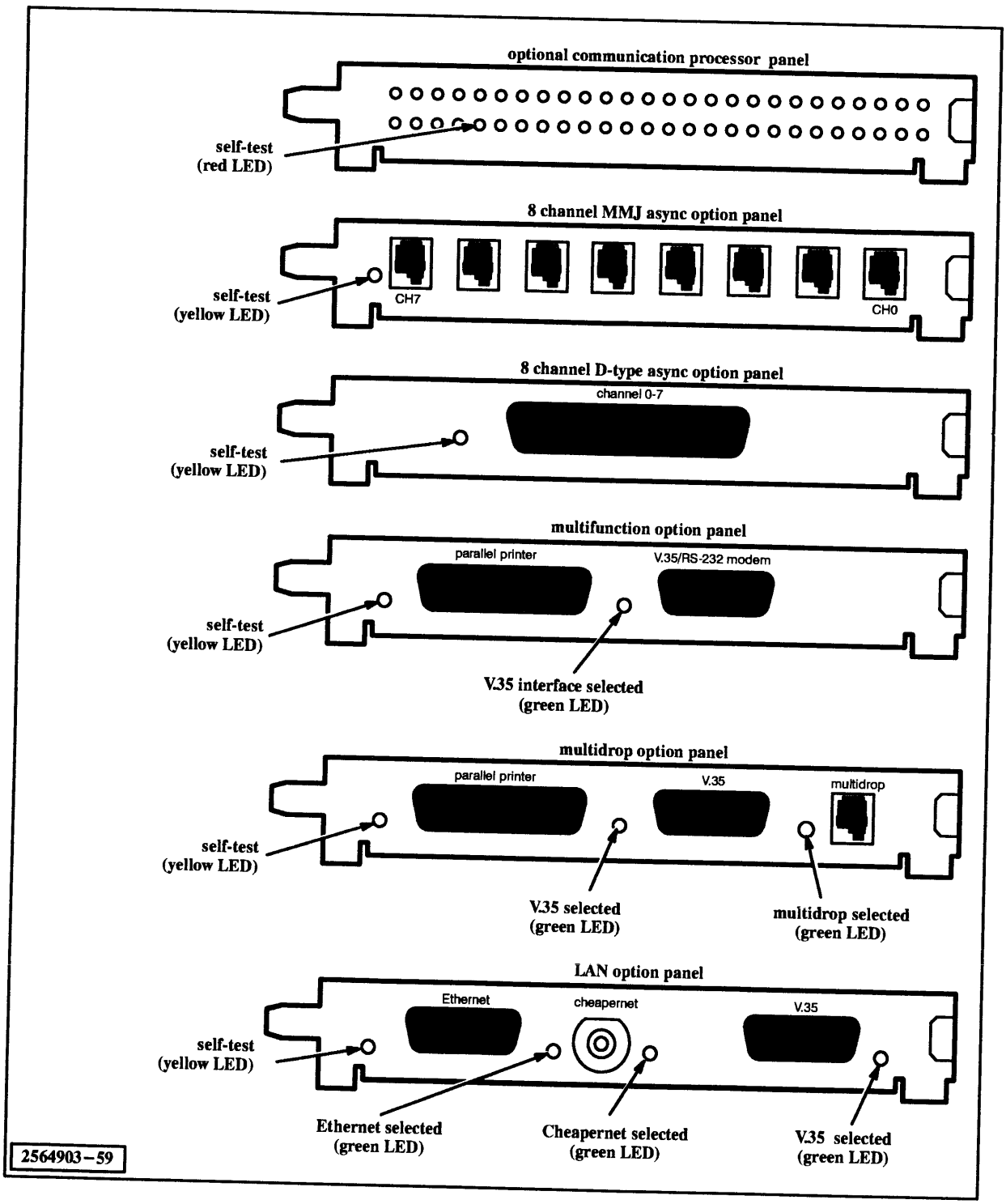
- Positions 0 and 1 — Communication ports 0 and 1, respectively. These positions are supported by the main logic board (MLB) communication processor and can accept any one of the communication option boards in this manual.
- Position 2 — Auxiliary expansion port. This position is reserved for future expansion.
- Position 3 — Communication expansion port. This position accepts an optional plug-in communication processor, functionally similar to the one built into the MLB. This optional communication processor supports option board positions 4 and 5 (expansion communication ports 0 and 1) and must be installed before communication option boards can be installed in those positions.
- Position 4 and 5 — Expansion ports 0 and 1. These positions are supported by the optional communication processor (when installed) in option board position 3 and can accept any one of the available communication option boards described in the module entitled SBC Option Boards in this manual.

Checking the Option Board Configuration

4.2.4 Figure 4-3 shows the communication option board panels. Each of these boards has a unique panel that is visible at the rear of the computer after the board is installed. Check the option panels to ensure that the boards specified by your purchase order have been installed.

NOTE: If your system includes a local area network (LAN) communication board, it is normally configured at the factory for Cheapernet operation. The module entitled SBC Option Boards in this manual provides detailed information about the communication option boards and instructions for installing them in your system enclosure.

Figure 4-3 Communication Option Board Panels



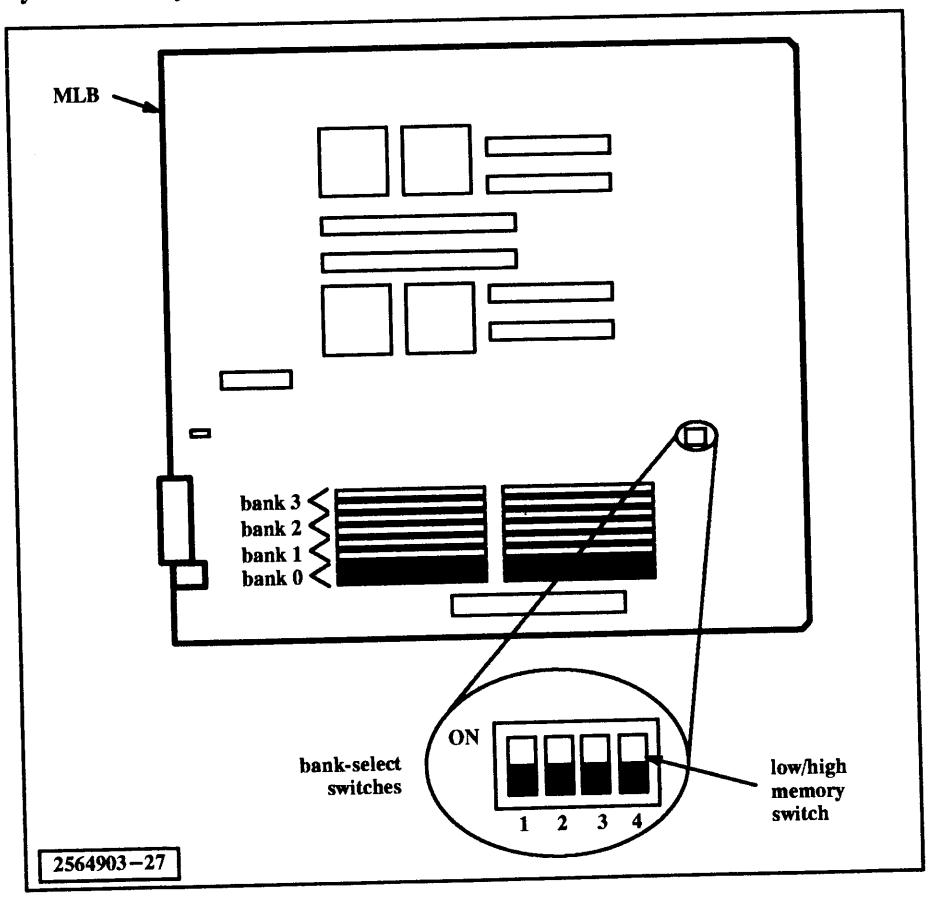
Checking and Expanding the System RAM Configuration

4.2.5 Figure 4-4 shows the system memory area on the computer MLB. The system memory contains four memory banks (0 through 3), each of which consists of four printed wiring board (PWB) connectors. Each of these connectors can accommodate one 1-megabyte single inline memory module (SIMM) or one 4-megabyte SIMM for a total capacity of either 4 megabytes or 16 megabytes per bank.

A low/high memory switch (switch 4 in Figure 4-4) must be set to the appropriate position for the type of SIMMs you have installed. The appropriate settings are low (OFF, as shown) for 1-megabyte SIMMs and high (ON) for 4-megabyte SIMMs.

Each memory bank (except bank 0) also has an associated bank-select switch. These switches (1, 2, and 3 in Figure 4-4) allow you to activate a memory bank after its connectors are filled.

Figure 4-4 **System Memory**



The total memory for your system is the standard, factory-installed memory for the system you purchased plus any additional optional memory you specified at the time of purchase. Memory banks 1, 2, and 3 shown in Figure 4-4 are the banks for optional memory kits. Each of these kits contains either four 1-megabyte SIMMs or four 4-megabyte SIMMs. These kits are installed at the factory if they are specified on your original purchase order. However, you can also purchase field-installable kits that you or your service representative can install at a later

date. To verify that your system memory is configured in accordance with your purchase order, check the following items:

Memory banks 1, 2, and 3 shown in Figure 4-4 are the banks for optional memory kits. Each of these kits contains either four 1-megabyte SIMMs or four 4-megabyte SIMMs. These kits are installed at the factory if they are specified on your original purchase order. However, you can also purchase field-installable kits that you or your service representative can install at a later date. To verify that your system memory is configured in accordance with your purchase order, check the following items:

- Bank 0 — Contains either four 1-megabyte SIMMs or four 4-megabyte SIMMs, depending upon the system you purchased. These are the standard memory configurations. There are no bank-select switches associated with this bank.

- Bank 1 — If your purchase order specifies one memory expansion kit, bank 1 contains either four 1-megabyte SIMMs or four 4-megabyte SIMMs, depending upon the system you purchased. Bank-select switch 3 must be set to its ON position for these configurations.

- Bank 2 — If your purchase order specifies two memory expansion kits, banks 1 and 2 each contain either four 1-megabyte SIMMs or four 4-megabyte SIMMs, depending upon the system you purchased. Bank-select switches 2 and 3 must both be set to their ON positions for this configuration.

- Bank 3 — If your purchase order specifies three memory expansion kits, banks 2 and 3 each contain either four 1-megabyte SIMMs or four 4-megabyte SIMMs, depending upon the system you purchased. Bank-select switches 1, 2, and 3 must all be set to their ON positions for this configuration.

NOTE: For proper operation and full use of all your installed memory, the bank-select switch settings must match the amount of memory installed. If the switches are set for less memory than is installed, the system uses only the selected banks. However, if the switches are set for more memory than is installed, the system attempts to use the empty banks and returns parity errors for the missing memory.

The memory expansion kits specified in the foregoing descriptions are factory-installed kits. When you expand your system memory by adding system memory kits at a later date (see paragraph 4.2.5.1), you must use one of the following field-installable SIMM kits:

- Field-installable 4-megabyte SIMM kit, TI part number 2561354-0001, for the System 1505 computer.

- Field-installable 16-megabyte SIMM kit, TI part number 2571453-0001, for the System 1507 computer.

NOTE: You cannot mix the 4-megabyte and 16-megabyte SIMM kits. That is, if your system contains 1-megabyte SIMMs (a 4-megabyte SIMM kit) in bank 0, then you must also use 1-megabyte SIMMs for any additional memory you install. If your system contains 4-megabyte SIMMs (a 16-megabyte SIMM kit) in bank 0, then you must also use 4-megabyte SIMMs for any additional memory you install. Also, if you change the memory from one type SIMM kit to the other, be sure to check the position of the high/low memory switch (switch 4 of Figure 4-4).

Installing SIMMs

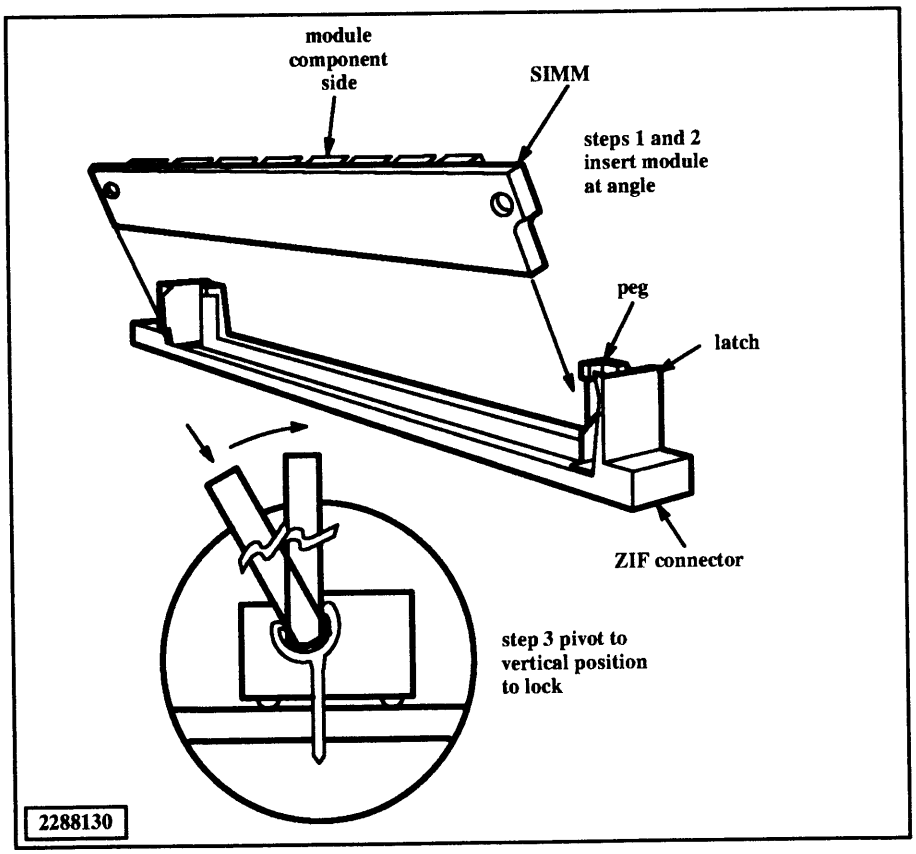
4.2.5.1 The memory expansion area on the MLB use special connectors called zero insertion force (ZIF) connectors. These connectors protect your SIMMs by allowing you to install them without the force required with ordinary plug-in connectors.

Follow these steps to install SIMMs in the ZIF connectors as shown in Figure 4-5:

1. Position the SIMM above the connector as shown in Figure 4-5, with the component side of the SIMM facing the pegs on the connector.

2. Insert the SIMM in the connector at approximately a 30-degree angle and apply pressure until the SIMM is fully seated.

Figure 4-5 **Installing a SIMM**



3. Rotate the top of the SIMM toward the connector until you hear a click. The SIMM is now locked securely into the connector.

After you add one or more memory expansion kits, you must clear the memory and issue a boot (BT) command as described in steps 7 and 8 of paragraph 5.2.3.2 in this module.

CAUTION: Do NOT use SIMMs from sources other than TI.

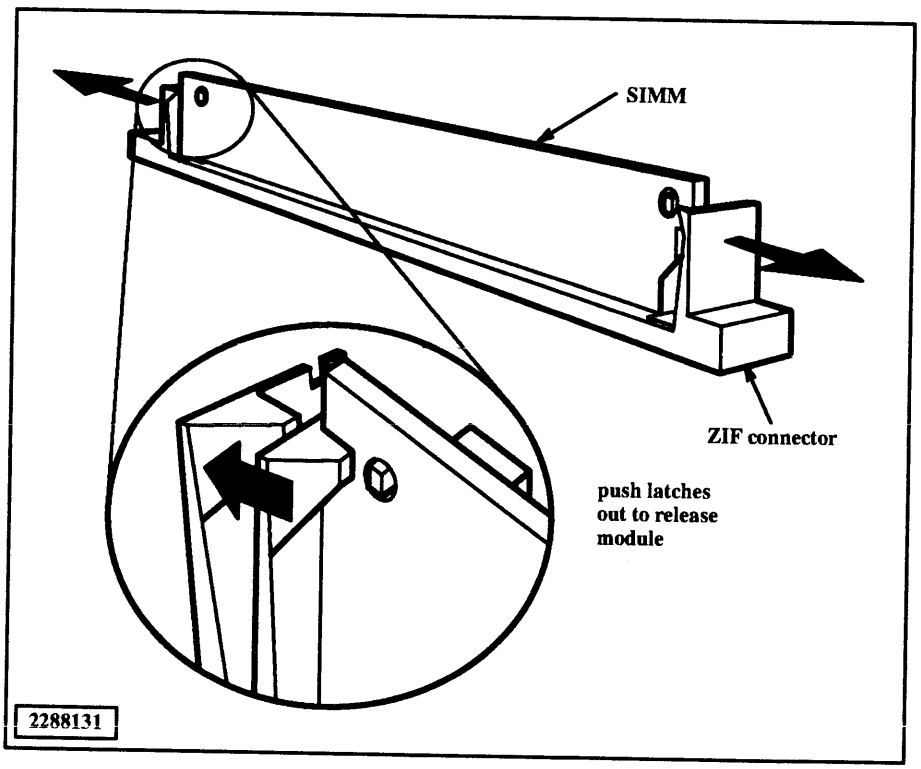
Removing SIMMs

4.2.5.2 Because of the close proximity of the ZIF connectors, any time you remove a SIMM you must first remove all the SIMMs above it in the same row. For example, if you remove the byte 0 SIMM in memory bank 3, you must first remove the byte 1 SIMM. Figure 4-6 shows how to remove a SIMM. Paragraph 2.4 of this module provides information about SIMM byte designation.

Follow these steps to remove a SIMM:

1. Apply outward pressure on both latches as shown in the inset of Figure 4-6.
2. Lift the SIMM out of the connector at approximately a 30-degree angle.

Figure 4-6 **Removing a SIMM**

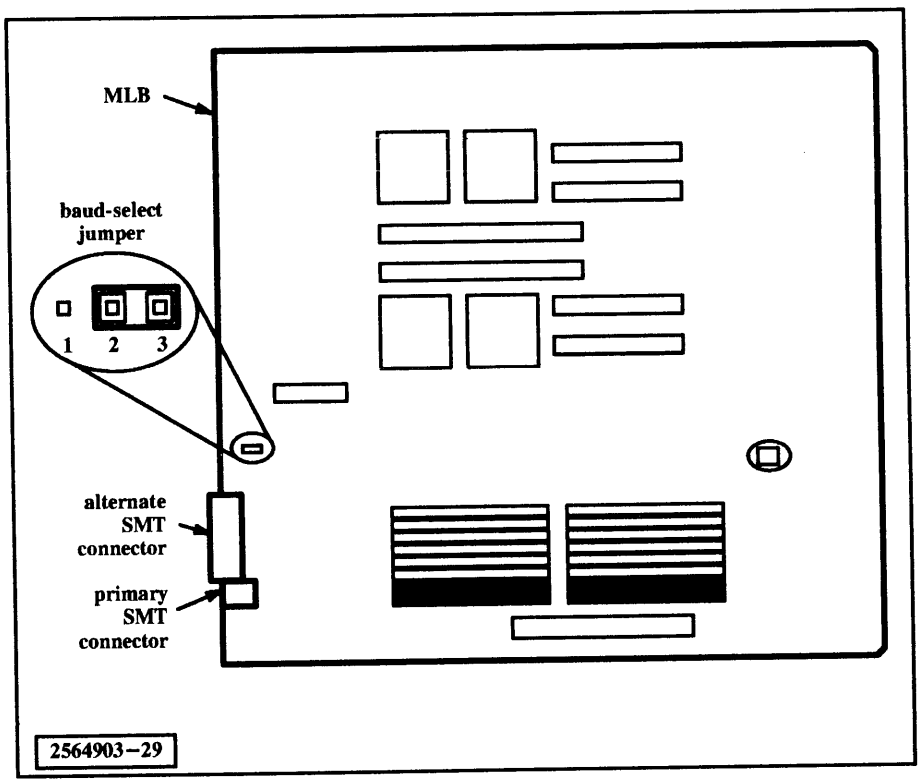


Checking the Baud-Select Jumper

4.2.6 Figure 4-7 shows the baud-select jumper location on the MLB. This jumper allows you to set the data-transfer rate for the alternate system maintenance terminal (SMT) connector to either 1200 baud (jumper installed on terminals 1 and 2) or 9600 baud (jumper installed on terminals 2 and 3, as shown in Figure 4-7).

The 1200 baud position of the baud-select jumper allows you or your service representative to connect the alternate SMT connector via an EIA-232 modem to a remote diagnostic terminal. This can be useful for persons such as customer service representatives at the factory when analyzing problems at your site.

Figure 4-7 **Baud-Select Jumper**



Checking the Mass Storage Configuration

4.2.7 The mass storage configuration consists of operator-access devices and internally-mounted devices (Figure 4-8). A specially designed small computer systems interface (SCSI) data cable connects all the devices to the SCSI interface connector on the MLB (Figure 4-9). The MLB also provides operating power to the devices via specially designed power cables.

Operator-access devices, such as half-height and full-height tape drives, can be mounted in the operator-access device-mounting bracket in several mounting configurations. Positions on the operator-access device-mounting bracket are are identified by numbers 0 through 3, for half-height devices. Full-height devices occupy two half-height positions. Although the half-height and full-height devices can be mounted in any of the positions, the normal positions are two half-height drives in positions 0 and 1, and one full-height drive in positions 2 and 3.

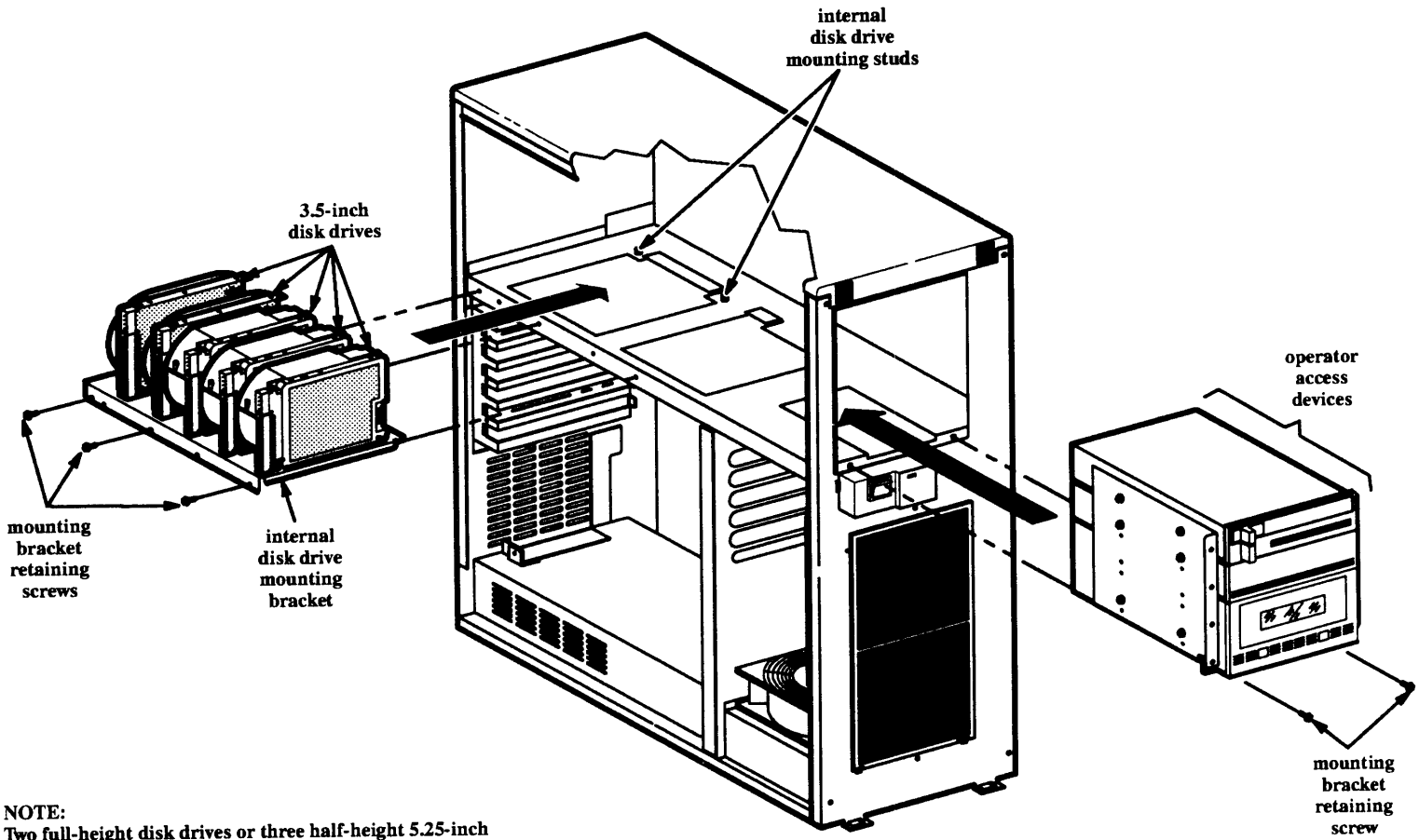
Internally-mounted devices, such as half-height and full-height disk drives, can be mounted on the internal-device mounting bracket in several mounting positions. The positions on the internal-device mounting-bracket are identified by number/letter combinations 4A through 4E, for five 3.5-inch disk drives mounted in a crosswise orientation. When less than five drives are mounted on the bracket, the drives should be mounted in successive order, starting with position 4A and progressing through position 4E. Refer to Figure 4-8 for a pictorial view of the drive position numbering scheme.

The internal-device mounting-bracket will also mount two full-height 5.25-inch drives or three half-height 5.25-inch drives in a lengthwise orientation. The position identification for the two full-height drives is 4A and 4B; for the three half-height drives the position identification is 4A, 4B, and 4C. When less than a full complement of drives are mounted, the first drive should be mounted in position 4A, the second in position 4B, and the third in position 4C.

The SCSI data cable and the power cables each have enough connectors to connect to a full complement of drives. When less than a full complement of drives are installed, the connectors at vacant drive positions are left unconnected. One end of the SCSI data cable connects to the MLB. The other end connects to an exter nal connector for a terminator or another SCSI data cable that connects to external drives. The terminator is always placed at the end of the SCSI data cables after the last drive. Refer to Figure 4-9 for a wiring diagram of the SCSI data cabling and the dc power cabling. Figure 4-10 and Figure 4-11 show pictorial views of the placement of the SCSI data cabling and the dc power cabling in the computer chassis.

Dc power for the drives is generated in the power supply located at the bottom of the system chassis. The dc power is fed through a connector from the power supply to the MLB, and then to the SCSI power connector on the MLB. Three power cables distribute the dc power from the SCSI power connector to the drives.

Figure 4-8 Mass Storage Device Mounting Configurations



NOTE:
Two full-height disk drives or three half-height 5.25-inch disk drives can be mounted on the internal disk drive mounting bracket as an option.

2579747–15

Figure 4-9 SCSI Bus Data Cabling and DC Power Cabling Wiring Diagram

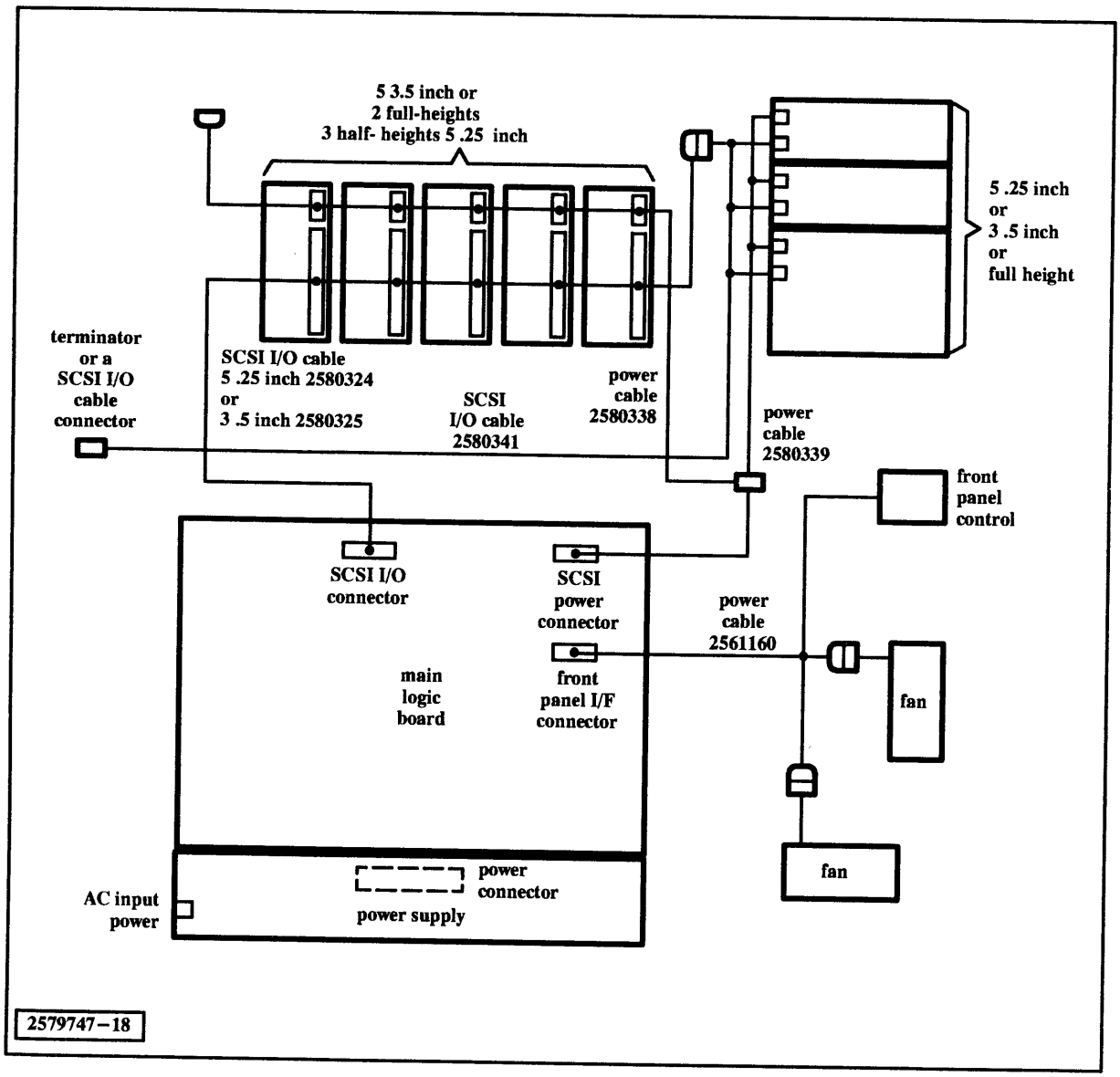


Figure 4-10 SCSI Bus Data Cable Placement

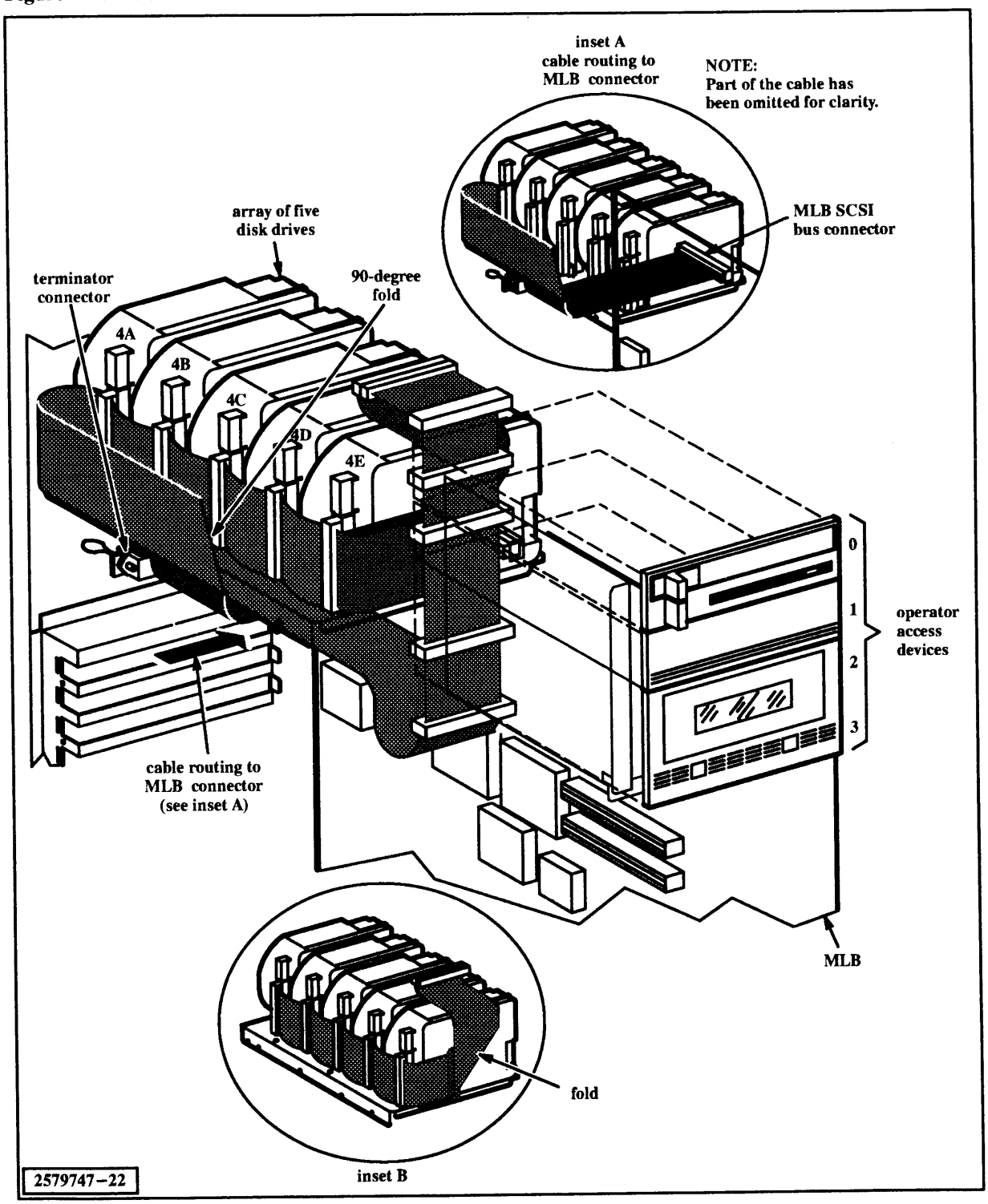
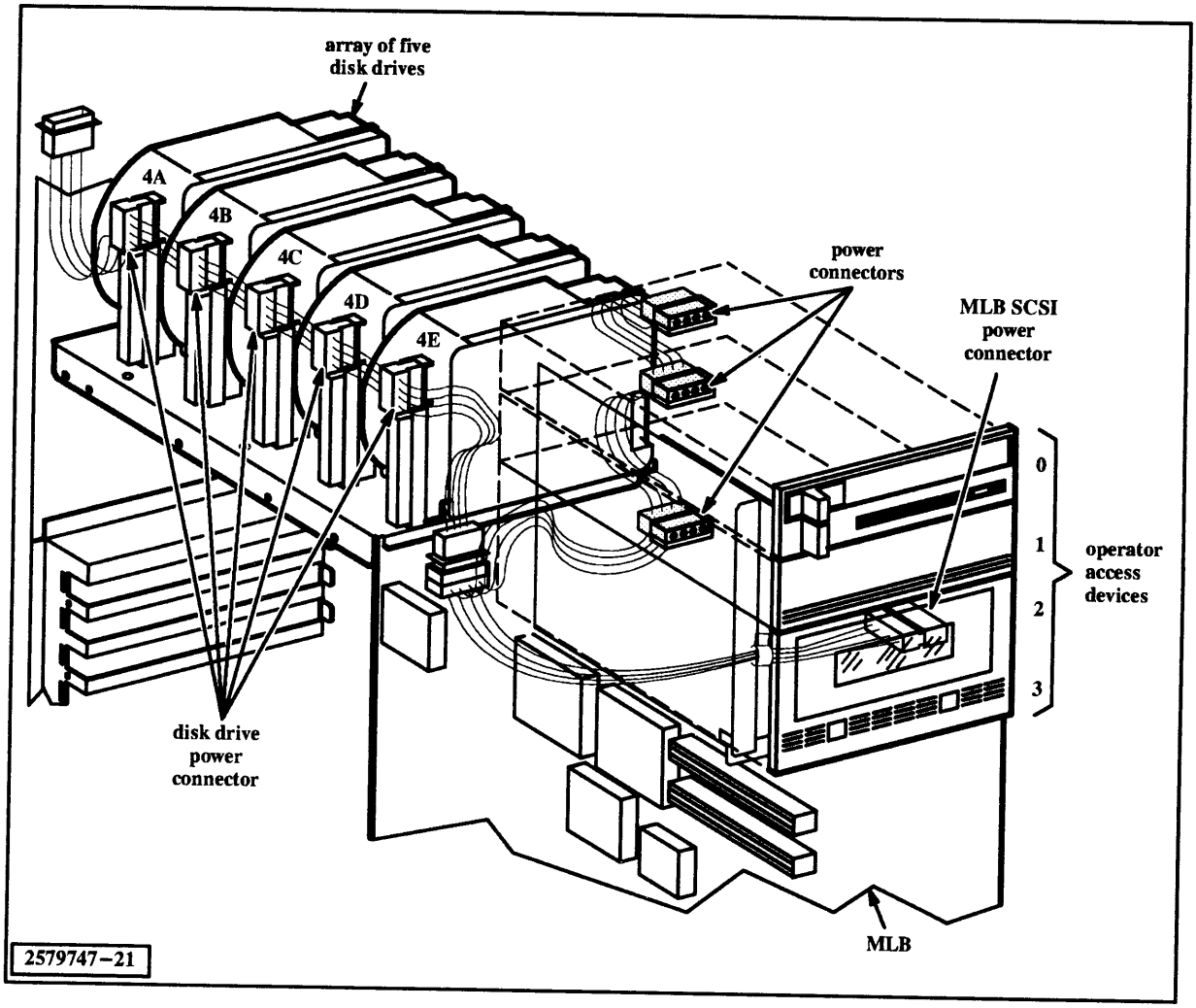


Figure 4-11 DC Power Cable Placement



SCSI Bus Addresses

4.2.7.1 To avoid addressing conflicts on the SCSI bus, both within the system enclosure and for external devices, each SCSI device must be configured for a unique SCSI address. These devices are normally configured at the factory in accordance with the following addressing rules:

- Main logic board — SCSI address 5
- Position 0 (system tape drive) — SCSI address 3
- First disk drive installed (normally in position 4A) — SCSI address 0
- Second disk drive installed (regardless of position) — SCSI address 2
- Third disk drive installed (regardless of position) — SCSI address 6
- Fourth disk drive installed (regardless of position) — SCSI address 4

The recommended SCSI address for the next device depends upon the sales order specifications. The next device should be set to SCSI address 7 if the sales order does not include an MT3201 tape drive or to SCSI address 1 if the sales order does not include a CT2000 cartridge tape drive. Table 4-1 shows examples of drive addressing in a computer chassis.

Table 4-1 Examples of Drive Addressing in Computer Chassis

Example	Position	Drive Type	Address
First	0	System tape drive (half-height drive)	3
	1	Blank space	
	2	Backup tape drive (full-height drive)	
	3	in drive positions 2 and 3	1
	4A	First disk drive (3.5-inch drive)	0
	4B	Second disk drive (3.5-inch drive)	2
	4C	Third disk drive (3.5-inch drive)	6
	4D	Fourth disk drive (3.5-inch drive)	4
	4E	Fifth disk drive (3.5-inch drive)	7
Second	0	System tape drive (half-height drive)	3
	1	Half-height drive	7
	2	Backup tape drive (full-height drive)	
	3	in drive positions 2 and 3	1
	4A	First disk drive (3.5-inch drive)	0
	4B	Second disk drive (3.5-inch drive)	2
	4C	Third disk drive (3.5-inch drive)	6
	4D	Fourth disk drive (3.5-inch drive)	4
	4E	Blank space	
Third	0	System tape drive (half-height drive)	3
	1	Half-height drive	7
	2	Backup tape drive (full-height drive)	
	3	in drive positions 2 and 3	1
	4A	First disk drive (full-height drive)	0
	4B	Second disk drive (full-height drive)	2
	4C	Blank space	6 (see note)
	4D	Blank space	4 (see note)
	4E	Blank space	
Fourth	0	System tape drive (half-height drive)	3
	1	Half-height drive	7
	2	Backup tape drive (full-height drive)	
	3	in drive positions 2 and 3	1
	4A	First disk drive (half-height 5.25-inch drive)	0
	4B	Second disk drive (half-height 5.25-inch drive)	2
	4C	Third disk drive (half-height 5.25-inch drive)	6
	4D	Blank space	4 (see note)
	4E	Blank space	

Note:
These address numbers can be used to address drives in a mass storage peripheral enclosure.

Removing/Installing Operator-Access Devices on the Operator-Access Device-Mounting Bracket

4.2.7.2 Refer to Figure 4-12 for details on mounting 5.25-inch devices on the operator-access device-mounting bracket. Use the adapter shown in Figure 4-13 to mount a 3.5-inch disk drive on the operator-access device-mounting bracket. The following paragraphs provide general instructions as required to remove and/or install operator-access devices on the operator-access device-mounting bracket.

The operator-access device-mounting bracket must be removed from the System 1505/1507 computer chassis in order to remove/install an operator-access device. If necessary, perform the following procedure to remove the operator-access device-mounting from the System 1505/1507 compute chassis:

1. Remove the main access side panel. Refer to paragraph 4.2.1.

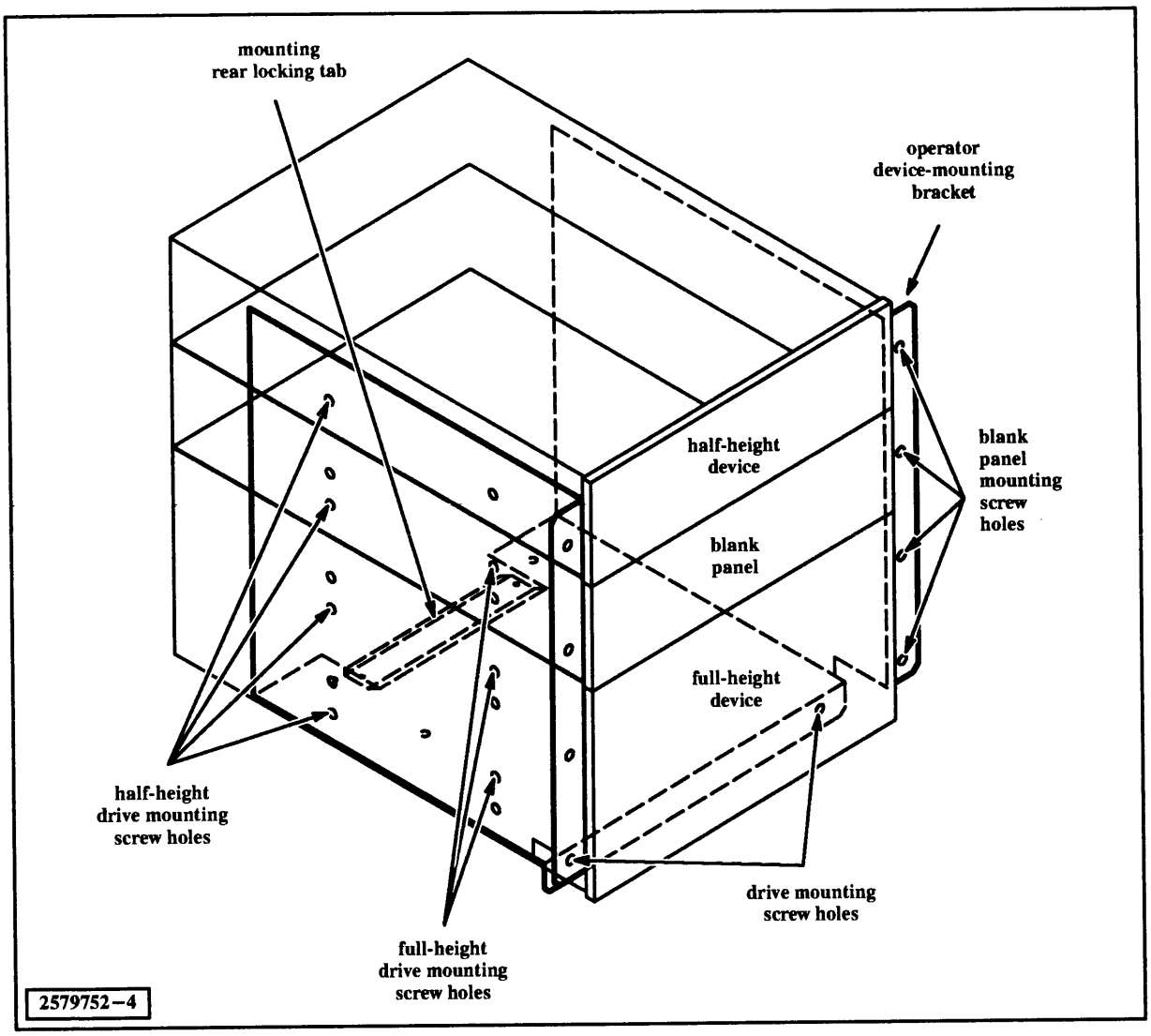
2. Remove the two screws that secure the operator-access device-mounting bracket to the computer chassis and slide the operator-access device-mounting bracket, with its mounted drives, part way out of the computer chassis.

3. Disconnect the SCSI data cable connectors and the power cable connectors at the rear of the drives mounted on the operator-access device-mounting bracket.

4. Completely remove the operator-access device-mounting bracket with its mounted drives from the computer chassis.

To remove an operator-access device from the operator-access device-mounting bracket, remove the four screws that secure the operator-access device to the operator-access device-mounting bracket, and slide the device from the bracket.

Figure 4-12 Operator Access Device Mounting With Devices



To install an operator-access device in the operator-access device-mounting bracket, proceed as follows:

1. Check that the address jumpers or switches, the power-up sequence jumpers, and other miscellaneous jumpers on the operator-access device are set properly. Refer to the *SCSI Mass Storage Devices* section of this manual for information on jumpers and switch settings for particular drives. Also, refer to paragraph 4.2.7.1 for examples of SCSI bus addressing.

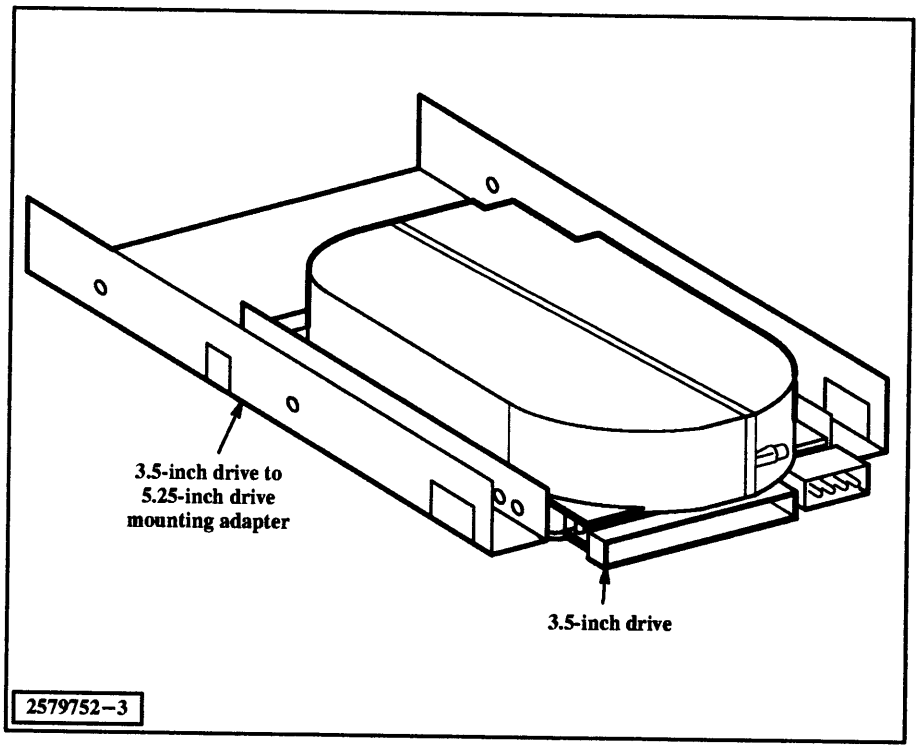
2. Check that the SCSI bus terminators are not installed on the operator-access device.

3. Place the operator-access device in the desired position on the internal-device mounting-bracket, and secure it with two mounting screws.

When the operator-access devices are installed in the proper positions on the operator-access device-mounting bracket, install the operator-access device-mounting bracket in the System 1505/1507 computer chassis in the reverse order that it was removed. Check that the rear locking tab on the operator-access device-mounting bracket is in its proper place to secure the rear of the operator-access device-mounting bracket to the System 1505/1507 computer chassis.

Test the operation of the new operator-access device by running the General Diagnostics Operating System (GDOS) software. Refer to the *Diagnostics User's Guide*, TI part number 2534850-0001 for instructions on using GDOS.

Figure 4-13 **3.5-Inch Drive to 5.25-Inch Drive Mounting Adapter With Drive**



Removing/Installing Drives on the Internal-Device Mounting-Bracket

4.2.7.3 Refer to Figure 4-14 for details on mounting five 3.5-inch devices on the internal-device mounting-bracket. Note that half-height and 1.0-inch high drives can be intermixed on the internal-device mounting-bracket. Figure 4-15 and Figure 4-16 show the details for mounting three half-height or two full-height 5.25-inch drives on the internal-device mounting-bracket. The following paragraphs provide general instructions as required to remove and/or install drives on the internal-device mounting-bracket.

The internal-device mounting-bracket must be removed from the System 1505/1507 computer chassis in order to remove/install a drive. If necessary, perform the following procedure to remove the internal-device mounting-bracket from the System 1505/1507 computer chassis:

1. Remove the main access side panel. Refer to paragraph 4.2.1.

2. Remove the three screws that secure the internal-device mounting-bracket to the computer chassis and slide the internal-device mounting-bracket, with its mounted drives, part way out of the computer chassis.

3. Disconnect the SCSI data cable connectors and the power cable connectors at the rear of the drives mounted on the internal-device mounting-bracket.

4. Completely remove the internal-device mounting-bracket with its mounted drives from the computer chassis.

To remove a drive from the internal-device mounting-bracket, remove the two screws that secure the drive to the internal-device mounting-bracket, and lift the drive from the bracket.

To install a drive on the internal-device mounting-bracket, proceed as follows:

1. Check that the address jumpers or switches, the power-up sequence jumpers, and other miscellaneous jumpers on the drive are set properly. Refer to the *SCSI Mass Storage Devices* section of this manual for information on jumpers and switch settings for particular drives. Also, refer to paragraph 4.2.7.1 for examples of SCSI bus addressing.

2. Check that the SCSI bus terminators are not installed on the drive.

3. Place the drive in the desired position on the internal-device mounting-bracket, and secure it with two mounting screws.

When the drives are installed in the proper positions on the internal-device mounting-bracket, install the internal-device mounting-bracket in the System 1505/1507 computer chassis in the reverse order that it was removed. Check that the rear locking tab on the internal-device mounting-bracket is in its proper place to secure the rear of the internal-device mounting-bracket to the System 1505/1507 computer chassis.

Test the operation of the new drive by running the General Diagnostics Operating System (GDOS) software. Refer to the *Diagnostics User's Guide*, TI part number 2534850-0001 for instructions on using GDOS.

Figure 4-14 **Five 3.5-Inch Drives on the Internal-Device Mounting-Bracket**

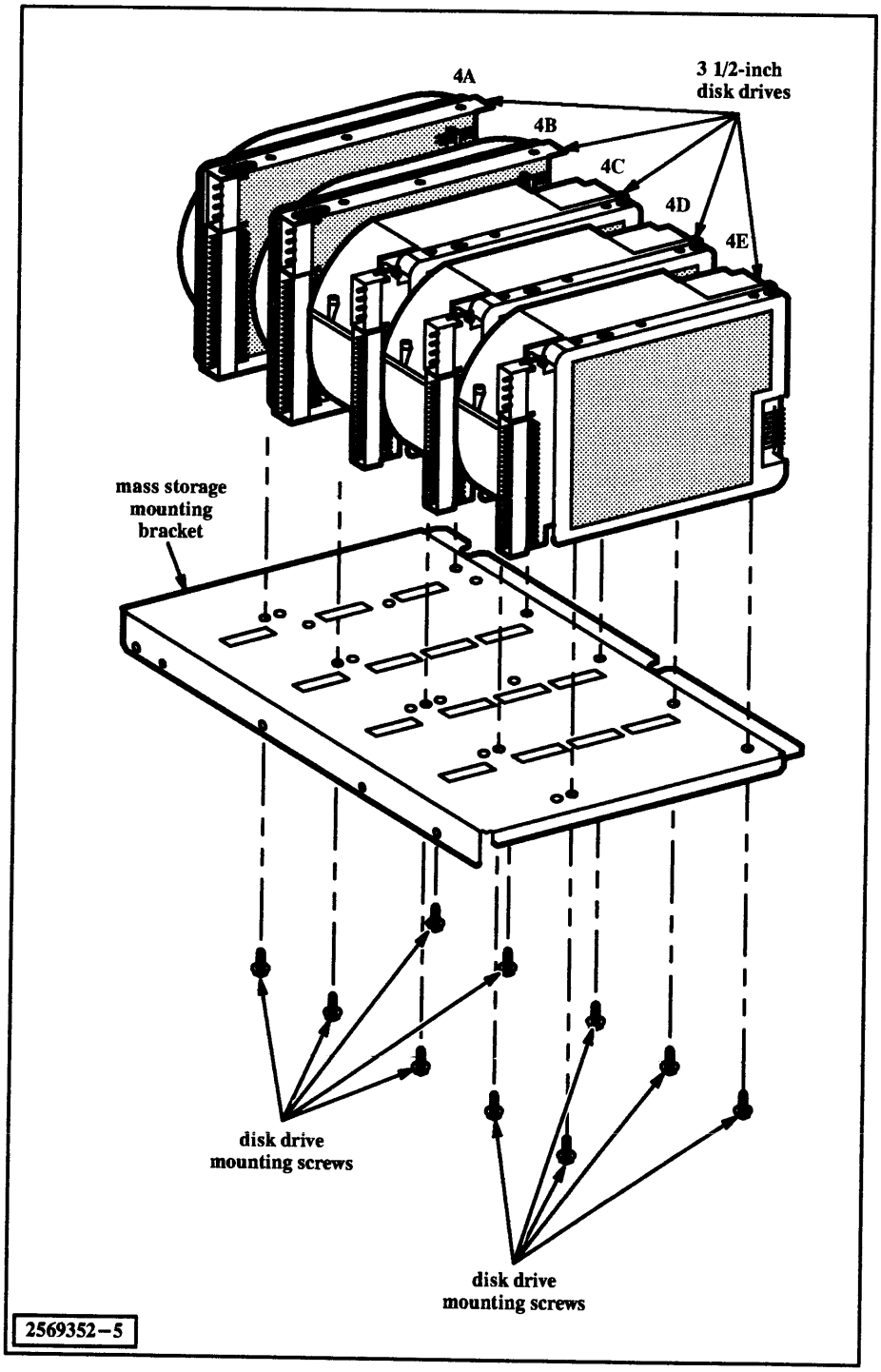


Figure 4-15 **Three Half-Height Drives on the Internal-Device Mounting-Bracket**

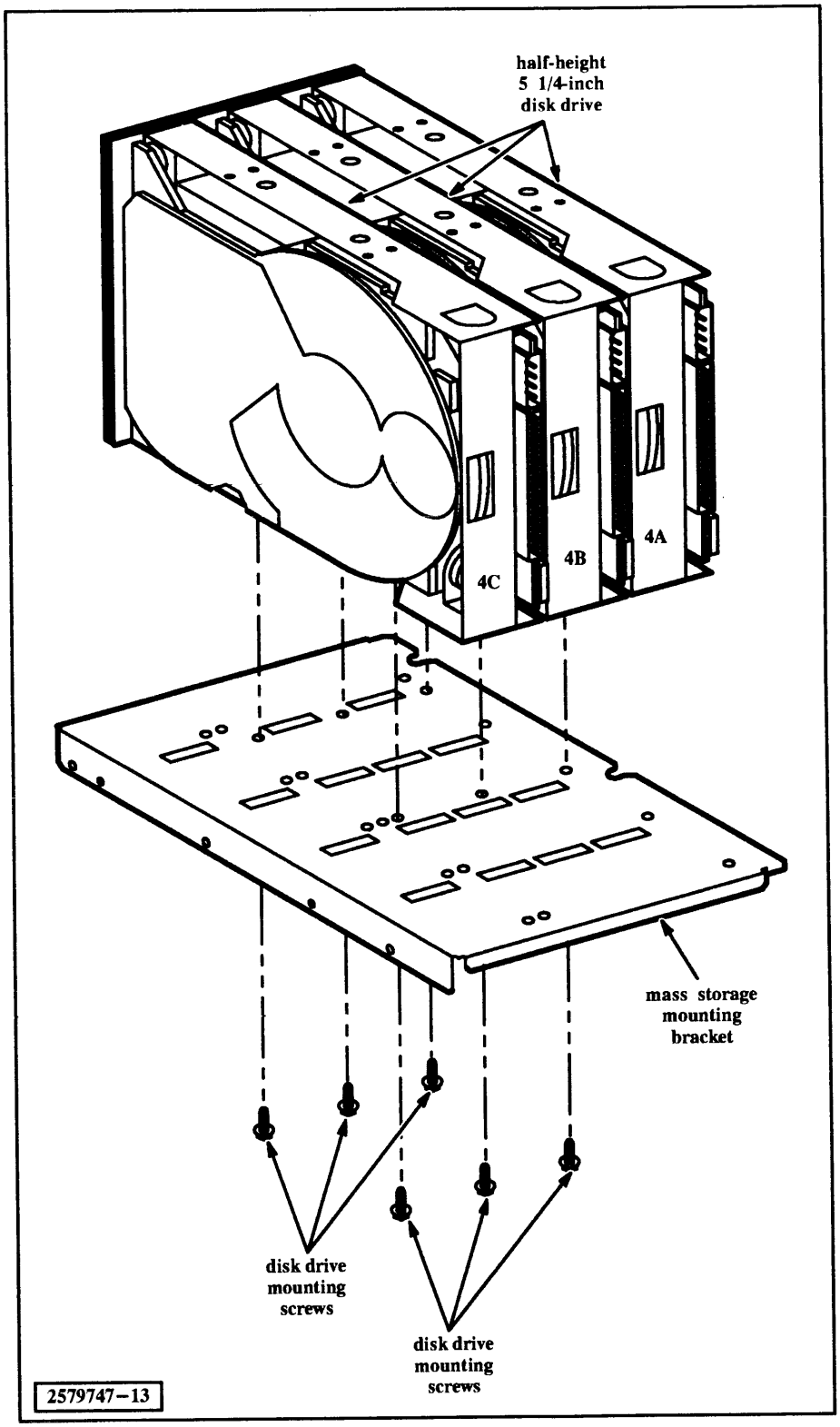
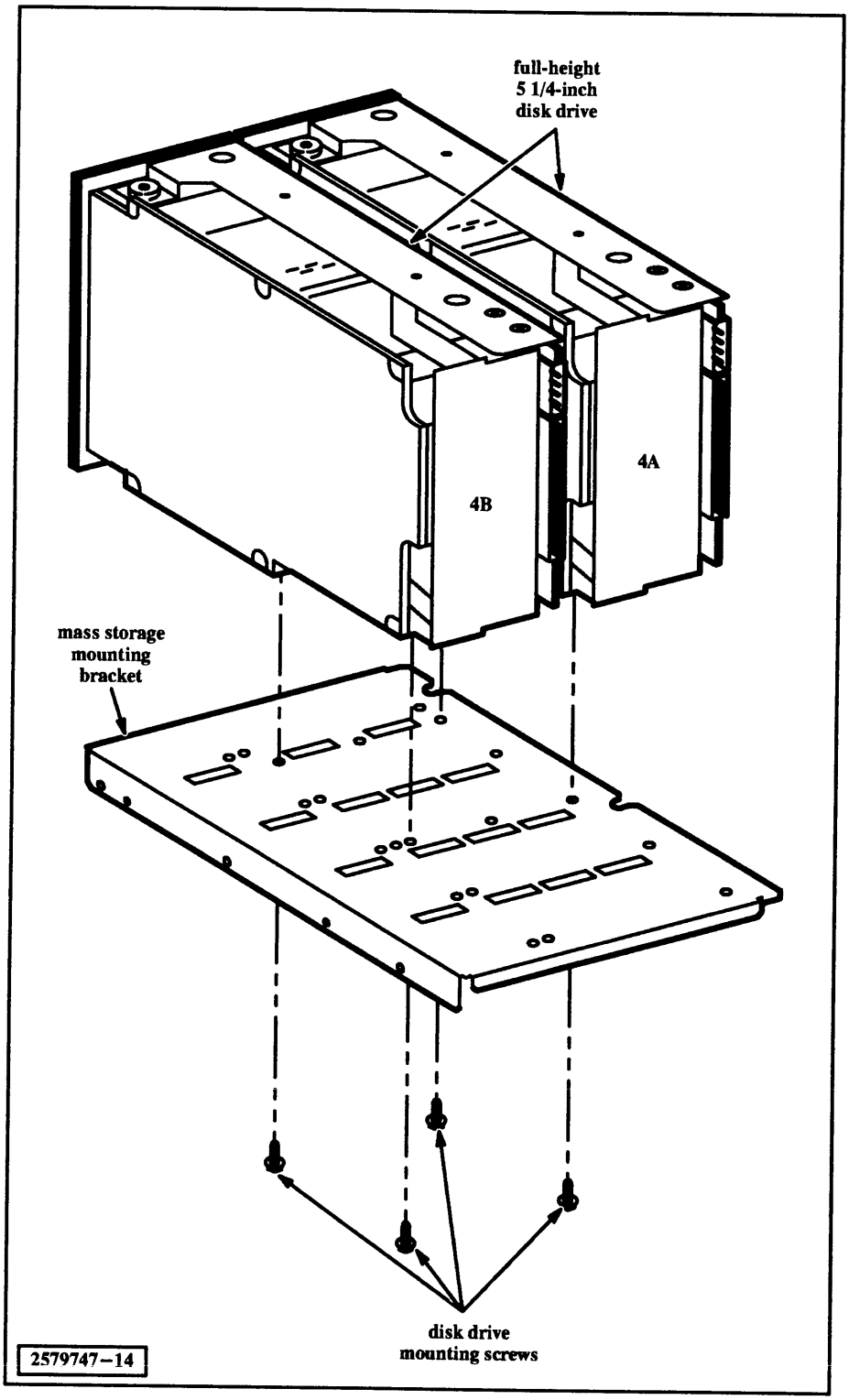


Figure 4-16 **Two Full-Height Drives on the Internal-Device Mounting-Bracket**



Installing External Mass Storage Devices

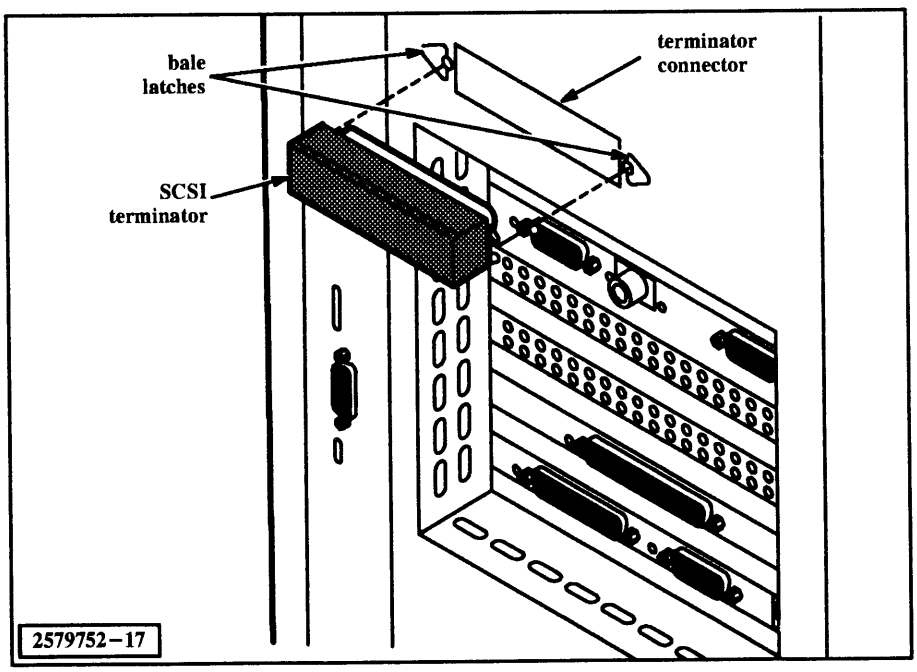
4.2.7.4 If your application requires further mass storage expansion after you have expanded the internal mass storage subsystem to its maximum capacity, TI offers a choice of several mass storage enclosures, each containing one or two mass storage devices. You can add these external mass storage devices to your mass storage subsystem by removing the SCSI bus terminator from the system enclosure and replacing it with a cable to the mass storage enclosures.

Figure 4-17 shows the SCSI bus terminator and the terminator connector on the rear of the system enclosure. The terminator connector has a bale latch (wire clip) on each side. These bale latches secure the terminator to the terminator connector. To remove the terminator, press out on the bale latches to disengage them from the terminator and then pull the terminator straight out.

For more information about the available mass storage devices and how to install external mass storage devices, refer to the module entitled SCSI Mass Storage Devices in this manual and the following manuals:

- *Mass Storage Unit (MSU IIA) Installation and Operation*, TI part number 2557935-0001
- *System 1500 Series Mass Storage Tower Installation and Operation,* TI part number 2579752-0001.

Figure 4-17 **SCSI Bus Terminator Installation on the System Enclosure**

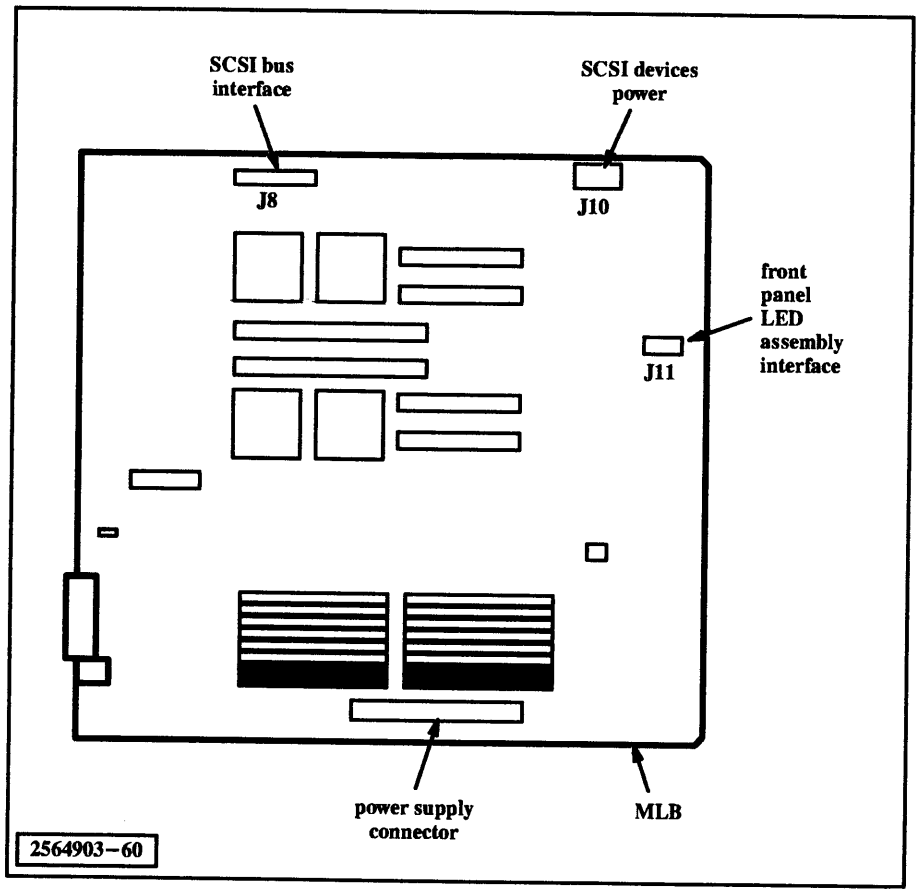


NOTE: When planning an extension to your mass storage subsystem, please remember that the SCSI bus protocol can support a maximum of seven devices.

Checking the Internal Connections

4.2.8 Figure 4-18 shows the SCSI bus interface connector, the SCSI devices power connector, the front panel light-emitting diode (LED) assembly interface connector, and the power supply connector on the MLB. Although the various cables are attached to these connectors at the factory, you should check to ensure that they did not loosen during shipment.

Figure 4-18 **Connector Locations on the MLB**



NOTE: After you have verified that your computer hardware is configured correctly, reinstall the main access panel and front panel and then proceed with the installation as described in paragraph 4.3.

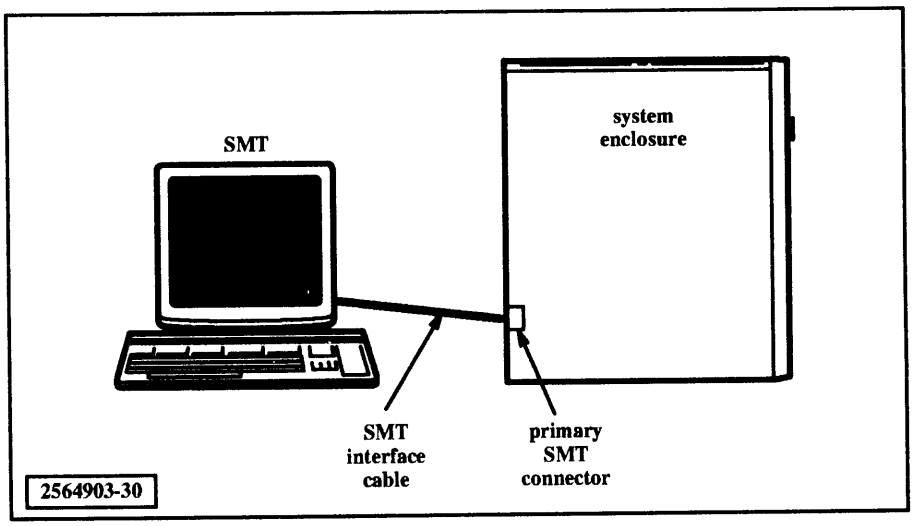
Installing the System Enclosure

4.3 The system enclosure installation consists of positioning the enclosure, connecting the SMT and other peripheral devices, and connecting the computer to the ac power source. Before proceeding with the installation, position the system enclosure near its final position (normally beneath a desk or table, see paragraph 4.3.6) and then refer to the following paragraphs for the installation procedures.

Connecting the SMT

4.3.1 Figure 4-19 shows the SMT connected to the system enclosure. The system enclosure provides two connectors (primary and alternate) for connecting the SMT. The primary connector is a 6-pin modified modular jack (MMJ) connector. It accepts the 25-foot (7.62-meter) SMT cable, TI part number 2554927-0001, that is supplied with your system enclosure. The alternate SMT connector is a 25-pin, female, D-type connector that accepts a shielded EIA-232 serial communication interface cable.

Figure 4-19 **SMT Connected to the System Enclosure**



The SMT can be any video display terminal (VDT) that is compatible with your computer, such as TI Models 924 or 928. Place the VDT on the work surface (normally a desk or table) near its final position and then use these steps to connect the SMT to the primary SMT connector:

1. The MMJ connector on the SMT interface cable mates with the primary SMT connector on the computer in the same manner as a commercial telephone jack. Connect either end of the 25-foot SMT interface cable to the primary SMT connector.

2. Route the cable from the system enclosure to the VDT so that it does not interfere with routine operations in the working environment and is free of any condition (such as foot traffic) that might damage the cable.

3. Use one of the following steps to connect the SMT interface cable to the VDT:

   a. TI Model 928 VDT — Connect the cable to the MMJ connector at the rear of the VDT.

b. TI Model 924 VDT — Connect an adapter, TI part number 2554900-0001, to the SMT interface cable. Connect the other end of the adapter to the EIA-232 serial interface connector at the rear of the VDT. Use a screwdriver to secure the captive retaining screws on the adapter.

If your installation requires a shielded EIA-232 communication interface cable, you must use the alternate SMT connector. You can use any of the following cables for this connection:

- 13-foot (3.96-meter) cable, TI part number 2230504-0001
- 26-foot (7.92-meter) cable, TI part number 2230504-0002
- 49-foot (14.93-meter) cable, TI part number 2230504-0003

Each of these cables has a 25-pin, male, D-type connector at each end.

Use these steps to connect the SMT to the alternate SMT connector:

1. Connect one end of the cable to the alternate SMT connector at the rear of the computer.
2. Use a screwdriver to secure the captive screws in the cable connector to the alternate SMT connector.
3. Route the cable from the system enclosure to the VDT so that it does not interfere with routine operations in the working environment and is free of any condition (such as foot traffic) that might damage the cable.
4. Connect the other end of the cable to the 25-pin, female, D-type interface connector on the VDT and secure the connector as in step 2.
4. Refer to the user's manual supplied with your VDT and set the VDT data-transfer rate (baud rate) to 9600 baud.

NOTE: The baud-select jumper on the computer MLB is set to the 9600 baud position at the factory. See paragraph 4.2.6.

Setting the SMT Operating Parameters

4.3.2 Table 4-2 and Table 4-3 list, respectively, the communications setup parameters for the Model 924 VDT and the port 1 setup parameters for the Model 928 VDT when either of these devices is connected as the SMT. To set these parameters, follow the procedures described in the appropriate VDT user's manual. These manuals also describe these parameters.

Table 4-2 **Model 924 VDT SMT Operating Parameters**

Communication Setup Parameters	Setting
Transmit=	9600
Receive=	Receive = transmit
XOFF at 64/128	XOFF at 128
Bits, Parity/No Parity	7 bits, odd parity
1 Stop Bit/2 Stop Bits	1 stop bit
Local Echo/No Local Echo	No local echo
EIA Port, Modem Control/Data Leads Only	EIA port, modem control
Disconnect 2 s/60 ms Delay	Disconnect, 2-second delay
Limited/Unlimited Transmit	Unlimited transmit

Table 4-3 **Model 928 VDT SMT Operating Parameters**

Port 1 Setup Parameters	Setting
Communication	Full duplex
Data Length	7 bits
Parity	Odd
Stop Bits	1
Xmit Baud	9600
Recv Baud	= Xmit
Xmit Pace	Xon/Xoff
Recv Pace	Xon/Xoff at 128
Limited Transmit	Off
DSRI	No
CTS	Ignore
CD	Ignore
Break Duration	170 ms
Disconnect Delay	2 sec
Aux Printer Type	National

Connecting User Terminals and Printers

4.3.3 The communication option boards provide a variety of methods for expanding your computer system to include multiple users. Section 1 of this module shows some typical examples. Before connecting these peripheral devices, position them near their final positions.

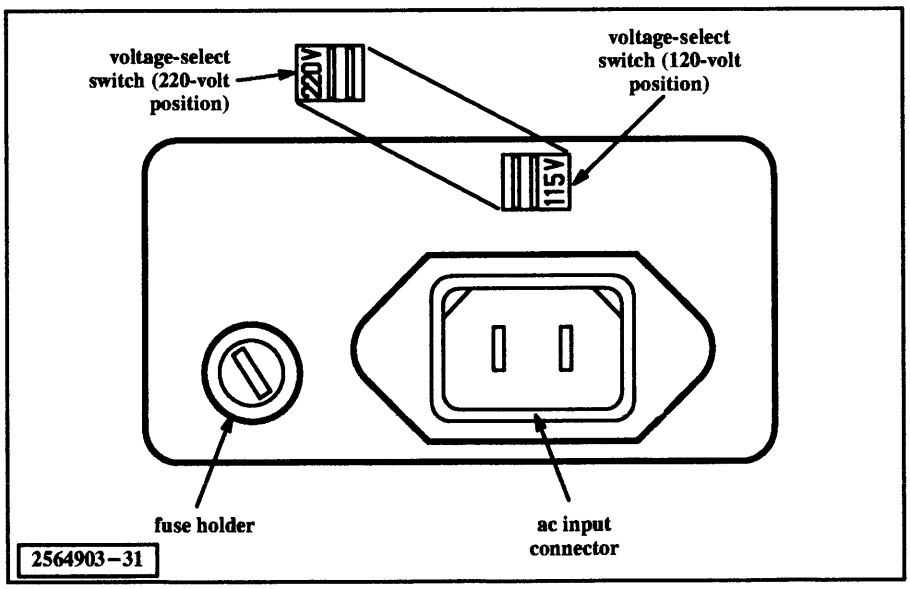
If your computer has communication option boards installed, refer to the appropriate sections of the module entitled SBC Option Boards in this manual for information about connecting terminals, printers, and modems to the boards.

Connecting the Power Source

4.3.4 Figure 4-20 shows the features of the ac power input assembly. This assembly is located at the bottom rear of the system enclosure and it contains the ac input connector, the enclosure fuse, and the voltage-select switch. Use these steps to connect the enclosure to the ac power source:

1. Verify that the site ac power is installed in accordance with the requirements of the module entitled Site Preparation in this manual.
2. Verify that the enclosure power switch on the front panel is set to the off (0) position.
3. Verify that the voltage-select switch is in the correct position for the site line voltage. The voltage setting is visible on the switch. To change the setting, insert a flat-blade screwdriver in the slotted switch and move the switch to the correct position.
4. With the power cord disconnected from the site power outlet, insert the power cord connector into the enclosure ac power input connector. Ensure that the power cord connector is fully seated.
5. Connect the other end of the cable to the site power outlet.

Figure 4-20 **AC Power Input Assembly**



Installing an Uninterruptible Power Supply

4.3.5 When you purchase an uninterruptible power supply (UPS) from TI, you receive a kit that includes the UPS, a tape containing the UPS software utility, the UPS interface cable, and instructions for installing the UPS and the software utility. The UPS interface cable connects to the UPS status connector at the rear of the system enclosure. Figure 1-3 of this module shows the location of this connector.

In the event of a power failure, the UPS serves as a backup power source that provides operating power to the computer until power is restored. Figure 4-21 shows the UPS status connector pin configuration. The connector is a 9-pin, female, D-type connector that provides connections for the following signals:

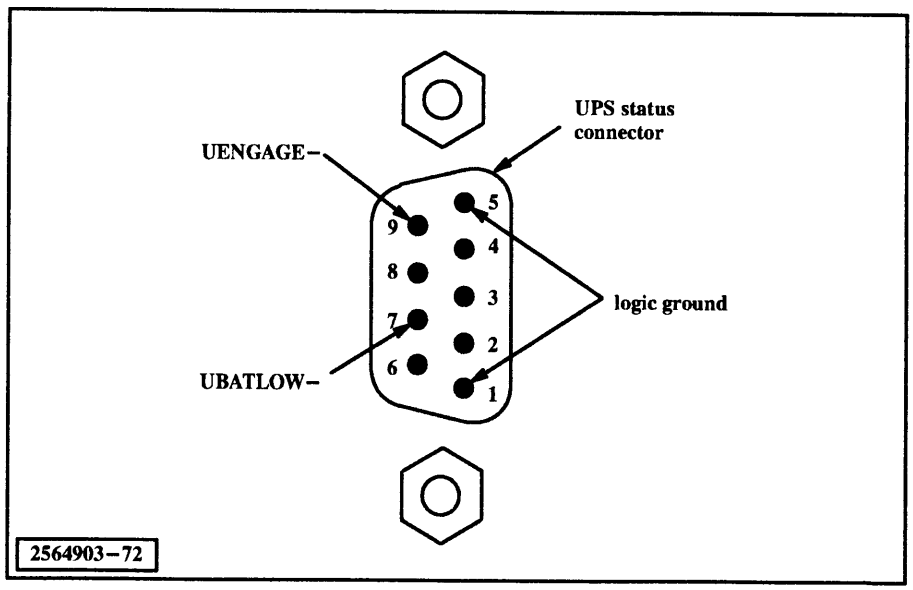
- Pins 1 and 5 — Logic ground
- Pin 7 — UPS battery low (UBATLOW-)
- Pin 9 — UPS engaged (UENGAGE-)

These signals were designed for use with dry-contact switches, but they work equally well with TTL-level signals. The computer MLB receives the signals, processes them, and presents them to the interrupt controller for interrupt generation.

When the UPS detects a power failure, it activates UENGAGE- to generate a level-7 interrupt that is shared with the over temperature (OVERTMP-) signal from the computer power supply. The UPS software utility then reads the status of UENGAGE- to determine the cause of the interrupt.

If the UPS battery becomes too weak to provide sufficient power to the computer during a power-loss condition, the UPS activates UBATLOW-, which generates a power failure warning interrupt to the computer. This condition halts all computer activity.

Figure 4-21 **UPS Status Connector Pin Assignments**

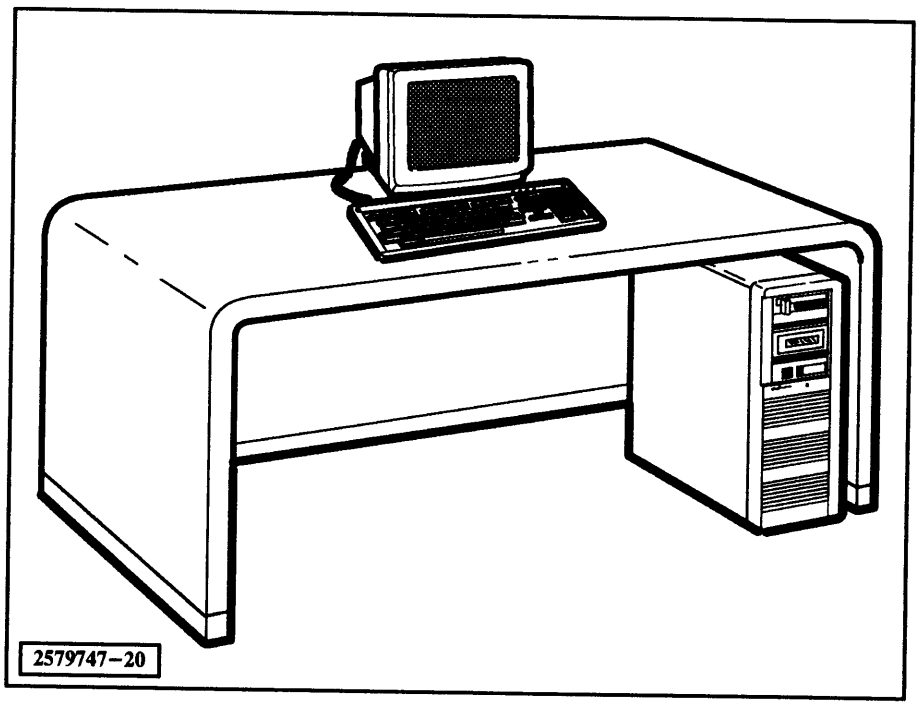


Positioning the System Enclosure

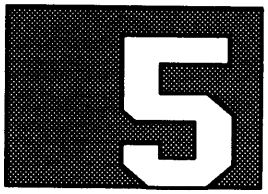
4.3.6 For reliable, trouble-free operation, TI recommends that you position your computer so that the front panel is easily accessible and so that all cables are out of the way of personnel or any form of traffic. A good location for your computer is beneath a table or desk with the front panel facing toward the front of the table or desk as shown in Figure 4-22.

To ensure proper air flow through the computer, the rear of the enclosure should be at least six inches from any wall or other such obstruction. Also, after you have positioned your computer, avoid placing any obstructive device directly in front of the air intake vents at the front of the enclosure.

Figure 4-22 **A Good Location for Your Computer**



OPERATING AND TESTING YOUR COMPUTER



Introduction

5.1 This section provides information about how to power-up and initialize your system hardware and operating system. At power-up, the central processing unit (CPU) initiates a self-test of the main logic board (MLB) and any option boards installed in the computer. Upon successful completion of these self-tests, the CPU initiates the boot process. Upon completion of this process, your computer is ready for normal operation.

After completing the installation described in Section 4 of this module, power-up the standard and optional system components in the following order:

1 . System maintenance terminal (SMT)

2. Peripheral devices (user terminals, printers, and modems)

3. Network terminal concentrators (NTCs) and multidrop terminal concentrators (MTCs)

4. External mass storage devices

5. System enclosure

System Boot Process

5.2 The system boot process occurs automatically at power-up, immediately following self-test execution. This process requires that the SMT be connected, as described in Section 4 of this module. All other items required for the boot process are installed at the factory. These factory-installed items include the TI System V operating system, the general diagnostic operating system (GDOS), and the software protection adapter (SPA).

NOTE: If you ever need to reload the TI System V operating system or GDOS, refer to the manual entitled *TI System V Release Information*, TI part number 2549448-0001, for software installation instructions.

The following paragraphs describe the SPA password and the system boot sequence.

SPA Password

5.2.1 An envelope labeled OPEN ME FIRST and SOFTWARE PROTECT ADAPTER PASSWORDS ENCLOSED is attached to your system enclosure before shipment. (If you ordered software as an option to an existing system, the envelope is in the software package.) This envelope contains the SPA identification (ID) number, the sales order number, the password required to boot your system, and other important information that you need.

NOTE: Any time the SPA is replaced, you must obtain a new password from TI.

If you ever rebuild your system disk, you must reenter your password. If you lose your password, you must contact TI with your sales order number and your SPA ID number to obtain the original password that matches your SPA. The SPA ID number is visible through a slot beneath the option board positions at the rear of your system enclosure.

If your original SPA is replaced, you or your service representative must contact TI with the original system sales order number and the original SPA ID number in order to receive a new password.

System Boot Sequence

5.2.2 To initiate the system boot sequence, power-up the system components in the order listed in paragraph 5.1. Allow about 30 seconds for the SMT to complete its internal self-test before powering up the remaining components. If the SMT does not power-up correctly or if the terminal self-test fails, contact your service representative for assistance.

Upon successful completion of the SMT self-test, power-up the remaining devices in the order listed in paragraph 5.1. When you power-up the system enclosure, the CPU initiates a self-test of each major function of the MLB. If the self-test encounters no errors, the SMT displays the following messages as self-test execution progresses:

```
Selftest BEGINS
   Test 00 RAM          passed
   Test 01 PARITY       passed
   Test 02 ICC          passed
   Test 03 CACHE        passed
   Test 04 MAD          passed
   Test 05 TIMER        passed
   Test 06 FPU          passed
   Test 07 NVRAM        passed
   Test 08 SPA          passed
   Test 09 C-ROM        passed
Selftest COMPLETE
```

NOTE: If you wish to halt the boot program at any time during self-test execution, enter the break character from your SMT keyboard. To enter the break character from a Model 924 keyboard, press the key labeled BREAK. To enter the break character from a Model 928 keyboard, press the Alt key and the Pause/Break key simultaneously.

As self-test execution progresses, the SMT may display certain error messages. Many of these errors do not prevent normal system operation, and at the conclusion of self-test execution, the SMT still displays the `Selftest COMPLETE` message to indicate that you may continue.

If the self-test encounters a parity error during the random-access memory (RAM) test, the SMT displays a message indicating that the error has been logged in the parity map of the system nonvolatile RAM (NVRAM). Paragraph 5.2.3 provides information about parity errors and how to handle them.

If the SMT displays a message such as K1, K2, K3, or K4 during self-test execution, contact your service representative for assistance. These messages indicate mortal kernel errors. Self-test execution cannot continue under any of these conditions. If there are no fatal errors, and all MLB functions pass the self-test, the CPU continues to test the system and the SMT displays a message similar to the following:

```
Slot C CPU TESTING SYSTEM:

Slot 8 CPO passed
Slot 9 SPC passed
Slot C CPU passed

Global ARB passed
```

NOTE: The slots indicated in these messages are not related to the communication option board positions described in Section 4 of this module. The slots indicated here are functional areas of the MLB. For example, slot C is the CPU, slot 8 is the communication processor, slot 9 is the SCSI peripheral controller, and so on.

Upon completion of all self-tests, the SMT displays the following system load menu:

```
D=Default load, M=Menu load, R=Retest, E=Extended tests
```

If you press the R key, for `Retest`, the system runs the self-tests again. If you press the E key, for `Extended tests`, the system runs the extended self-tests described in paragraph 5.3. If you press the G key, the system loads the GDOS, although the G is not listed in the system menu.

If you press the D key, for `Default load`, or you do not choose a load or test option within 15 seconds following the display of the system load menu, the system loads the default software from the system disk. If you press the M key, for `Menu load`, the SMT displays a message similar to the following, including the `Select load device :` prompt, to allow you to select an alternate load device:

```
Available load devices

* A = Slot 9 Disk 00

Select load device :
```

The message (`* A = Slot 9 Disk 00`) indicates that the only available load device is slot 9, the SCSI peripheral controller (SPC). Press the A key to choose this device. The system then loads the software from the system disk.

NOTE: To suspend the default initialization before the 15-second time-out occurs, press any key except a command character (such as D, M, R, E, or G) that specifies a load procedure.

During the software loading process, the SMT displays the following messages to indicate that the the system is loading the software:

```
Waiting
Loading configuration partitions from Slot 9 unit 00 partition default
Booting processor slot C
Loading unx1 from Slot 9 unit 00
```

Upon completion of the loading process, the SMT displays a copyright notice and other information about your system. The node name, release, version, and mem (memory) items in these messages reflect your software release version and the amount of memory installed in your system.

As the booting process continues, the SMT displays the following messages to indicate that the system is ready to verify your password:

```
Password verification failure
SPA ID # nnnn
Enter correct password:
```

NOTE: In the message `SPA ID # nnnn`, the term `nnnn` is the SPA ID number.

Enter the password furnished with your system. (See paragraph 5.2.1). If the password is correct, the SMT displays the following prompt:

```
Init: Single User Mode
#
```

Enter `init 2` after the `#` prompt to initialize the system to the multiuser mode. The SMT then displays prompts similar to the following:

```
Is the date Thu jul 31 13:28:24 CDT 1986 correct? (y or n)

Do you want to check the file systems? (y or n)
```

The default response is `y`. (Refer to the *TI System V Administrator's Guide*, TI part number 2540539-0001, for more information.) After you have responded to the above prompts, the SMT displays the following messages:

```
Load CCBs

Site name

login:
```

The `login:` prompt indicates that the booting process is complete and the system is ready for use. To log into the system, enter your locally assigned ID number in response to the `login:` prompt.

Handling Memory Errors

5.2.3 Your computer employs a parity-checking scheme to verify the integrity of data stored in the system memory. A parity error is a condition in which a memory bit cell fails to retain the value (either 1 or 0) that was stored in the cell. In a later attempt to recover the information from the bit cell, the parity-checking logic recognizes this condition and the software logs it in the parity map area of NVRAM for future comparison.

If later examination of the byte in which the parity error occurred reveals that all of its bit cells are again capable of retaining a value, the software logs the condition into the parity map as a *soft* (recoverable) error. Soft errors detected during self-test execution do not prevent the system from booting or operating normally following the booting process.

If the examination indicates that the bit cell is still incapable of retaining a value, the software logs the condition into the parity map as a *hard* (nonrecoverable) error. Hard errors are classified as errors that must be corrected before attempting any further operation. If these errors occur during self-test, the booting process will not complete.

NOTE: The *TI System V Administrator's Guide*, TI part number 2540539-0001, provides information about the handling of parity errors that are detected after the system is booted.

The following paragraphs describe the indications of soft and hard errors that occur during the booting process. Information about how to handle these errors is also found in the following paragraphs.

Handling Soft Errors

5.2.3.1 If the system self-test encounters random parity errors during the RAM test or any other test, the software interprets these as soft errors. The self-test reports entries to the parity map region of NVRAM, and the SMT displays a message similar to the following:

```
Selftest BEGINS
      Test 00 RAM
        *** ERROR No. 0001
        Unexpected bus error, Type 7: Memory parity
        Bus error source= 0100 Flag bits= 80 Timeout register= 0000
        SR=2700 PC=FCFE3550 Format=OB Offset=0008 SW=074D DCFA=C0000010


Logging of parity error in progress. . .

        *** WARNING No. 0063
        Soft memory error(s) logged in parity map
        Error address= C0000010 Control data= 46202008

Recoverable parity error logged
-- Use "BT" command from ROM monitor to reboot

D0-D7= 00000003 00000003 . . . . . .00000000 00000000
A0-A7= 00000026 FCFE5214 . . . . . .C0FFE7F8 C0FFE61C

S1500>
```

The portion of the message following `Logging of parity error in progress` and the statement `Recoverable parity error logged` indicate that the system memory contains one or more soft parity errors. Since this type of error does not prevent normal system operation, you can restart the booting process as indicated by the statement `-- Use "BT" command from ROM monitor to reboot.`

To use the BT (boot) command, type `BT` in response to the `S1500>` prompt. The SMT displays a message similar to the following:

```
Selftest BEGINS
   Test 00 RAM
       One or more entries logged in parity map
                          passed
   Test 01 PARITY         passed
   Test 02 ICC            passed
   Test 03 CACHE          passed
   Test 04 MAD            passed
   Test 05 TIMER          passed
   Test 06 FPU            passed
   Test 07 NVRAM          passed
   Test 08 SPA            passed
   Test 09 C-ROM          passed
Selftest COMPLETE
```

The message `One or more entries logged in parity map` indicates that the operating system or self-test has logged one or more soft errors in the parity map at some previous time. These entries remain in the parity map area of NVRAM for evaluation during the next few self-test executions. The self-test does not report a failure and the booting process continues normally following self-test completion. The SMT continues to display the message during the next few executions of the self-test; that is, each time you power up the system or otherwise cause the self-test to be executed.

Handling Hard Errors

5.2.3.2 If the self-test encounters the same error twice during a predetermined number of self-test executions or the location of an error fails to pass a test during the logging process, the software then interprets these as *hard* (nonrecoverable) errors, and the SMT displays a message similar to the following:

```
Selftest BEGINS
      Test 00 RAM
        *** ERROR No. 0001
        Unexpected bus error, Type 7: Memory parity
        Bus error source= 0100 Flag bits= 80 Timeout register= 0000
        SR=2700 PC=FCFE3550 Format=0B Offset=0008 SW=074D DCFA=C0000010


Logging of parity error in progress. . .

        *** ERROR No. 0063
        Hard memory error(s) logged in parity map
        Error address= C0000010 Control data= 46202008

D0-D7= 00000003 00000003 . . . . . .00000000 00000000
A0-A7= 00000026 FCFE5214 . . . . . .C0FFE7F8 C0FFE61C

S1500>
```

The portion of the message following `Logging of parity error in progress` indicates that the memory contains one or more hard errors. Since this type of error prevents normal system operation, you cannot reboot the system until the condition is corrected. Typing the BT command in response to the S1500> prompt causes the SMT to display a message similar to the following:

```
Selftest BEGINS
   Test 00 RAM
       *** ERROR No. 0067
       Hard memory error(s) logged in parity map

                       passed
   Test 01 PARITY      passed
   Test 02 ICC         passed
   Test 03 CACHE       passed
   Test 04 MAD         passed
   Test 05 TIMER       passed
   Test 06 FPU         passed
   Test 07 NVRAM       passed
   Test 08 SPA         passed
   Test 09 C-ROM       passed
Selftest COMPLETE

Selftest FAILED in Slot C

S1500>
```

The message `Selftest FAILED in Slot C` indicates that the CPU (slot C) has encountered one or more hard memory errors in one or more bytes (SIMMs) of memory, and the booting process does not complete. The message `S1500>` is a prompt that indicates you must type a response before the computer performs any further operations.

After receiving the `Selftest failed in Slot C` message, you must determine which SIMM is defective and replace the defective SIMM before attempting any further operation. To determine which SIMM is defective, type the command `DPEM` (Display Parity Error Map) at the `S1500>` prompt. The SMT displays a message similar to the following:

```
CRC= D8A0   Size=  16   Entries=  1   Reserved= FFFFFFFF

Address   Bank   Byte Flags (0-1-2-3)   Type  Origin  Task  Test Count
C0000000   0           1-0-0-0           E      F     20       32
```

It is not necessary to understand all fields of this message in order to determine which SIMM is defective. However, the following message fields can aid you or your service representative in analyzing a memory fault:

- `Size` — This field indicates the maximum number of entries allowed in the parity map area of NVRAM.
- `Entries` — This field indicates the number of entries currently active in the parity map area of NVRAM.
- `Address` — This field indicates the memory address at which the error occurred.
- `Bank` — This field indicates the memory bank (0, 1, 2, or 3) for which the parity error has been logged. For this example, it is bank 0.

- `Byte Flags` — This field indicates the byte (SIMM) or bytes (0, 1, 2, or 3) in which parity errors have occurred for the specified memory bank.

  The binary values below the `Byte Flags` field indicate which SIMMs had (`1`) and which SIMMs did not have (`0`) parity errors. Thus, the values `1-0-0-0` in this example indicate that a parity error occurred in the SIMM associated with byte 0 of memory bank 0. (A value of `0-1-0-0` in this field would indicate SIMM 1, a value of `0-0-1-1` would indicate SIMMs 2 and 3, and so on.)

  In some cases, the values in the `Byte Flags` field may all be 0. This condition indicates that, at the time the error was detected, it was not possible to determine which byte was defective.

- `Type` — This field indicates one of two types of entries logged to the parity map. Type `W` indicates recoverable errors; type `E` indicates nonrecoverable errors.

- `Origin` — This field indicates one of two origins of the codes that logged an error. Type `F` indicates self-test firmware; type `U` indicates operating system software.

Using the information contained in the `Bank` and `Byte Flags` fields of the message, you can easily isolate the problem to SIMM 0 of memory bank 0. Thus, before you attempt further operation, you should replace this SIMM or contact your service representative. (See paragraph 2.5 of this module for information about memory organization.) Use these steps to replace the defective SIMM:

1. Power-down your computer and disconnect the ac power cord.
2. Remove the front panel and the main access panels as described in paragraphs 4.2.1 and 4.2.2 of this module.
3. Remove the defective SIMM and plug in the repacement SIMM as described in paragraph 4.2.5 of this module. SIMM 0 of memory bank zero is at the extreme lower left corner of the memory bank as shown in Figure 2-3 of this module.
4. Reinstall the main access panel and the front panel.
5. Reconnect the ac power cord and set the computer power switch to its on (1) position. The system attempts to reboot but fails the self-test because the parity error map has not been cleared.
6. At the `S1500>` prompt type the command `CPEM` (Clear Parity Error Map) and press RETURN; then type `CNTRL-Y` and press RETURN again. This procedure clears the parity error map and returns the `S1500>` prompt.
7. At the `S1500>` prompt, type the command `BT` and press RETURN. The system should complete the self-test and the booting process without further errors.

Extended Self-Tests

5.3 The extended self-tests are similar to the initial boot self-tests. However, these tests include more extensive test patterns and routines. Therefore, the execution time for these tests is greater than for the initial boot self-tests. To select the extended self-tests, press the E key in response to the system load menu described in paragraph 5.2.2.

As the CPU begins the extended self-tests, the SMT displays the following message to indicate that the CPU is testing the system:

```
Slot C CPU TESTING SYSTEM:
```

During extended self-test execution, the CPU tests all installed option boards and then tests itself. During these tests, the CPU suspends its output to the SMT and upon completion of the extended self-tests, it sends the results to the SMT. The SMT then displays messages similar to the following, depending upon which option boards are installed:

```
Slot 8 CPO (TIAU 00002561080-0001 **)
COMM CARRIER & OPTION BOARD TEST

NuBus slave cycle memory test       passed
NuBus master logic test             passed
ROM CRC                             passed
Icc test                            passed
COSI registers test                 passed
RAM pattern test                    passed
RAM bit test                        passed
RAM address test                    passed
COSI timer test                     passed
LAN ID ROM test                     passed
COSI DMA test                       passed
Bus exception test                  passed

PORT 0

OPTION   : MULTI-DROP\V.35
ADAPTOR : MULTI-DROP with printer

Read write device test              passed
PI/T 68230 test                     passed
MC68440 DMA test                    passed
MC68606 DMA test                    passed
Transmit and receive frames test    passed

PORT 1

OPTION   : 8 channel ASYNC
ADAPTOR : 8 channel ASYNC

Read/Write register test            passed
Interrupt test                      passed
ASYNC baud rate test                passed
External/Internal loopback          passed
Adapter board test                  passed
Read/Write UART test                passed
passed
Slot 9 SPC (TIAU 00002561080-0001 **) passed
Slot C CPU (TIAU 00002561080-0001 **)
Testing STBM processor (wait 0.5 - 3 min)

Global ARB passed
```

NOTE: The system test boot master (STBM) is the processor that controls the self-test and booting process. In the case of a single processor system, such as the System 1505 or System 1507, the terms STBM and CPU are synonymous.

Upon completion of extended self-test execution, the SMT again displays the following system load menu to allow you to continue the booting process as described in paragraph 5.2.2:

```
D=Default load, M=Menu load, R=Restart, E=Extended test:
```

Additional Test Options

5.4 In addition to the extended self-tests described in paragraph 5.3, the system load menu (`D=Default load, M=Menu load, R=Retest, E=Extended test:`) also provides the following test options:

- Looping on all installed option boards — Loops the extended interface diagnostics on all installed option boards. Use these steps to perform this procedure:

  1. Type `!` (exclamation point) in response to the system load menu. The CPU runs the extended interface diagnostic tests in a continuous loop on all installed option boards until an error occurs or until you manually stop the process.

  2. To stop the process, press any key. The current test completes and then the looping process stops.

- Looping on selected option boards — Loops the extended interface diagnostics on a selected option board. Use these steps to perform this procedure:

  1. Type `@` (*at* sign) in reponse to the system load menu. The following prompt appears:

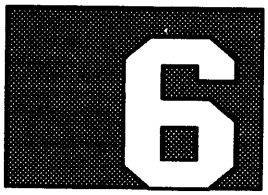
     ```
     Loop on slot (option board position) number :
     ```

  2. Type the number of the option board position that contains the board to be tested. The CPU runs the extended interface diagnostic tests in a continuous loop on the selected option board until an error occurs or until you manually stop the process by pressing any key.

- Executing the GDOS diagnostics on all installed option boards — Press the G key to load the GDOS within 15 seconds after the system load menu appears. (If default initialization occurs, reboot the system to recover the system load menu.)

  For more information about the GDOS diagnostics and how to use them, refer to the System 1500 *Diagnostics User's Guide*, TI part number 2534850-0001.

PREVENTIVE MAINTENANCE



Introduction

6.1 Preventive maintenance for the system enclosure includes controlling external dust build up on the outer surfaces of the enclosure and servicing the air-cleaning filter. Excessive dust on the front panel may enter the enclosure through the air-cleaning filter and possibly damage internal components or reduce system reliability. Excessive dust on the air-cleaning filter also reduces airflow through the air-cooling system, resulting in possible damage to internal components due to excessive heat buildup.

Preventive maintenance is the responsibility of the system user and is not normally performed by Texas Instruments service personnel. The following schedule is recommended for performing preventive maintenance procedures:

- Cleaning external system enclosure surfaces — As needed
- Vacuuming the air-cleaning filter — Monthly or more frequently in very dusty environments
- Washing the air-cleaning filter — Every 6 months
- Changing the air-cleaning filter — Annually

CAUTION: Dust buildup can cause overheating, accelerated aging of computer components, and reduced reliability. Monitor the air-cleaning filter condition and set up a schedule for more frequent cleanings if the filter collects excessive dust between cleanings.

Cleaning the Enclosure

6.2 Keep the front panel clean and dust-free by wiping the exterior with a damp (not wet) lint-free cloth and a mild detergent. Pay particular attention to the panel grill work and the air-intake vents.

CAUTION: Do not use any type of solvent or strong detergents to clean the enclosure.

Servicing the Filter

6.3 The air-cleaning filter should be serviced periodically in accordance with the recommended schedule or your own local schedule. Use these steps to service the filter:

1. Turn off your computer, disconnect the ac power cord, and remove the computer front panel as described in Section 4.
2. The filter snaps into the front of the system enclosure. To remove the filter, pull it straight out from the front of the enclosure.
3. Use a standard or industrial vacuum cleaner to clean the filter, starting with the air-intake side.
4. Wash the filter with lukewarm tap water and a mild detergent. Allow the filter to dry thoroughly before reinstalling it.
5. After the filter is completely dry, install it by snapping it back into its original position on the system enclosure.

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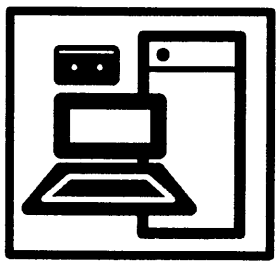

SBC OPTION BOARDS

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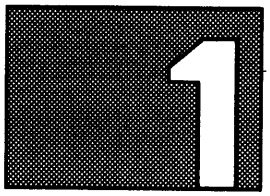
INSTALLING SBC OPTION BOARDS



Introduction

1.1 The single-board computer (SBC) main logic board (MLB) provides a central processing unit (CPU), the system memory composed of four single inline memory modules (SIMMs), and all other elements necessary to support a basic computer.

The MLB also contains a small computer system interface (SCSI) for mass storage devices, and a communication processor that supports optional communication boards. These boards plug into connectors on the MLB and provide a variety of connections to optional terminals, printers, modems, and local area networks (LANs).

An optional communication processor that plugs into a connector on the MLB supports up to two additional communication option boards. Thus, the computer can support a maximum of four communication option boards.

This module describes the communication option boards and provides instructions for installing them in the SBC. Section 2 describes the optional communication processor and Sections 3 through 5 describe various communication option boards that the communication processors can support.

CAUTION: All boards, options, and peripherals contain components that are sensitive to static electricity. When handling any of these items, protect against static electricity by using wrist grounding straps and grounded working mats. When moving or storing items, use the antistatic bags supplied with the items.

The Basic SBC

1.2 Figure 1-1 shows a block diagram of the basic SBC with no options installed. The MLB contains all the elements required to perform the basic computer functions and to provide information interchange between the system maintenance terminal (SMT) and the mass storage devices (disk drives and tape drive). In addition, the MLB provides the following connectors:

- Communication ports 0 and 1 — Accept and support any of the communication option boards described in Sections 3 through 6 of this module. The MLB on-board communication processor supports these communication ports.
- Auxiliary expansion connector — Reserved for future use.
- Expansion ports 0 and 1 — Accept and support any of the communication option boards described in Sections 3 through 6 of this module. The optional communication processor is required to support these communication ports.
- Communication expansion connector — Accepts the optional communication processor.
- Uninterruptible power supply status cable connector — Provides a status interface to an uninterruptible power supply (UPS). The UPS maintains power to the system in case of a failure in the system ac line voltage source.
- Memory slots — Provide connectors for installing the standard system memory and a maximum of 12 dynamic random-access memory (DRAM) expansion modules. These modules are available in kits of four modules each. The module entitled System Enclosure in this manual provides a detailed description of the system memory.

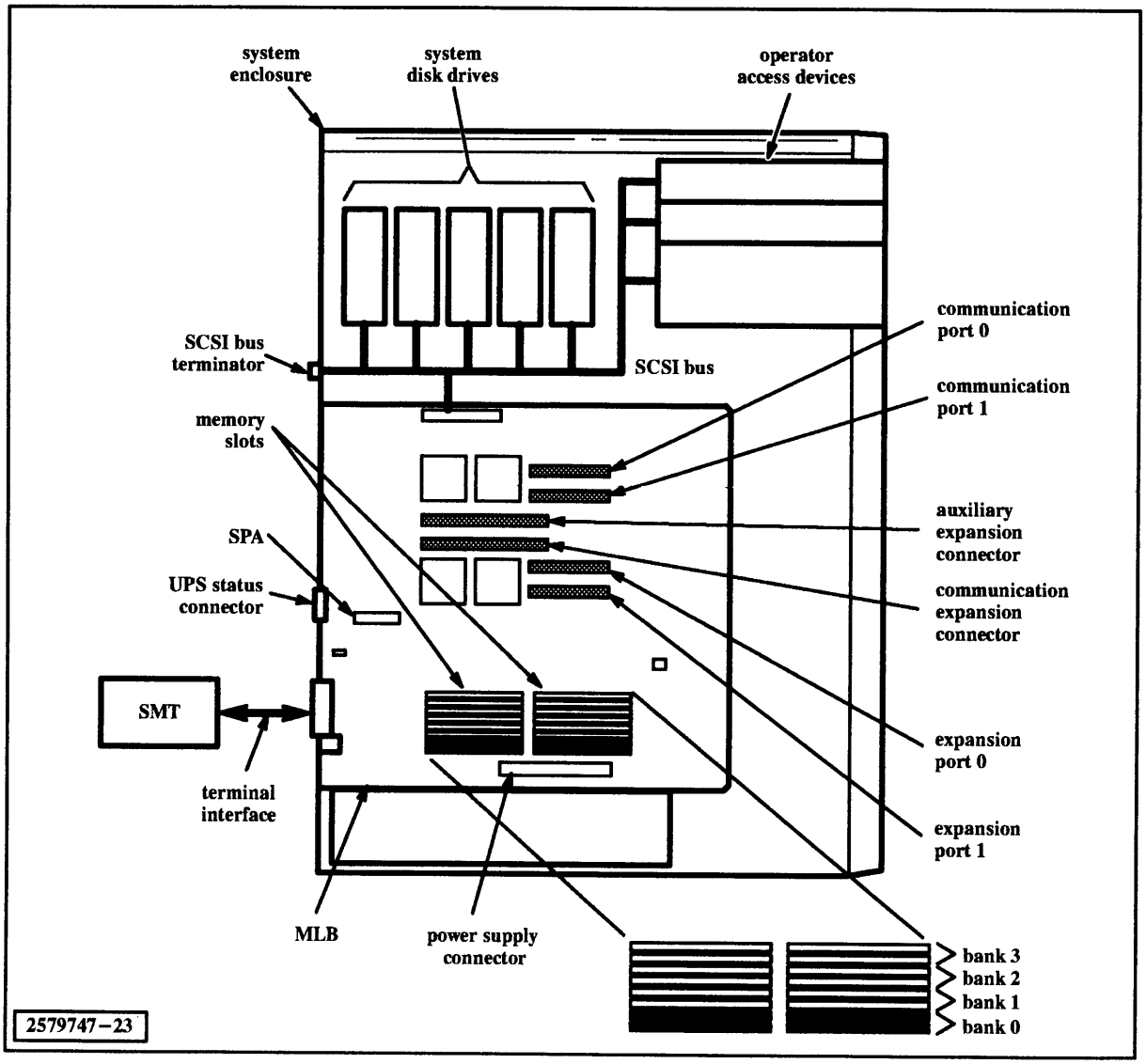
The SMT allows the operator to communicate with the CPU, via the terminal interface, and to perform such administrative tasks as initializing the operating system and executing extended self-tests. The terminal used as an SMT is user-specified and can be either a TI Model 928 or a TI Model 924 Video Display Terminal (VDT).

The software protection adapter (SPA) protects the system software against unauthorized use. Each SPA requires anyone who is initializing the operating system to enter a password that is uniquely associated with the SPA. TI provides this special password when you purchase your computer.

The SCSI bus transfers data, command, and control information from the computer to the mass storage subsystem. It transfers data and status information from the mass storage devices to the computer. A SCSI bus terminator must be installed after the last device on the bus.

The mass storage subsystem consists of the system disk and tape drives and the SCSI bus. The system disk drive contains the TI System V operating system and provides mass data storage for the computer. The system tape drive provides backup for the mass storage subsystem and provides a means of transporting data between your computer system and other computers. The mass storage subsystem can be expanded to include a total of seven mass storage devices. (Refer to the module entitled SCSI Mass Storage Devices.)

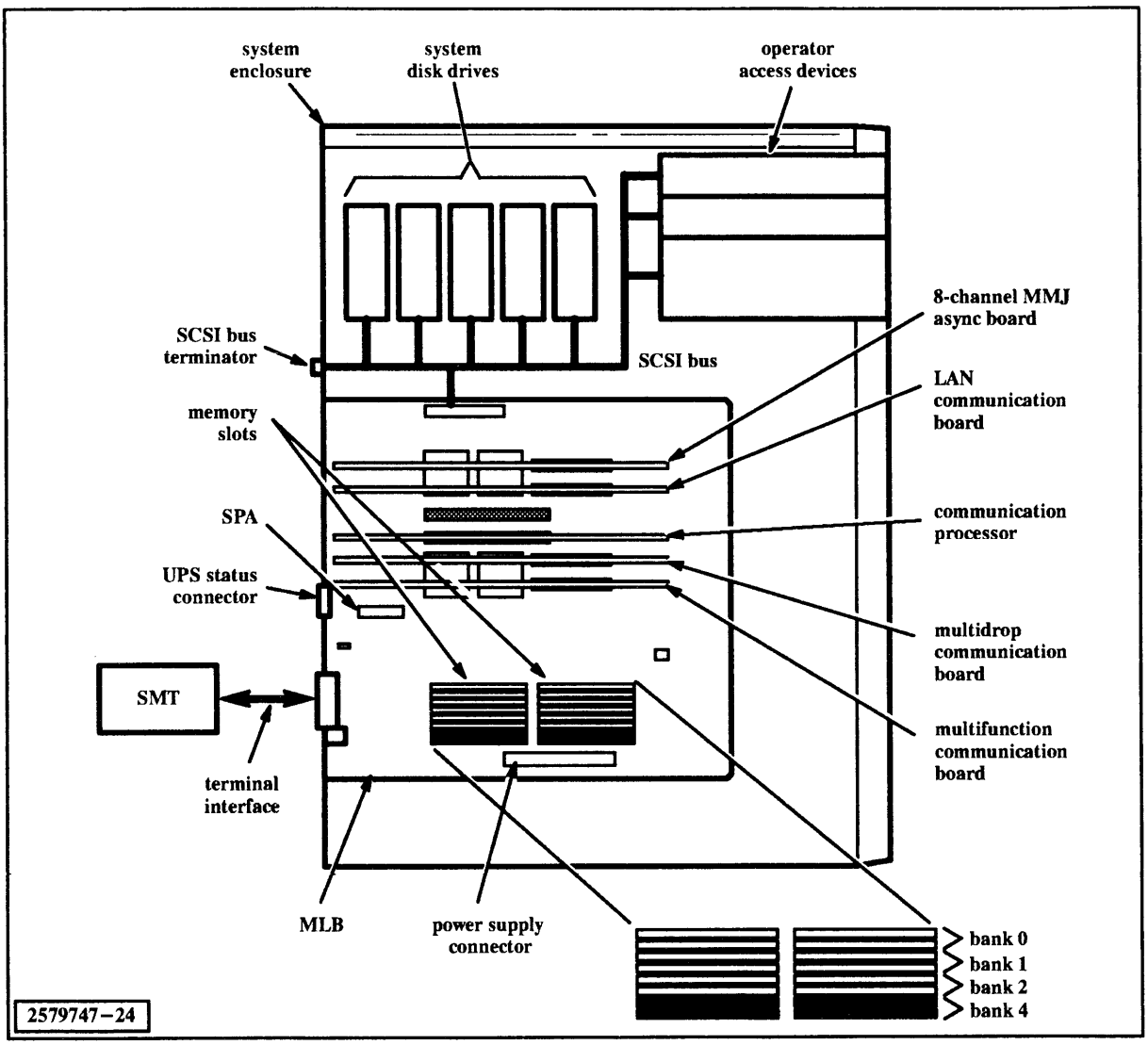
Figure 1-1 Basic SBC Block Diagram



Expanding the Basic SBC

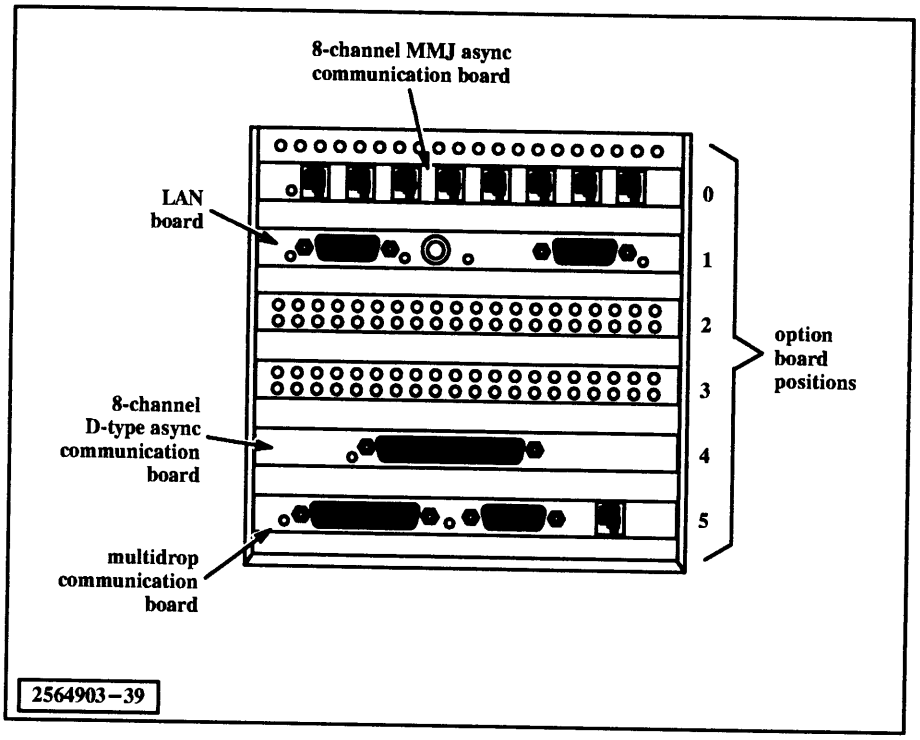
1.3 Figure 1-2 shows an example of the basic SBC expanded to include the communication option boards described in Sections 2 through 6 of this module. This expansion allows the computer to support multiple terminals, printers, and modems in any of several different ways.

Figure 1-2 Expanded SBC Block Diagram (Example)



Each of the communication option boards described in Sections 2 through 6 of this module includes an option panel that fits into a slot in the computer chassis and secures the board. After an option board is installed in the computer chassis, the option panel is visible at the rear of the computer as shown in Figure 1-3. These panels allow access to the option board peripheral connectors and provide viewing apertures for light-emitting diodes (LEDs) on the boards.

Figure 1-3 **Option Panels Visible at the Rear of the Computer**



The following are brief descriptions of the communication option boards:

- Communication processor board — Provides an interface between the SBC bus and the communication expansion bus connected to expansion ports 0 and 1. (See Section 2 of this module.)

- 8-channel modified modular jack (MMJ) asynchronous (async) communication board — Provides an interface between the communication processor and up to eight peripheral devices such as terminals and printers. This board contains eight MMJs similar to the standard jacks used by commercial telephone companies. (See Section 3 of this module.)

- 8-channel D-type async communication board — Identical to the 8-channel MMJ async communication board except that, instead of the MMJ connectors, it provides a single 62-pin D-type connector for connecting an EIA-232 (Electronic Industries Association) serial interface connector strip. The connector strip contains eight 25-pin, female, D-type shielded connectors that support a maximum of eight terminals, printers, and modems. (See Section 3 of this module.)

- Local area network (LAN) communication board — Provides a single-channel interface to an Ethernet™ 802.3 or Cheapernet 802.3a LAN. This board also provides an interface to a CCITT (Comité Consultatif International Télégraphique et Téléphonique) V.35 standard modem for connection, via leased telephone lines, to other computers or computer networks in remote locations. (See Section 4 of this module.)

Ethernet is a trademark of Xerox Corporation.

- Multidrop communication board — Provides an interface to a multidrop subsystem, a V.35 modem, and a parallel printer. The multidrop subsystem provides connection to multiple terminals and printers via one or more multidrop terminal concentrators (MTCs). The V.35 modem provides connection to multiple terminals and printers via leased telephone lines and one or more remote MTCs. (See Section 5 of this module.)

NOTE: The multidrop communication board provides all the hardware necessary to support the interfaces described above. However, the system software does not currently support the V.35 modem.

- Multifunction communication board — Provides an interface to a parallel printer and either a V.35 modem or an EIA-232 modem. Either of these modems provides connection, via commercial telephone lines, to remote systems. (See Section 6 of this module.)

Unpacking an Option Board

1.4 The option boards are wrapped in antistatic bags and shipped in cardboard containers. Before unpacking an option board, visually inspect the shipping container for damage. If the inspection reveals damage to the container, contact the carrier agent for instructions on filing a claim. After resolving any problems with container damage, use these steps to unpack the board.

1. Carefully cut or remove the tape on top of the shipping container.
2. Open the container and remove the board in its antistatic bag.

CAUTION: All boards, options, and peripherals contain components that are sensitive to static electricity. When handling any of these items, protect against static electricity by using wrist grounding straps and grounded working mats. When moving or storing items, use the antistatic bags supplied with the items.

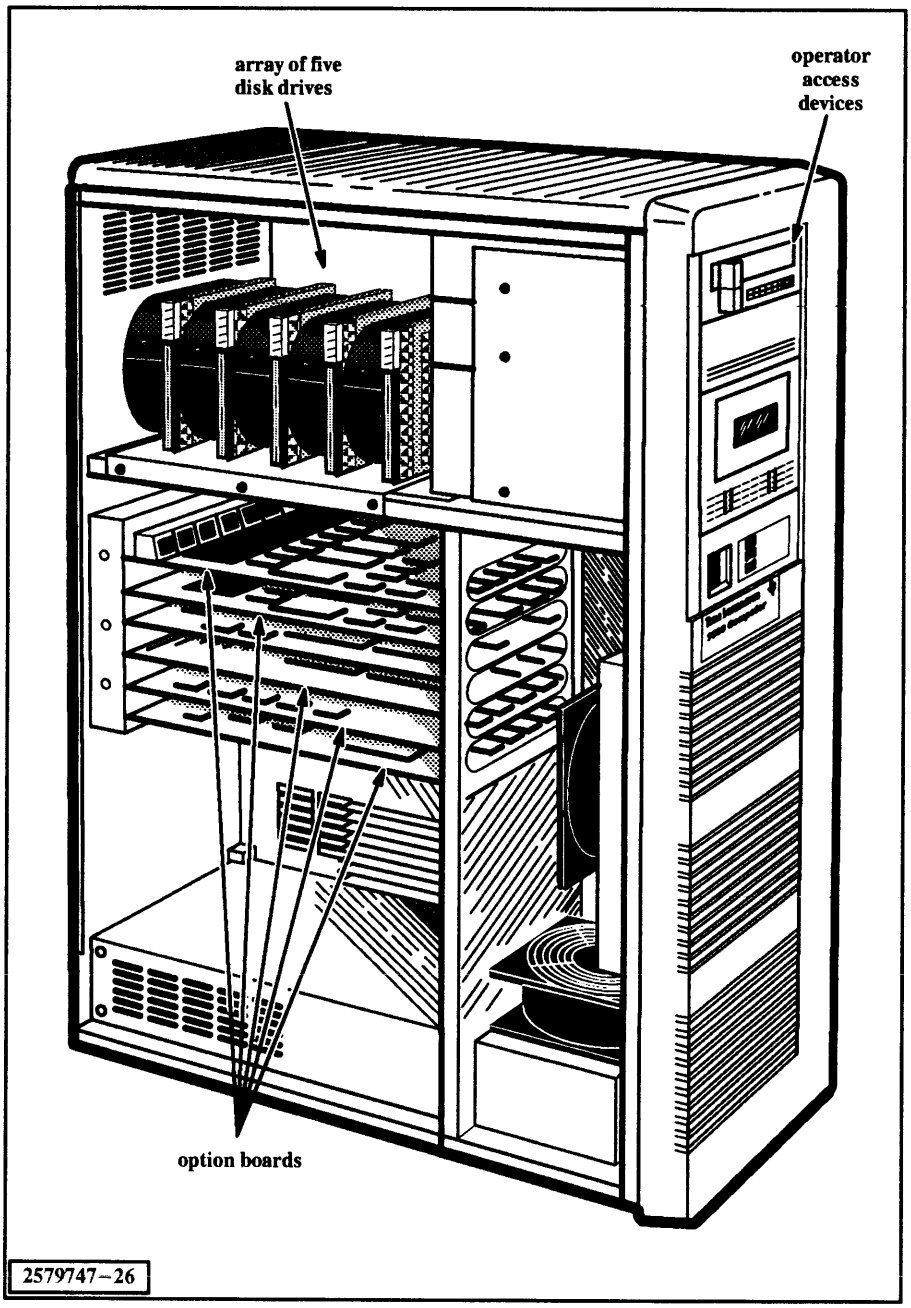
---

3. Open the antistatic bag and remove the board. Place the board on your work surface on top of the antistatic bag.
4. Inspect the board for evidence of shipping damage. If the inspection reveals such damage, contact the carrier agent. After the carrier agent inspects the damage, contact a Texas Instruments Field Service Office and notify them of the damaged board.
5. Save all packing materials for future use.

Installing the Option Boards

1.5 Figure 1-4 shows a computer with the main access panel removed and with option boards installed in every available option board position (except the auxiliary expansion port). The boards are positioned horizontally with the component side up and the option panel facing to the left (toward the rear of the computer). A single mounting screw holds each board in place.

Figure 1-4 **Computer With Option Boards Installed**



The computer contains six option board positions numbered (from top to bottom) 0 through 5. These positions and their port assignments are as follows:

- Position 0 — Communication port 0 can accept any communication option board except the communication processor.
- Position 1 — Communication port 1 can accept any communication option board except the communication processor.
- Position 2 — Auxiliary expansion port is reserved for future expansion.
- Position 3 — Communication expansion port can accept the optional communication processor board.
- Position 4 — Expansion port 0 can accept any communication option board except the communication processor.
- Position 5 — Expansion port 1 can accept any communication option board except the communication processor

---

NOTE: Option board positions 4 and 5 cannot be used unless a communication processor has been installed in position 3.

Use these steps to install an option board in the computer:

1. Set the computer power switch to its off position, and disconnect the ac power cord.
2. Carefully pry the top of the computer front panel away from the computer until it disengages, and remove the panel as shown in Figure 1-5.
3. Remove the two mounting screws from the main access panel. Slide the access panel toward the front of the computer about an inch and then remove the panel as shown in Figure 1-6.

Figure 1-5 **Removing the Computer Front Panel**

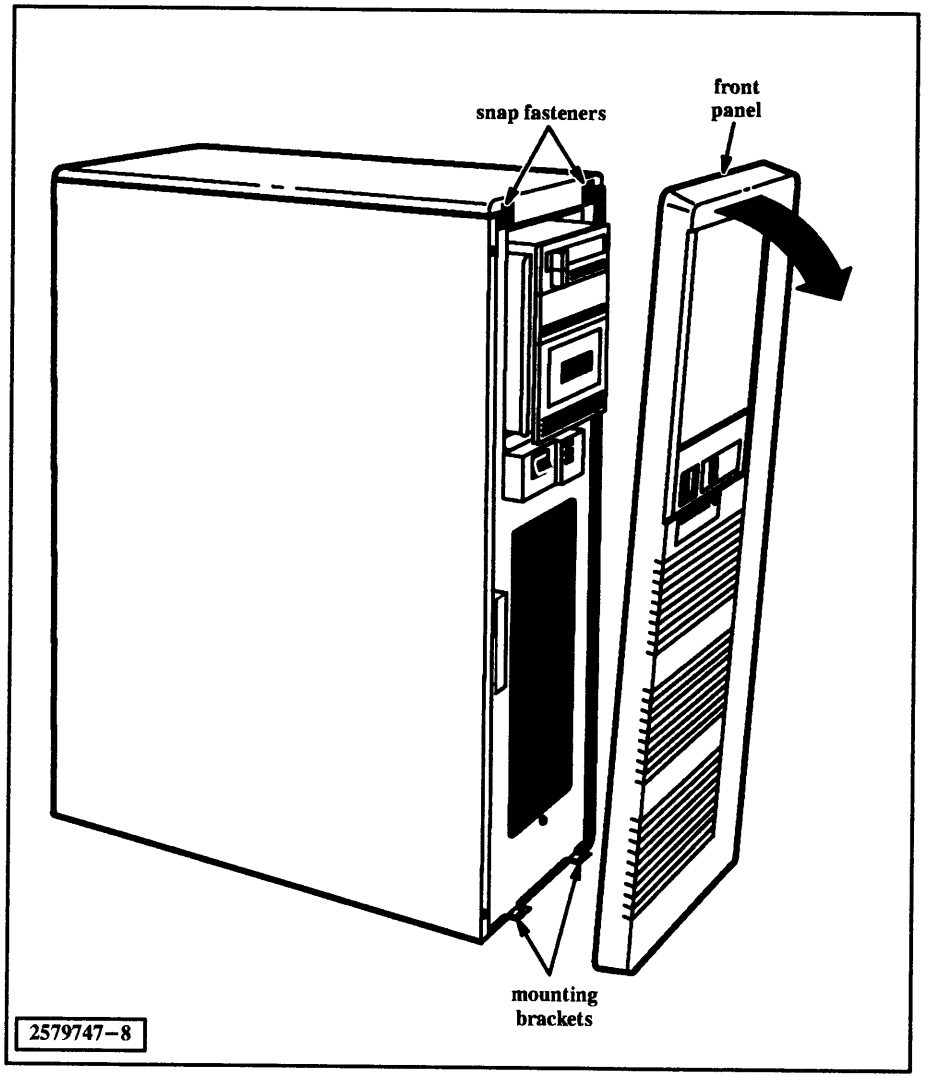
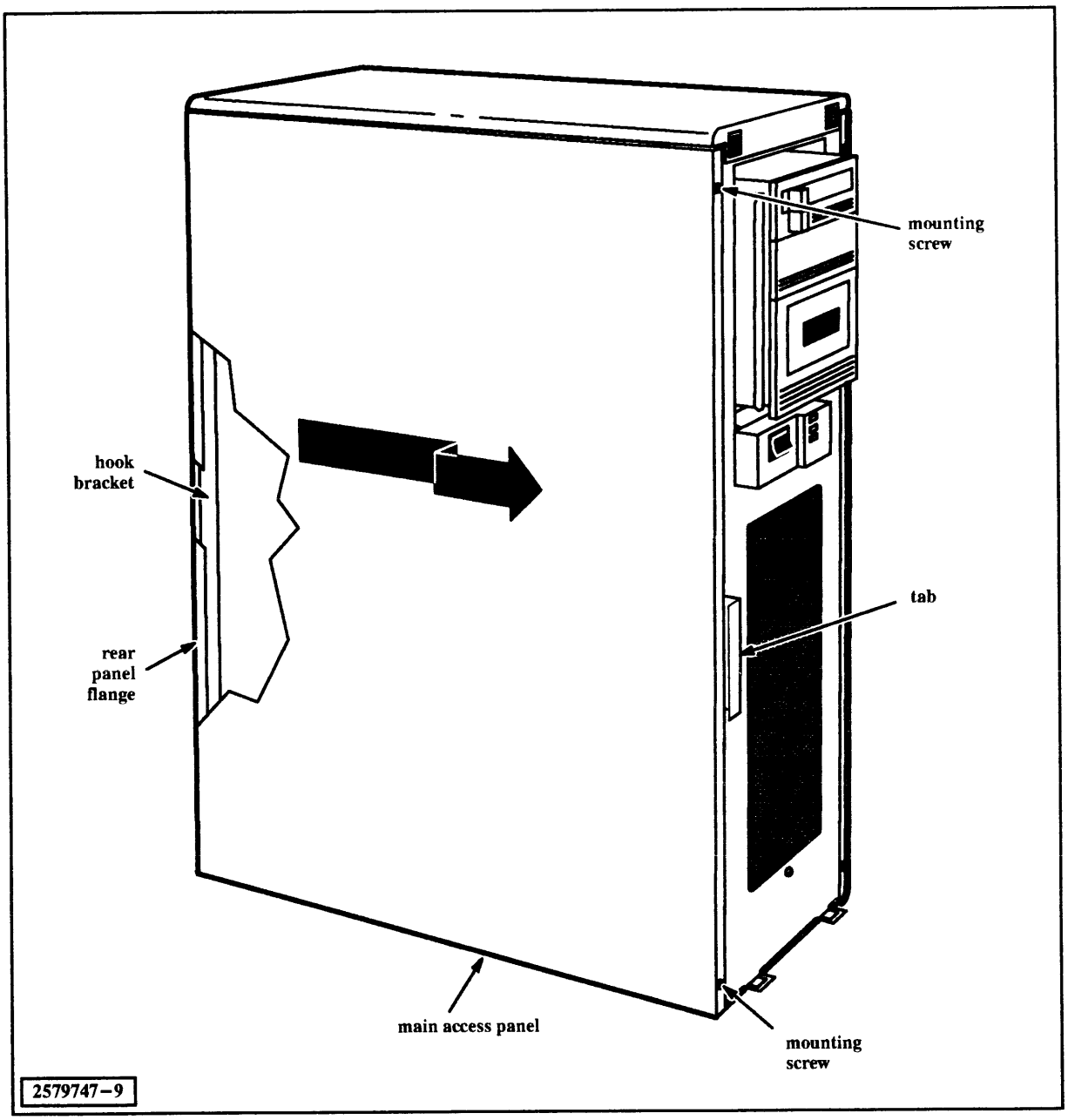
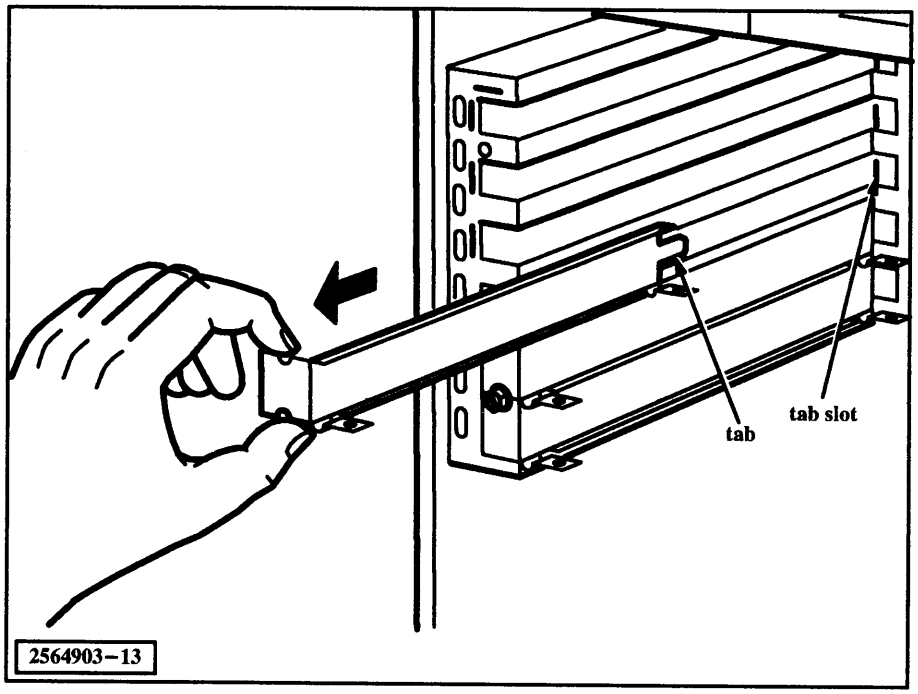


Figure 1-6 Removing the Main Access Panel



4. Locate the position in which you want to install the option board and remove the screw that holds the blank option panel in place (Figure 1-7). Pull the blank option panel out of the chassis.

Figure 1-7 **Removing the Blank Option Panels**



5. Orient the option board horizontally with the component side up and the option panel facing to the left as shown in Figure 1-8, and then follow these steps:

   a. Place the right edge of the board in the notch at the right side of the card cage and the option panel in the vacant option panel slot at the left.

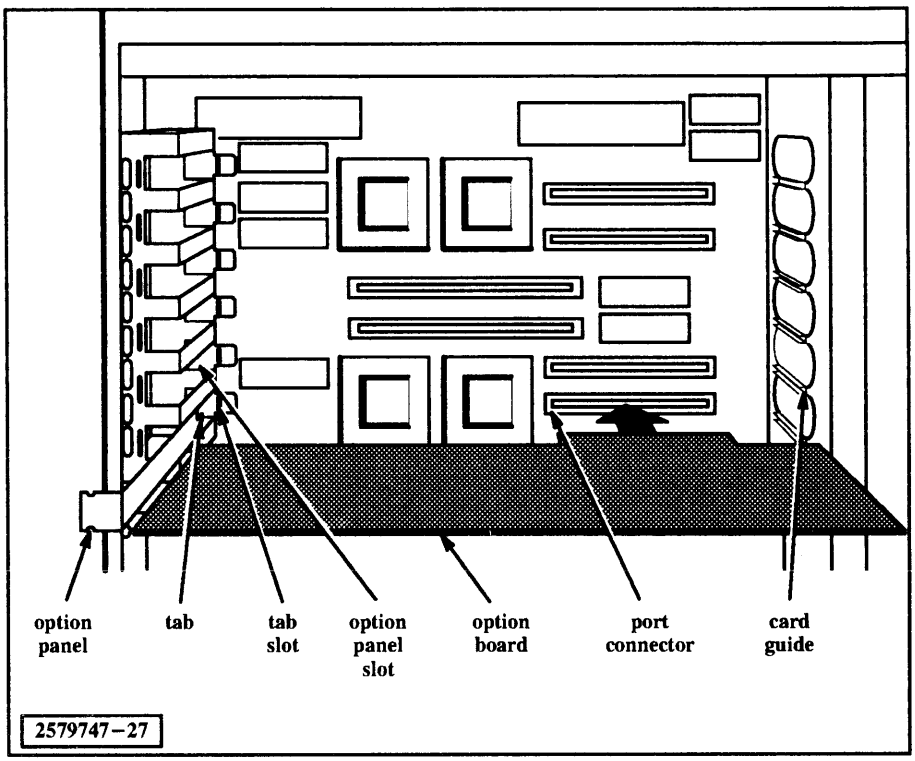
CAUTION: When performing the following step use extra care to ensure that the board edge connector engages its corresponding port connector properly.

   b. Carefully slide the board into the card cage until the board edge connector engages the port connector on the main logic board and the tab on the option panel engages the tab slot from which the blank option panel was removed.

   c. Gently press on the board (in the direction of the large arrow in Figure 1-8) until it is fully seated in the MLB port connector.

   d. Replace the screw that you removed in step 4.

Figure 1-8 **Installing an Option Board**



6. If you have other option boards to install, repeat steps 4 through 6 for each board.

NOTE: Recall that if you wish to install option boards in option board positions 4 and 5 (expansion ports 0 and 1), you must also install the optional communication processor in position 3. If you are installing the LAN communication board, ensure that the configuration jumpers on the board have been set for the proper configuration. (See Section 4 of this module.)

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7. Reinstall the main access panel and the front panel.

8. Reconnect the ac power cord and return the computer power switch to its on position. The computer automatically executes the self-test and initializes the computer hardware and operating system.

After you have completed installing your option boards, you can connect peripheral devices to the boards as described in Sections 3 through 6 of this module. After you have connected all peripheral devices and returned the computer to operation, refer to the module in this manual entitled System Enclosure for information about logging into the system.

Arranging for TI to Install Your Option Boards

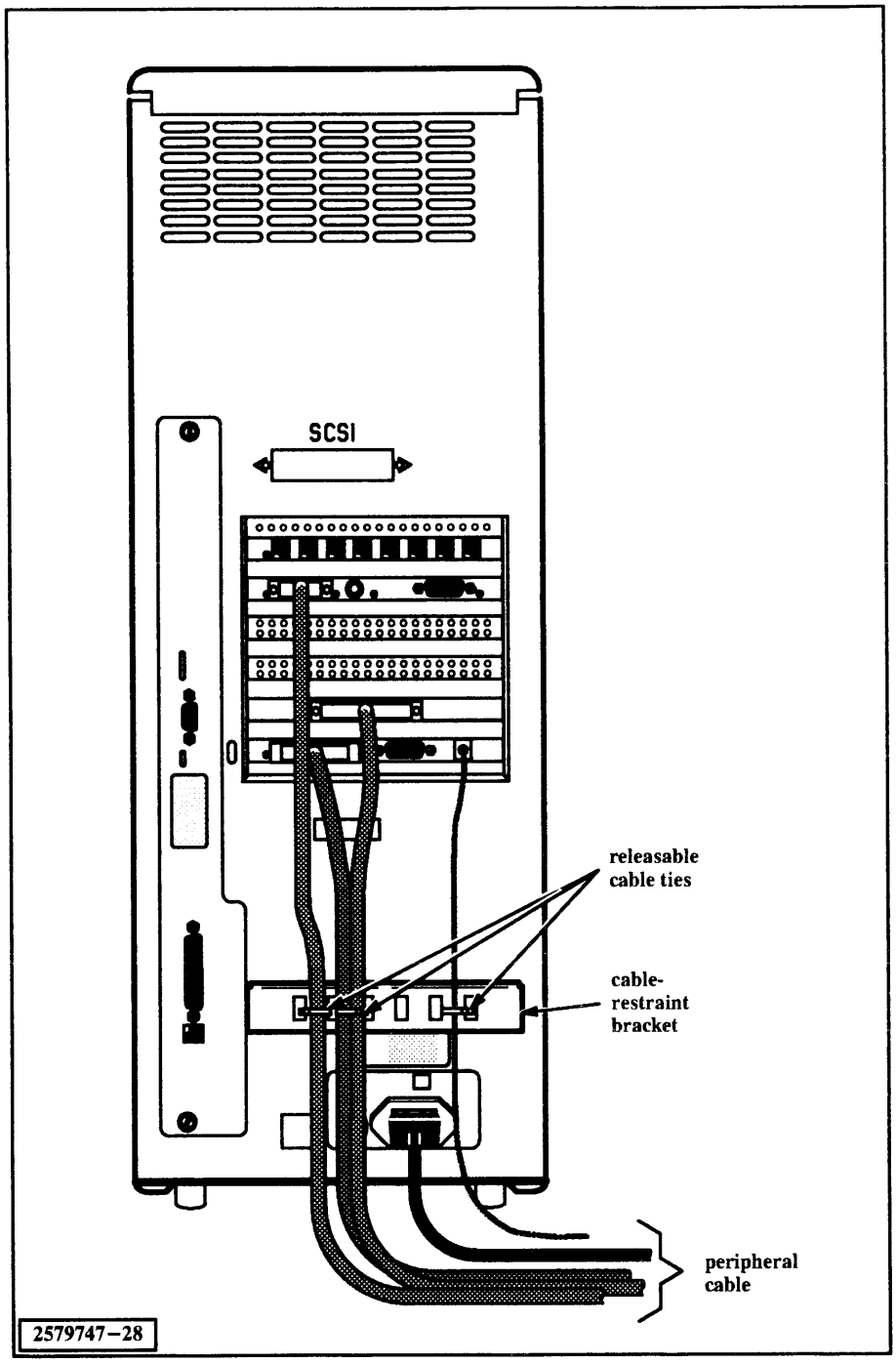
1.6 If you prefer to have TI install your option boards rather than installing them yourself, contact the Field Service Communications Center at toll-free telephone number 1-800-572-3300 to schedule the installation. You will need to furnish the following information:

- The system serial number from the label on the back of your computer
- Your name and the name of your company
- Your company street address, city, state, and zip code and any special directions for finding the location
- The name and telephone number of the person to contact
- The purchase order number of the option to be installed

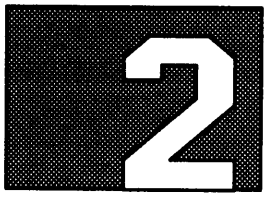
Installing Peripheral Cables

1.7 Sections 3 through 6 of this module explain how to connect various peripheral devices to the communication option boards. Figure 1-9 shows a rear view of the system enclosure with several peripheral cables installed. The system enclosure provides a cable-restraint bracket to support these cables in a stable position. Releasable cable ties (shipped with your computer) let you attach the cables to the bracket as shown.

Figure 1-9 **Peripheral Cables Properly Installed**



COMMUNICATION PROCESSOR OPTION



Introduction

2.1 The single-board computer (SBC) main logic board (MLB) includes a communication processor that provides interface and control functions for two communication option ports (0 and 1). Each of these ports can accept and support any one of the communication option boards described in Sections 3 through 6 of this module. If your system requires additional communication option boards, you must first install the optional communication processor board. This board provides support for two additional communication option ports (expansion ports 0 and 1) located at option board positions 4 and 5, respectively.

The principle components of the communication processor board are a 68010 microprocessor, an interrupt controller, and an application-specific integrated circuit (ASIC). The board also provides 64K bytes of static random-access memory (RAM), 512K bytes of pseudo-static RAM, and 64K bytes of read-only memory (ROM). The communication processor provides the following functions for the computer system:

- Polls the expansion ports to determine the type of option board installed in each port and the type of interface for which the option board is configured. (See paragraph 2.3.2.)
- Receives interrupt requests from the installed option boards and handles these requests according to the interrupt priority level.
- Controls direct memory access (DMA) arbitration between the installed option boards. Each option board that has DMA capability must arbitrate for access to the communication processor RAM. (See paragraph 2.3.3.)
- Transfers parallel data between the SBC bus and the expansion port bus.

CAUTION: All boards, options, and peripherals contain components that are sensitive to static electricity. When handling any of these items, protect against static electricity by using wrist grounding straps and grounded working mats. When moving or storing items, use the antistatic bags supplied with the items.

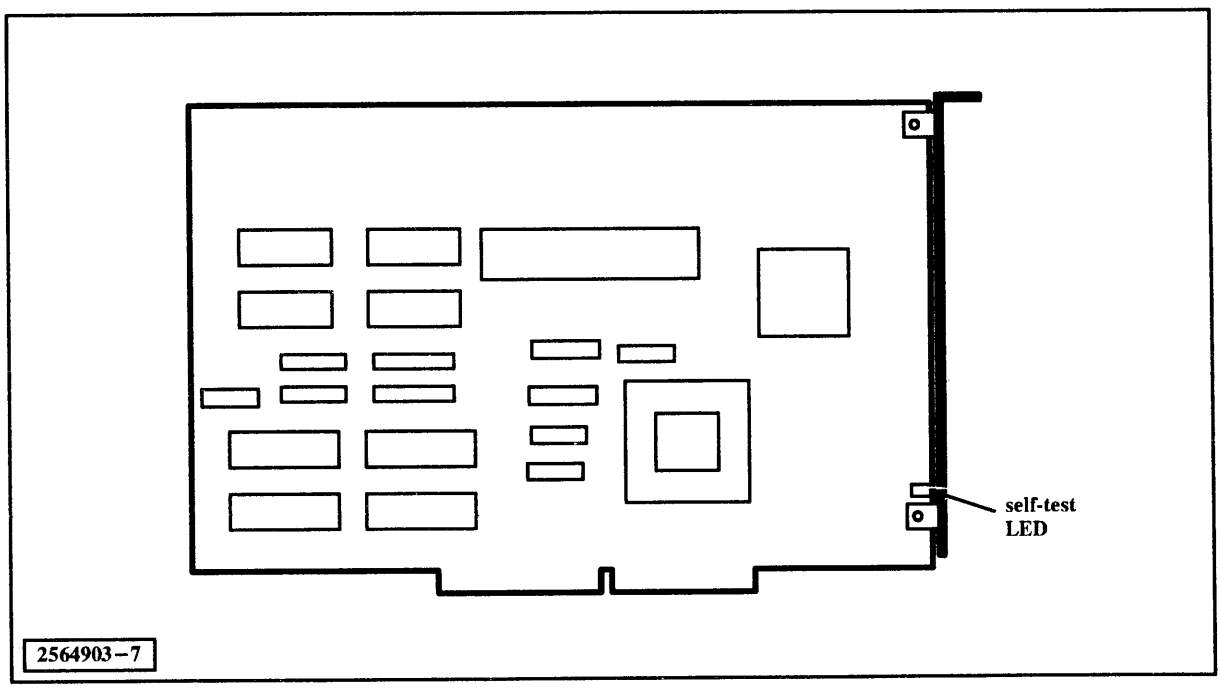
Physical Description

2.2 Figure 2-1 shows the communication processor board, TI part number 2561095-0001. This board has no configuration jumpers or switches and no connectors other than the 182-pin edge connector. This connector serves as an interface to both the SBC bus and the expansion port bus. The communication processor board is part of the following kits:

- Factory-installed CP101 communication processor kit, TI part number 2561356-0002
- Field-installable CP101 communication processor kit, TI part number 2561356-0001

The communication processor board contains a red self-test light-emitting diode (LED) that is visible through the option board panel. At power-up, the host computer executes a self-test to verify that all major system elements, including the option boards, are functional. The self-test LED lights to indicate the self-test is in progress. If the board fails the self-test, the LED remains on at the completion of self-test execution.

Figure 2-1 Communication Processor Board

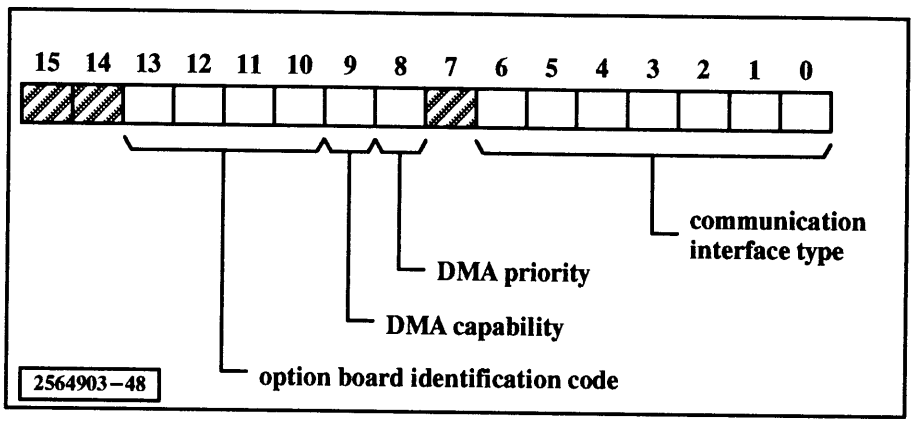


Option Board Configuration Registers

2.3 Each of the option boards described in Sections 3 through 6 of this manual contains a 16-bit configuration register (Figure 2-2) that provides the option board identification (ID), the type of communication interface the board can handle, whether or not the board has DMA capabilities, and, if so, the DMA priority level. The communication processor polls the option board positions to determine this information about each installed option board. The following paragraphs describe the configuration register contents.

NOTE: Configuration register bits 7, 14, and 15 are not used.

Figure 2-2 **Configuration Register**



Option Board Identification Codes

2.3.1 The configuration register on each option board contains a unique 4-bit binary code (bits 10 through 13) that identifies the board for the communication processor. If no board is installed in a particular option board position, that position returns an ID code of F (1111) to the communication processor. The option board ID codes are as follows:

- 8-channel MMJ or D-type async communication board — ID code 6 (0110)
- Local area network (LAN) communication board — ID code 3 (0011)
- Multidrop communication board — ID code 8 (1000)
- Multifunction communication board — ID code 4 (0100)
- No board installed — ID code F (1111)

Interface Configuration Codes

2.3.2 The configuration register on each option board contains a 7-bit binary code (bits 0 through 6) that indicates the type of communication interface the board is currently configured for. These codes are as follows:

- 8-channel MMJ or D-type async communication board — Configuration code 7C (111 1100) — EIA serial interface
- LAN communication board — Either of the following configuration codes is valid for this board:
  - Configuration code 77 (111 0111) — Ethernet 802.3 interface
  - Configuration code 79 (111 1001) — V.35 modem interface
- Multidrop communication board — Either of the following configuration codes is valid for this board:
  - Configuration code 72 (111 0010) — multidrop interface with parallel printer
  - Configuration code 74 (111 0100) — V.35 modem interface with parallel printer
- Multifunction communication board — Either of the following configuration codes is valid for this board:
  - Configuration code 74 (111 0100) — V.35 modem interface with parallel printer
  - Configuration code 7A (111 1010) — EIA-232 modem interface with parallel printer

Direct Memory Access

2.3.3 Some option boards require the capability of accessing the communication processor RAM directly. This is called direct memory access (DMA). The configuration register on each board has a single-bit field that, when set to a value of zero, indicates the board has this capability. Another single-bit field indicates the DMA priority. When more than one board arbitrates for DMA at the same time, the communication processor uses this information to determine which board to grant access to. The option board DMA parameters are as follows:

- 8-channel MMJ and D-type async communication board — No DMA capability (bits 8 and 9 both set to 1)
- LAN communication board configured for Ethernet 802.3 or Cheapernet 802.3a — High-priority DMA capability (bits 8 and 9 both set to 0)
- LAN communication board configured for V.35 interface — Low-priority DMA capability (bit 8 set to 1 and bit 9 set to 0)
- Multidrop communication board with V.35 interface cable connected — Low-priority DMA capability (bit 8 set to 1 and bit 9 set to 0)
- Multidrop communication board with multidrop interface cable connected — Low-priority DMA capability (bit 8 set to 1 and bit 9 set to 0)
- Multifunction communication board — Low-priority DMA capability (bit 8 set to 1 and bit 9 set to 0)

Installing the Communication Processor Board

2.4 The communication processor board is fully configured at the factory and, therefore, has no jumpers or switches to be set by the user. However, the board has a dedicated position (option board position 3) in the system enclosure and must always be installed in that position. Use these steps to install the communication processor board:

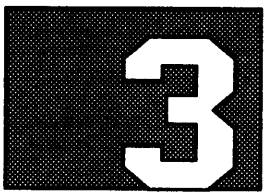
1. Turn off your computer, disconnect the ac power cord, and remove the computer front panel and main access panel as described in Section 1 of this module.

2. Install the communication processor board in option board position 3. Section 1 of this module provides a detailed procedure for installing boards.

3. Reinstall the main access panel and the front panel.

4. Reconnect the ac power cord and return the computer power switch to its on position.

EIGHT-CHANNEL ASYNC COMMUNICATION OPTION



Introduction

3.1 The 8-channel asynchronous (async) communication board provides an interface between a host computer and a maximum of eight peripheral devices, such as terminals, printers, or modems. The board accepts parallel data from the host, converts it to serial data, and passes it to the peripheral devices via an EIA-type serial interface. It receives asynchronous serial data from the peripheral devices, converts it to parallel data, and passes the data to the host computer.

A typical single-board computer (SBC) provides a communication processor that can support a maximum of two 8-channel async communication boards. Since each of these boards can support a maximum of eight peripheral devices, up to 16 devices can be connected without further expansion. By connecting 16 user terminals to the boards with an auxiliary printer attached to each terminal, this configuration can support a maximum of 32 devices (terminals and printers).

An optional communication processor board can be installed in a host computer option slot (see Section 2 of this module). This board can support up to two additional 8-channel async communication boards. Thus, the typical computer can be configured to support a maximum of 32 peripheral devices without external expansion. By connecting 32 user terminals to the boards with an auxiliary printer attached to each terminal, this configuration can support a maximum of 64 devices (terminals and printers).

This section provides essential information for anyone who installs the 8-channel async communication board in a computer system.

CAUTION: All boards, options, and peripherals contain components that are sensitive to static electricity. When handling any of these items, protect against static electricity by using wrist grounding straps and grounded working mats. When moving or storing items, use the antistatic bags supplied with the items.

Physical Description

3.2 The 8-channel async communication board is available in two versions, shown in Figure 3-1 and Figure 3-2, both of which are identical except for the method of connecting to the peripheral devices. The eight channels for both boards are designated channels 0 through 7 as shown in the figures. The two versions of this board are as follows:

- 8-channel modified modular jack (MMJ) async communication board, TI part number 2561100-0001. This version has eight independent MMJs, each of which can accept a terminal, printer, or modem. An MMJ is identical to a standard modular telephone connector except that the connector key is offset as shown in Figure 3-1. The 8-channel MMJ async communication board is part of the following kits:
  - Factory-installed CC801 8-channel async communication kit, TI part number 2561357-0002
  - Field-installable CC801 8-channel async communication kit, TI part number 2561357-0001
- 8-channel D-type async communication board, TI part number 2561150-0001. This version has a single 62-pin, female, D-type connector, which connects to an EIA-232 connector strip (shown in Figure 3-2), TI part number 2537333-0002. The connector strip contains eight 25-pin, female, D-type connectors, each of which can accept a printer, terminal, or modem cable. The 8-channel D-type async communication board and the EIA-232 connector strip are parts of the following kits:
  - Factory-installed CC805 8-channel async communication kit, TI part number 2561363-0002
  - Field-installable CC805 8-channel async communication kit, TI part number 2561363-0001

Both versions of the 8-channel async communication board contain a yellow self-test light-emitting diode (LED) that is visible through an aperture in the option panel. At power-up, the host computer executes a self-test to verify that all major system elements, including the option boards, are functioning properly. The self-test indicator lights to indicate the self-test is in progress. If the board fails the self-test, the indicator remains on at the completion of self-test execution.

Both versions also provide a 112-pin edge connector for plugging the board into an option board position of the system enclosure.

Figure 3-1 8-Channel MMJ Async Communication Board

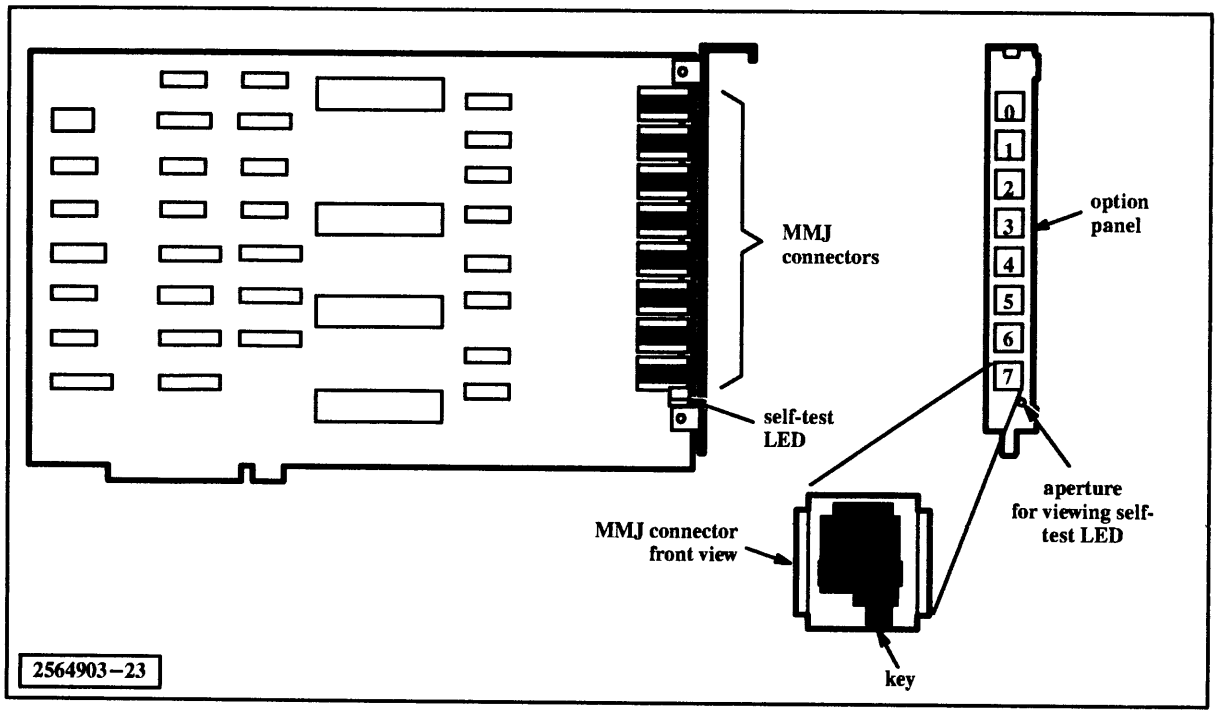
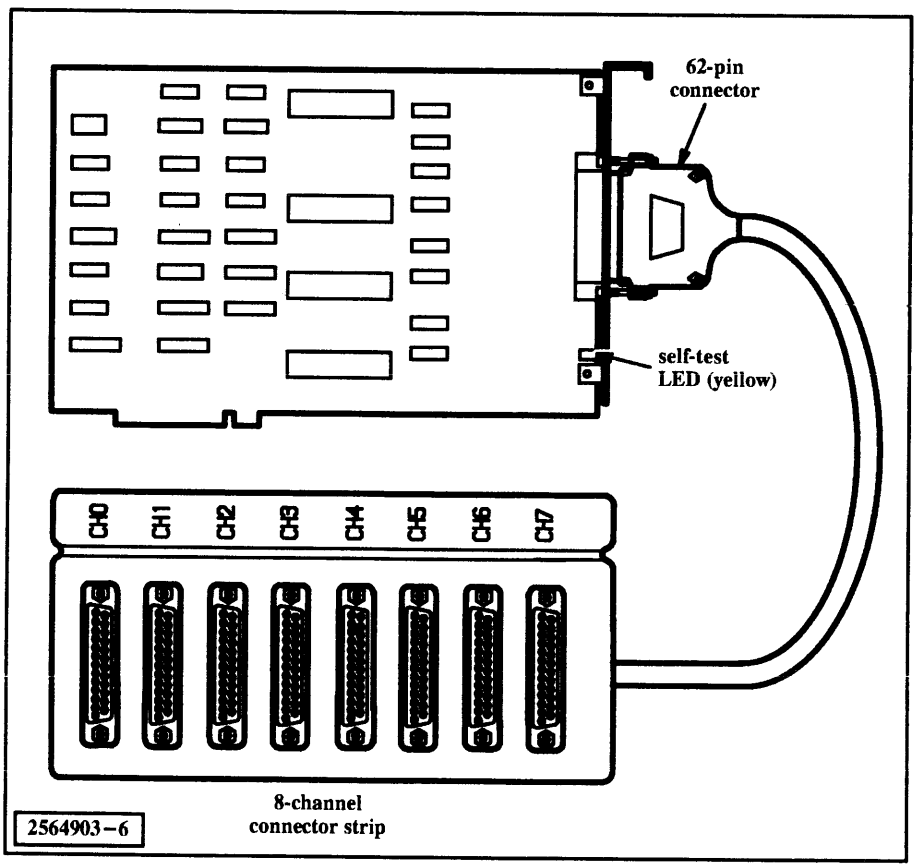


Figure 3-2 8-Channel D-Type Async Communication Board



Connecting Devices to the Board

3.3 After you have installed the 8-channel async communication board in a computer system, you can connect a maximum of eight peripheral devices as shown in the examples of Figure 3-3 and Figure 3-4. These boards require no hardware configuration, such as installing jumpers or setting switches.

Connecting Devices to the MMJ Async Communication Board

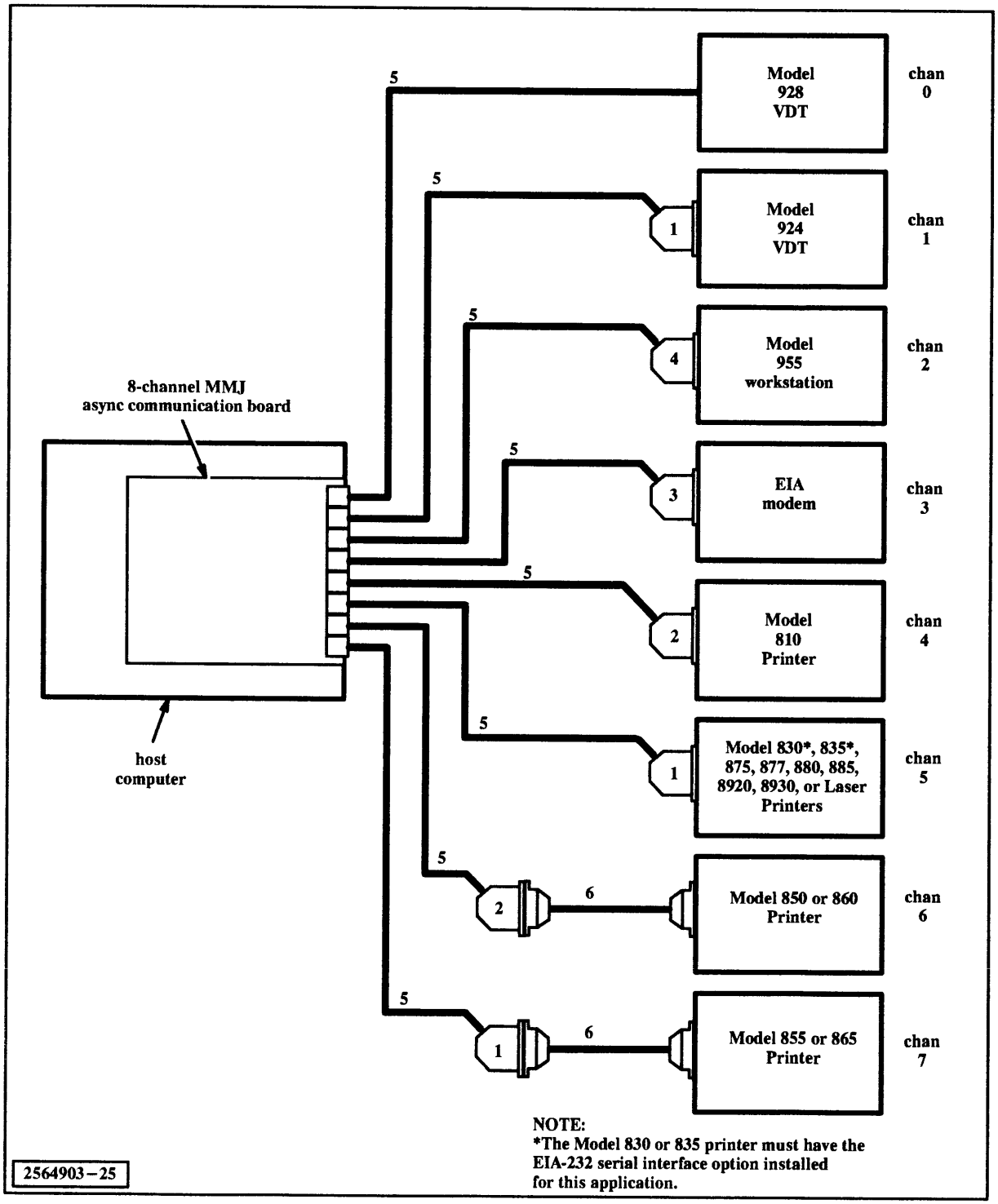
3.3.1 Figure 3-3 shows various devices (terminals, printers, and modems) connected to the 8-channel MMJ async communication board. Each of these devices (except the Model 928 VDT) is equipped with a standard 25-pin, D-type serial interface connector or a Centronics®-type parallel interface connector and, therefore, requires adaptation to the MMJ connector on the option board. Table 3-1 lists and describes the available cable assemblies and adapters for connecting the devices shown in Figure 3-3. The item numbers in the table correspond to the item numbers of Figure 3-3. The connection procedure follows Figure 3-3.

Table 3-1 MMJ Async Communication Board Cables and Adapters

Item	TI Part Number	Description
1	2554900-0001	Adapter. This adapter adapts a standard 25-pin, female, D-type connector to a 6-pin, male, MMJ connector. The Model 924 Video Display Terminal (VDT) and all TI printers except Models 810, 850, and 860 require this adapter.
2	2554900-0002	Adapter. This adapter adapts a standard 25-pin, female, D-type connector to a 6-pin, male, MMJ connector. TI Models 810, 850, and 860 Printers require this adapter.
3	2554900-0003	Adapter. This adapter adapts a standard 25-pin, female, D-type connector to a 6-pin, male, MMJ connector. EIA modems require this adapter.
4	2554900-0004	Adapter. This adapter adapts a standard 25-pin, male, D-type connector to a 6-pin, male, MMJ connector. The TI Model 955 Workstation requires this adapter. Also, this adapter provides an alternate means of connecting the TI Model 928 VDT to the 8-channel MMJ async communication board. (See Figure 3-5.)
5	2554927-0001	25-foot (7.62-meter) cable assembly with a 6-pin, male, MMJ connector on each end. One end connects to an MMJ connector on the 8-channel async communication board; the other end connects to an MMJ connector on the Model 928 VDT or to an MMJ-to-D-type adapter for other devices. This cable assembly is required for all devices connected to the 8-channel MMJ async communication board.
6	2222477-0002	Adapter cable. This cable adapts a standard 36-pin, female Centronics-type parallel printer connector to a standard 25-pin, male, D-type serial interface connector. TI Models 850, 855, 860, and 865 Printers configured for parallel operation require this adapter cable.

Centronics is a registered trademark of Centronics Data Computers.

Figure 3-3 Typical 8-Channel MMJ Async Communication Board Installation



To connect the peripheral devices shown in Figure 3-3 to the 8-channel MMJ async communication board, follow these steps:

1. Turn off your computer, disconnect the ac power cord, and remove the computer front panel and main access panel as described in Section 1 of this module.
2. Install the 8-channel MMJ async communication board in an available option board position as described in Section 1 of this module.
3. Ensure that each peripheral device power switch is set to its off position and its ac power cord is disconnected.
4. Use one of the following steps, depending upon which device you are connecting, to prepare the device for connection to the option board:

   a. Model 810 Printer — Connect an adapter, TI part number 2554900-0002 (item 2 of Figure 3-3), to the serial interface connector on the printer.

   b. Model 850 or 860 Printer — Connect the 25-pin, female, D-type connector of adapter cable, TI part number 2222477-0002 (item 6 of Figure 3-3), to the 25-pin, male, D-type interface connector on the printer. Connect an adapter, TI part number 2554900-0002 (item 2 of Figure 3-3), to the other end of the adapter cable.

   c. Model 855 or 865 Printer — Connect the 25-pin, female, D-type connector of adapter cable, TI part number 2222477-0002 (item 6 of Figure 3-3), to the 25-pin, male, D-type interface connector on the printer. Connect an adapter, TI part number 2554900-0001 (item 1 of Figure 3-3), to the other end of the adapter cable.

   d. All other printers shown in Figure 3-3 — Connect an adapter, TI part number 2554900-0001 (item 1 of Figure 3-3), to the 25-pin, female, D-type interface connector on the printer.

   e. Model 924 VDT — Connect an adapter, TI part number 2554900-0001 (item 1 of Figure 3-3), to the 25-pin, female, D-type interface connector on the VDT.

   f. Model 955 Workstation — Connect an adapter, TI part number 2554900-0004 (item 4 of Figure 3-3), to the 25-pin communication interface connector on the workstation.

   g. EIA modem — Connect an adapter, TI part number 2554900-0003 (item 3 of Figure 3-3), to the 25-pin, male, D-type interface connector on the modem.

NOTE: If you need help in locating the device connectors, refer to the manual entitled *Terminal/Printer Information*, TI part number 2557939- 0001. This manual also provides information about connecting auxiliary devices to the terminals.

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5. Use a screwdriver to secure all adapter and connector screws.

6. Connect one end of the cable assembly, TI part number 2554927-0001 (item 5 of Figure 3-3) to the 6-pin, female, MMJ connector on the TI Model 928 VDT or to an adapter (installed in step 4) on any other device. Connect the other end of the cable assembly to any available MMJ connector on the 8-channel async communication board. These jacks and connectors mate in the same manner as commercial telephone jacks and connectors.

7. Connect the ac power cord for each peripheral device and turn on the device power switches.

8. Reinstall the main access panel and the front panel.

9. Reconnect the computer ac power cord and set the computer power switch to its on position.

After you have connected all peripheral devices to the 8-channel MMJ async communication board, refer to the module in this manual entitled System Enclosure for information about initializing the operating system and logging into the system.

The preceding example illustrates the versatility of the 8-channel async communication board. You can connect any combination of terminals, printers, and modems to customize your system to fit your particular application and needs. This versatility is typical of all the SBC option boards described in this section and the following sections.

Connecting Devices to the D-Type Async Communication Board

3.3.2 Figure 3-4 shows various devices (terminals, printers, and modems) connected to the 8-channel D-Type async communication board via the 8-channel EIA-232 connector strip. Since the connector strip is equipped with standard D-type serial interface connectors, the MMJ-to-D-type adapters are not needed for these connections. However, printers that are equipped with only a Centronics-type parallel connector require the serial-to-parallel adapter cable, TI part number 2222477-0002.

Figure 3-4 Typical 8-Channel D-Type Async Communication Board Installation

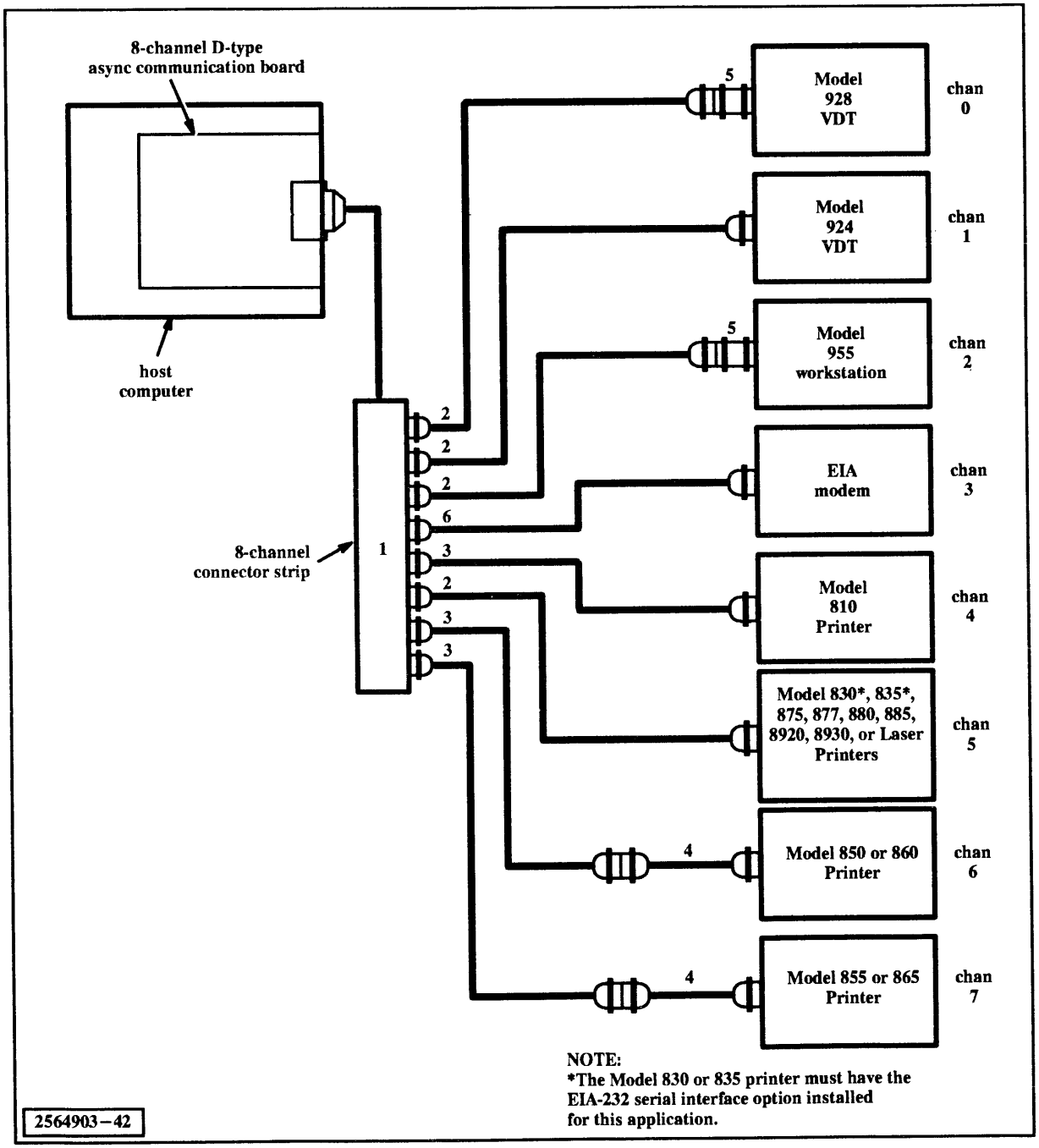


Table 3-2 lists and describes the available cable assemblies and adapters for connecting the devices shown in Figure 3-4. The item numbers in the table correspond to the item numbers of Figure 3-4.

Table 3-2 D-Type Async Communication Board Cables and Adapters

Item	TI Part Number	Description
1	2537333-0002	EIA-232 connector strip. This connector strip connects to the 8-channel D-type async communication board via a standard 62-pin, female, D-type connector and provides eight standard 25-pin, female, D-type serial interface connectors for connecting peripheral devices.
2	2230504-0001 2230504-0002 2230504-0003	13-foot (3.96-meter) cable assembly 26-foot (7.92-meter) cable assembly 49-foot (14.93-meter) cable assembly Each of these cable assemblies has a standard 25-pin, male, D-type connector at each end. These cables can be used with a TI Model 924 or 928 VDT, a TI Model 955 Workstation, or any TI printer except Models 810, 850, 855, 860, and 865.
3	2308663-0001	13-foot (3.96-meter) cable assembly with a standard 25-pin, male, D-type connector on each end. This cable is used to connect a TI Model 810, 850, 855, 860, or 865 Printer to the EIA-232 connector strip.
4	2222477-0002	Adapter cable. This cable adapts a standard 36-pin, female, Centronics-type parallel printer connector to a standard 25-pin, male, D-type serial connector. TI Models 850, 855, 860, and 865 Printers require this adapter cable.
5	2544288-0001	Adapter. This adapter adapts the standard 25-pin, male, D-type interface connector on the TI Model 928 VDT or the TI Model 955 Workstation to the standard 25-pin, male, D-type connector on the interface cable (item 2).
6	2532883-0001	10-foot (3.04-meter) cable assembly with a standard 25-pin, male, D-type connector at each end. This cable assembly connects EIA modems to the EIA-232 connector strip.

To connect the peripheral devices shown in Figure 3-4 to the 8-channel D-type async communication board, follow these steps:

1. Turn off your computer, disconnect the ac power cord, and remove the computer front panel and main access panel as described in Section 1 of this module.

2. Install the 8-channel D-type async communication board in an available option board position as described in Section 1 of this module.

3. Connect the EIA-232 connector strip (item 1 of Figure 3-4) to the 62-pin, female, D-type connector on the option board. Use a screwdriver to secure the connector with the captive screws provided.

4. Ensure that each peripheral device power switch is set to its off position and its ac power cord is disconnected.

5. Connect the required cable assemblies and adapters (shown in Figure 3-4 and described in Table 3-2) between the connector strip and the peripheral devices. Use a screwdriver to secure all adapter and connector screws.

NOTE: If you need help in locating the device connectors, refer to the manual entitled *Terminal/Printer Information*, TI part number 2557939-0001. This manual also provides information about connecting auxiliary devices to the terminals.

---

6. Connect the ac power cord for each peripheral device and turn on the device power switches.

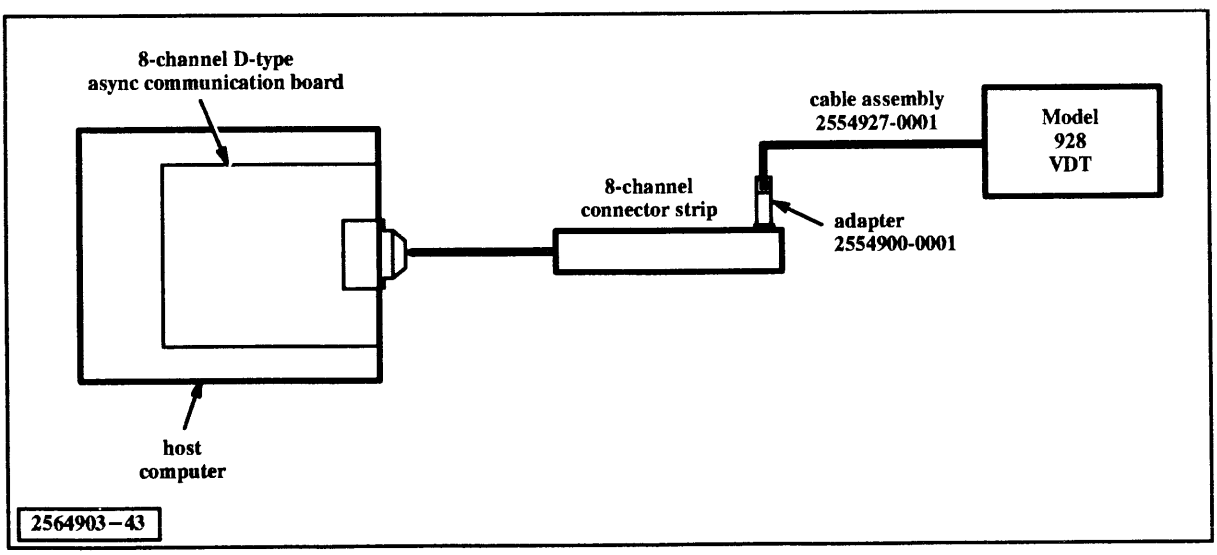
7. Reinstall the main access panel and the front panel.

8. Reconnect the computer ac power cord and set the computer power switch to its on position.

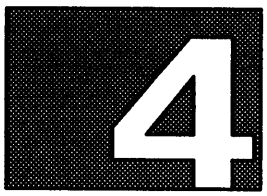
Figure 3-5 shows another way to connect the Model 928 VDT to the 8-channel D-type async communication board. This method requires the following items:

- EIA-232 connector strip, TI part number 2537333-0002.
- 25-foot (7.62-meter) cable assembly with a 6-pin, male, MMJ connector on each end, TI part number 2554927-0001.
- MMJ-to-D-type adapter, TI part number 2554900-0001.

Figure 3-5 Alternate Method of Connecting the Model 928 VDT to the D-Type Async Communication Board



LOCAL AREA NETWORK COMMUNICATION OPTION



Introduction

4.1 The local area network (LAN) communication option board provides a single-channel interface between a host computer and a LAN. These networks provide high-speed switched communication between such data equipment as computers, printers, display terminals, and plotters within a local area such as an office building, a hospital, or a manufacturing plant.

The LAN communication board receives parallel data from the host computer and transfers it to the LAN or modem as serial data. A Manchester code converter on the board encodes the data for use on the LAN, and decodes data received from the LAN for use by the host computer.

CAUTION: All boards, options, and peripherals contain components that are sensitive to static electricity. When handling any of these items, protect against static electricity by using wrist grounding straps and grounded working mats. When moving or storing items, use the antistatic bags supplied with the items.

After you install the LAN communication board in a host computer and connect it to a LAN, the computer becomes a part of the network. The computer can then take part in data-transfer operations with any other device or system on the network. Special configuration jumpers on the LAN communication board allow you to configure the option to support any of the following LAN standards:

- IEEE 802.3 Ethernet — The 802.3 Ethernet can contain up to five LAN segments, each with a maximum length of 1640 feet (500 meters). Each segment can support up to 100 nodes connected by rugged, double-shielded coaxial cable with N-series connectors. Each drop cable can be a maximum of 164 feet (50 meters) long and connects to the transceiver and the data equipment via a 15-pin, D-type connector. An Ethernet can contain multiple segments connected by repeaters.

- IEEE 802.3a Cheapernet — The 802.3a Cheapernet is a low-cost version of the Ethernet in which the transceivers are built into the data equipment. Also, its segment lengths are limited to 607 feet (185 meters) with a maximum node count of 30 nodes per segment. The Cheapernet uses standard BNC T connectors that connect directly to the data equipment. The Cheapernet is fully compatible with the Ethernet and can be intermixed in the same network as long as the Cheapernet limitations specified in this paragraph are not exceeded.

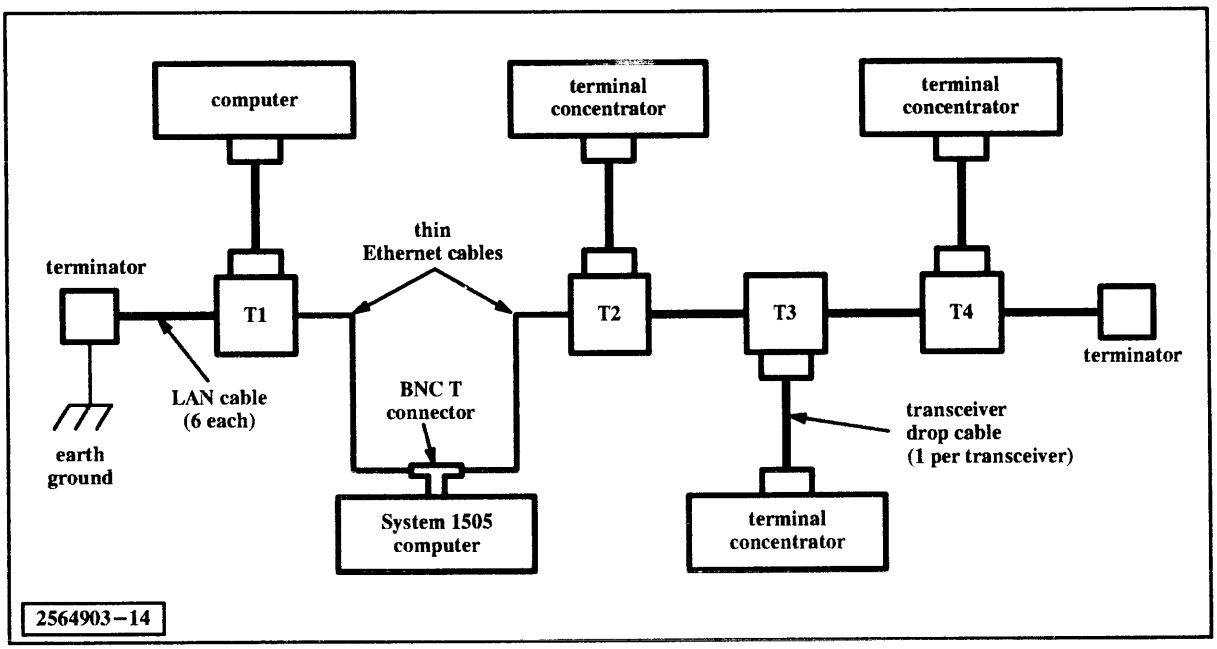
- V.35 Modem Interface — This is a high-speed serial communication interface that connects the LAN communication board directly to a V.35 modem. This interface provides support for wide area network (WAN) protocols by connecting the LAN communication board, via two V.35 modems and leased telephone lines, to peripheral devices and other computers or terminal concentrators at remote locations.

NOTE: Because of specific characteristics of the LAN coprocessor chip, the LAN communication board V.35 interface can only support TI System 1500 series (System 1500, System 1505, and so on) computers.

Typical LAN

4.2 Figure 4-1 shows an example of a simple LAN network consisting of one LAN segment. A typical LAN consists of one or more LAN segments containing Ethernet transceivers connected by cables. Each transceiver can support a single data equipment device and each LAN segment must have a terminator installed at each end.

Figure 4-1 Simple LAN Segment



The data equipment device may also be a terminal concentrator, which can support multiple data equipment devices. In networks containing more than one LAN segment, the segments must be connected through repeaters to prevent signal loss and distortion.

Each device in a LAN network must contain a LAN controller, such as the LAN communication option board, to handle the necessary control and data encoding functions required by the network.

For a single-board computer system (such as the System 1505) connected to a LAN, a typical installation may contain one or more computer systems and one or more terminal concentrators. Each computer system must have a LAN communication board installed; the terminal concentrator has a built-in LAN controller.

In the example LAN of Figure 4-1, the segment contains four Ethernet transceivers (T1 through T4) and two terminators. Each computer can be fully configured, with all its peripheral devices, and each terminal concentrator can connect to and support multiple terminals. Each transceiver connects to its respective computer or terminal concentrator via a transceiver drop cable. One of the computers shown is a System 1505 with a CC802.3 LAN board. In this case, no transceiver is required because the network connects directly to the LAN board Cheapernet interface via a BNC T connector. (The System 1505 computer has a built-in transceiver on its LAN board.)

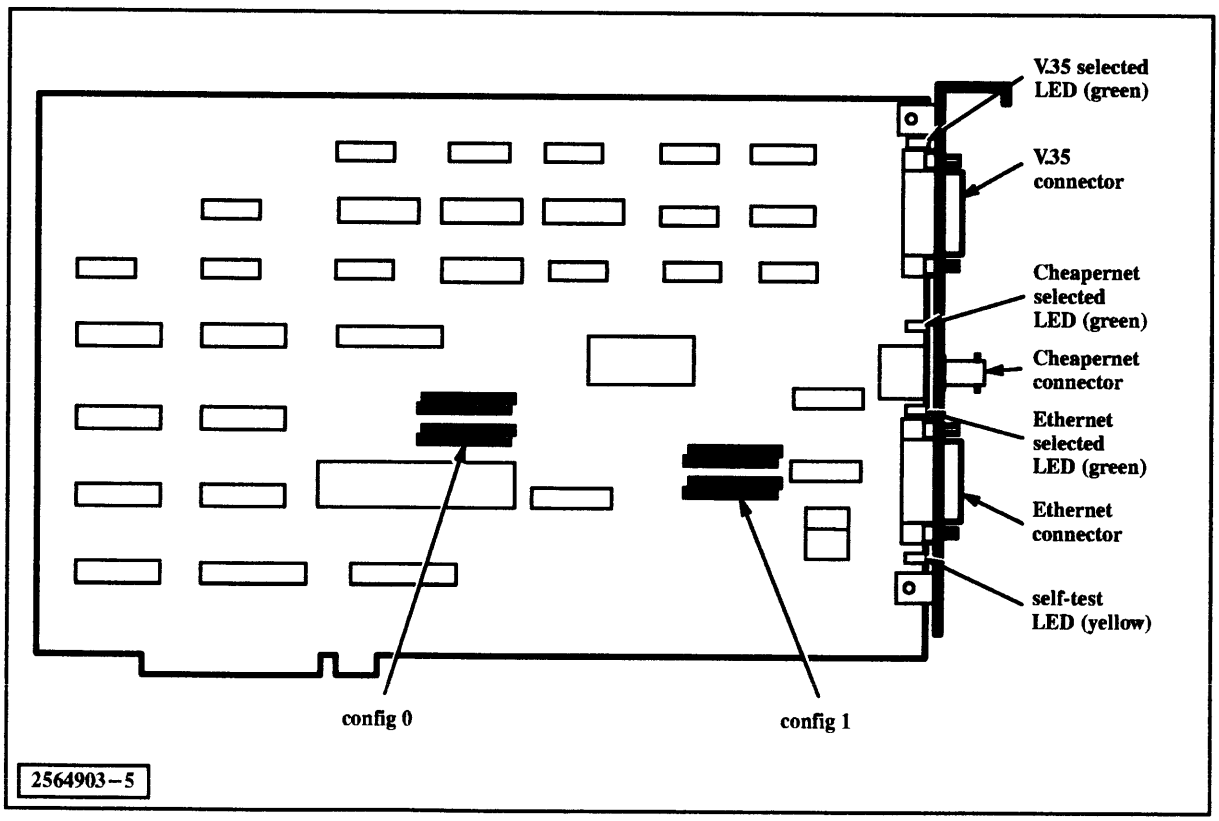
Physical Description

4.3 Figure 4-2 shows the LAN communication board, TI part number 2561105-0001. The configuration jumper sockets (config 0 and config 1) allow you to configure the board for an Ethernet, Cheapernet, or V.35 channel. The board provides a connector for each of these channels. The LAN communication board is part of the following kits:

- Factory-installed CC802.3 LAN communication kit, TI part number 2561358-0002
- Field-installable CC802.3 LAN communication kit, TI part number 2561358-0001

Each interface connector has an associated green light-emitting diode (LED). These LEDs are visible through apertures in the option panel and turn on to indicate the currently selected interface.

Figure 4-2 LAN Board



The option board also provides a yellow self-test LED that is visible through an aperture in the option panel. At power-up, the host computer executes a self-test to verify that all major system elements, including the option boards, are functioning properly. During this self-test, the self-test LED lights to indicate that the self-test is in progress. If the board fails the self-test, the LED remains on at the completion of self-test execution.

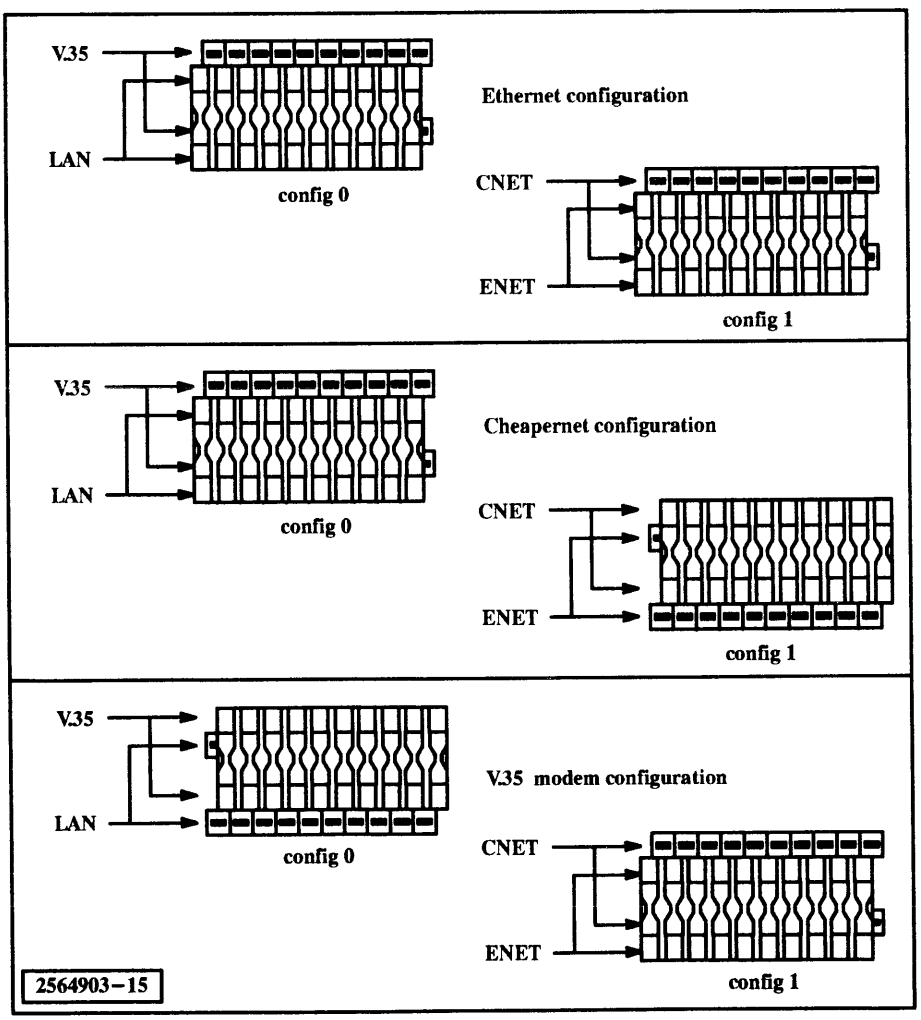
A 112-pin edge connector at the bottom of the LAN communication board provides a direct interface to the single-board computer (SBC) main logic board.

NOTE: Only one cable at a time can be connected to the LAN board.

Configuring the LAN Communication Board

4.4 Figure 4-3 shows the three possible configurations of the LAN communication board configuration jumpers. Two sockets (config 0 and config 1) accommodate two jumper plugs that allow you to configure the board for operation in an Ethernet or Cheapernet, or to function as a V.35 communication interface.

Figure 4-3 **Three Possible LAN Communication Board Configurations**



Connecting Devices to the Board

4.5 After you have configured the LAN communication board for the desired application and installed it in a computer system, you can connect an Ethernet, a Cheapernet, or a V.35 interface to the connectors provided at the option panel.

A built-in Ethernet transceiver on the LAN board provides an output, via the Cheapernet interface connector, directly to an Ethernet. This arrangement reduces by one the number of Ethernet transceivers required. Alternately, you can connect an existing Ethernet directly to the Ethernet interface connector on the board. The following paragraphs explain how to connect some of these options.

The Ethernet and Cheapernet connectors provide the following basic types of connection:

- Cheapernet option connected to the Cheapernet connector
- Cheapernet option connected to the Ethernet connector
- Ethernet option connected to the Cheapernet connector
- Ethernet option connected to the Ethernet connector

Connecting an Ethernet LAN to the Cheapernet Connector

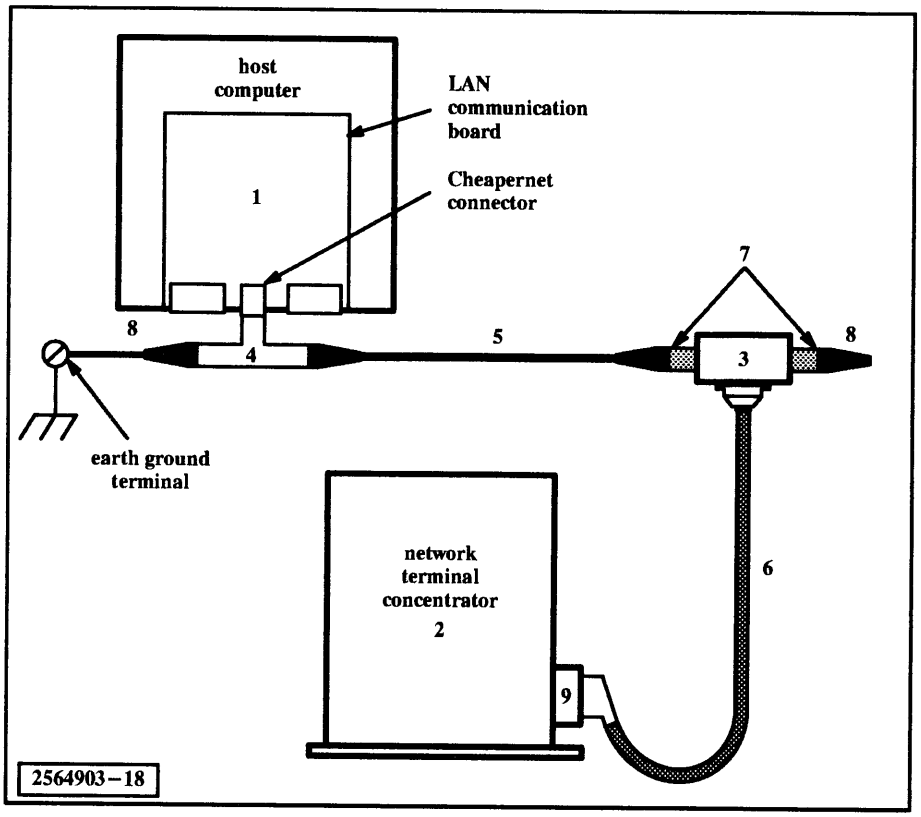
4.5.1 The CC1601 Ethernet starter kit, TI part number 2561371-0002 (domestic) or 2561371-0004 (international), provides a LAN communication board, a network terminal concentrator (NTC), and all the cables and accessories needed to connect these components to the Cheapernet connector in a basic Ethernet configuration, as shown in Figure 4-4.

Table 4-1 lists and describes the components of the domestic CC1601 Ethernet starter kit. Section 3 of the module entitled Kits and Components in the *Kits and Components Information* manual, TI part number 2571639-0001, lists the components of the international version. The item numbers in the table correspond to the item numbers of Figure 4-4.

Table 4-1 Ethernet Starter Kit Components

Item	TI Part Number	Description
1	2561105-0001	LAN communication board.
2	2537305-0001	NTC assembly. This assembly serves as an interface between the Ethernet and a maximum of 16 peripheral devices, such as terminals and printers. (The *Terminal Concentrator Installation and Operation* manual, TI part number 2557938-0001, provides instructions for connecting peripherals to the NTC.)
3	2244733-0001	Ethernet transceiver kit.
4	0411063-0001	BNC T connector.
5	2239703-0003	Thin Ethernet cable assembly. This cable assembly is a 98.4-foot (30-meter) cable with a BNC connector at each end. The cable is also available in the following lengths: 22.9 feet (7 meters), TI part number 2239703-0001 49.2 feet (15 meters), TI part number 2239703-0002 328 feet (100 meters), TI part number 2239703-0004
6	2239129-0001	Cable assembly (NTC-to-transceiver). This is a 32.8-foot (10-meter) cable assembly that connects the Ethernet interface adapter (item 9) to the Ethernet transceiver (item 3).
7	2239705-0001	BNC-female-to-N-series-male adapter assembly. These items adapt the BNC connectors on the thin Ethernet cable (item 5) or terminators (item 8) to the N-series connectors on the transceivers (item 3). The kit contains two of these items.
8	2239130-0001	Ethernet terminator kit. This kit consists of an ungrounded thin Ethernet terminator and a grounded thin Ethernet terminator. The grounded terminator must be connected to earth ground as shown in Figure 4-4.
9	2535600-0001	Ethernet interface adapter. This item adapts the Ethernet cable assembly (item 6) to the Ethernet interface connector on the NTC (item 2). The Ethernet interface adapter is located at the bottom left on the rear of the NTC.

Figure 4-4 **Ethernet LAN Connected to the Cheapernet Connector**



To connect the Ethernet starter kit to the Cheapernet connector, follow these steps:

1. Turn off your computer, disconnect the ac power cord, and remove the computer front panel and main access panel as described in Section 1 of this manual.

2. Set the LAN board configuration jumpers for Cheapernet operation, as shown in Figure 4-3.

3. Install the LAN communication board in any available option board position as described in Section 1 of this manual. Reinstall the main access panel and the front panel.

4. Install the two BNC-female-to-N-series-male adapters (item 7 of Figure 4-4) on the Ethernet transceiver (item 3 of Figure 4-4).

5. Connect the BNC T connector to the LAN board Cheapernet connector as shown in Figure 4-4.

6. Connect the thin Ethernet cable assembly (item 5 of Figure 4-4) between the BNC T connector and the Ethernet transceiver.

7. Install the Ethernet terminator kit (item 8 of Figure 4-4) on the BNC T connector and the Ethernet transceiver as shown in Figure 4-4. Notice that one of these terminators has a ground lug that you must connect to earth ground.

8. Install the Ethernet cable adapter (item 9 of Figure 4-4) on the back of the NTC.

NOTE: Although the examples in this Section (Figure 4-4 through Figure 4-7) show terminal concentrators connected to the Ethernet transceivers, these devices may also be additional computer systems configured for operation in an Ethernet LAN.

---

9. Connect the NTC-to-transceiver cable assembly (item 6 of Figure 4-4) between the Ethernet transceiver and the Ethernet cable adapter on the NTC. These connectors provide a slide latch arrangement on the transceiver connector instead of the conventional retaining screws. Paragraph 4.5.2 explains how to use these slide latches.

10. The *Terminal Concentrator Installation and Operation* manual, TI part number 2557938-0001, explains how to connect devices to the NTC.

11. Reconnect the ac power cord and turn on the power switches for all peripheral devices, the NTC, and the computer.

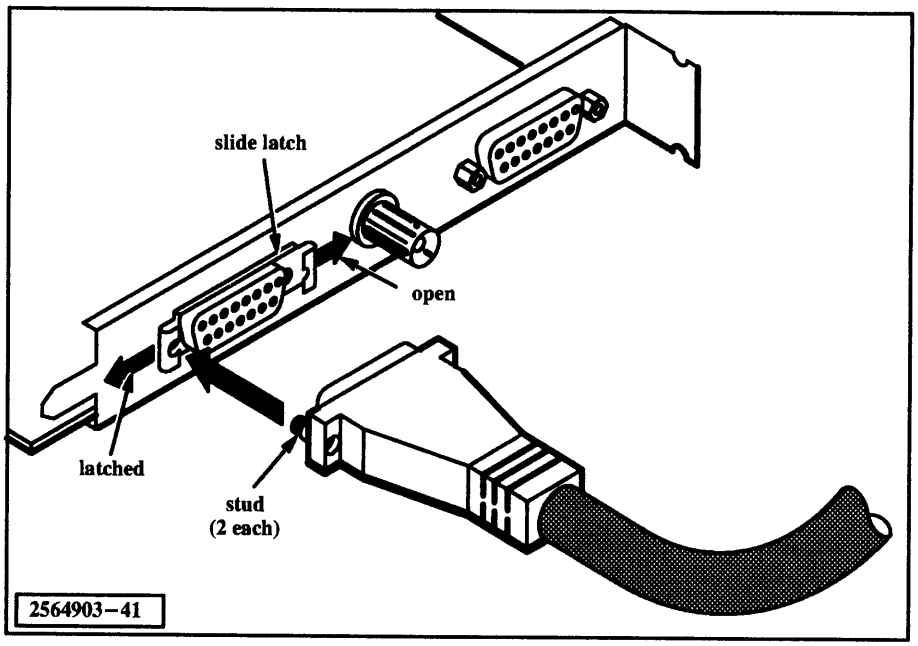
An additional Ethernet cable assembly, TI part number 2239133-000*n*, is also available. This cable assembly can be installed between the transceiver and the NTC-to-transceiver cable assembly (item 6 of Figure 4-4) to extend the length of this cable to a maximum of 164 feet (50 meters). The cable assembly is available in the following lengths:

- 32.8 feet (10 meters), TI part number 2239133-0001
- 65.6 feet (20 meters), TI part number 2239133-0002
- 130.2 feet (40 meters), TI part number 2239133-0003

Securing the Ethernet Connector Slide Latches

4.5.2 The Ethernet cable assemblies, TI part numbers 2239129-0001 and 2239133-000*n*, provide slide latch arrangements (shown in Figure 4-5) for securing the connectors to the transceiver or to the Ethernet connector on the LAN communication board. To connect these cables, slide the latch to its open position, insert the cable connector, and then slide the latch to its locked position. The slide latch should engage the studs on the connector.

Figure 4-5 **Ethernet Cable Slide Latch Arrangement**



Expanding an Ethernet LAN

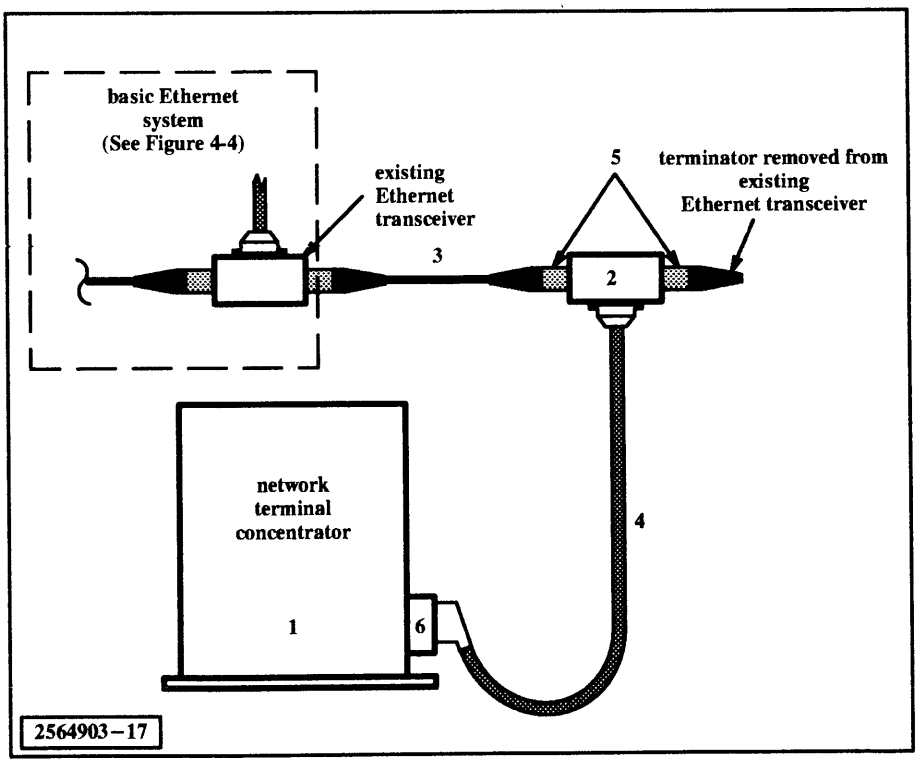
4.5.3 Figure 4-6 shows the basic Ethernet system of Figure 4-4 expanded to include a second NTC. An Ethernet extension kit, TI part number 2542985-0001 (domestic) or 2542985-0002 (international), provides an NTC, an Ethernet transceiver, and all the cables and accessories needed to connect these items.

Table 4-2 lists and describes the components of the domestic Ethernet extension kit. For a more detailed description of these components, see Table 4-1. The item numbers in Table 4-2 correspond to the item numbers of Figure 4-6.

Table 4-2 **CK1602 Ethernet Extension Kit Components**

Item	TI Part Number	Description
1	2537305-0001	NTC assembly
2	2244733-0001	Ethernet transceiver kit
3	2239703-0003	Thin Ethernet cable assembly
4	2239129-0001	Ethernet cable assembly
5	2239705-0001	BNC-female-to-N-series-male adapter assembly (2 each)
6	2535600-0001	Ethernet connector adapter

Figure 4-6 **Expanded LAN**



To install an Ethernet extension kit, follow these steps:

1. Turn off your computer and disconnect the ac power cord.
2. Remove the terminator from the existing Ethernet transceiver.
3. Install the two BNC-female-to-N-series-male adapters (item 5 of Figure 4-6) on the new Ethernet transceiver (item 2 of Figure 4-6).
4. Connect the thin Ethernet cable (item 3 of Figure 4-6) between the existing transceiver and the new transceiver.
5. Install the terminator removed in step 2 on the new transceiver.
6. Install the Ethernet connector adapter (item 6 of Figure 4-6) on the back of the NTC.
7. Connect the Ethernet cable assembly (item 4 of Figure 4-6) between the new Ethernet transceiver and the NTC Ethernet cable adapter. Paragraph 4.5.2 explains how to secure the connector slide latch.
8. To install devices on the NTC, refer to the *Terminal Concentrator Installation and Operation* manual, TI part number 2557938-0001.
9. Reconnect the ac power cord and turn on the power switches on all peripheral devices, the NTC, and the computer.

You can add as many Ethernet extension kits as you want, provided you do not exceed the maximum recommended length of the Ethernet segment or connect more than the maximum number of terminals recommended for your system. The IEEE 802.3 Ethernet standard limits the length of a single segment to 1640 feet (500 meters). Also, you can extend the length of the transceiver-to-NTC cable by installing a cable assembly, TI part number 2239133-000*n*, where *n* can be 1, 2, or 3, as described in paragraph 4.5.1.

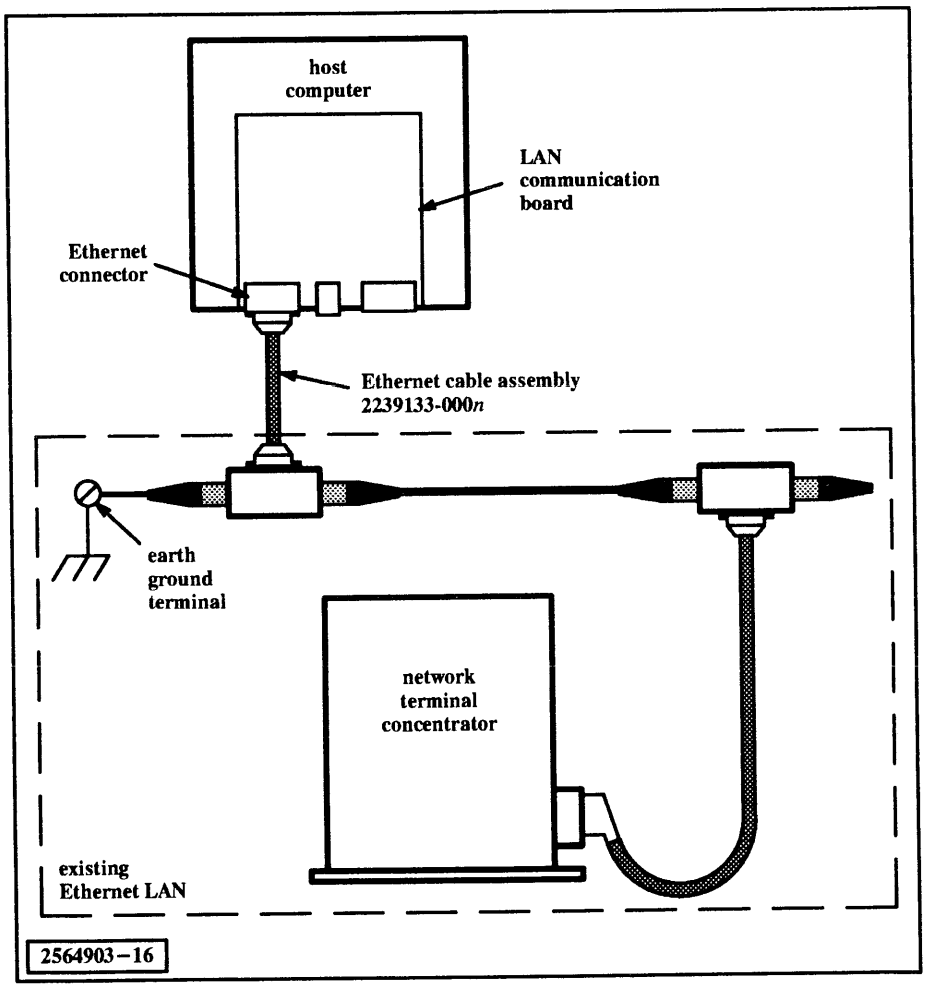
NOTE: It may be desirable, at times, to add a transceiver at some point in the middle of a LAN segment. The CC1601 and CK1602 kits, and other available Ethernet components listed in the module entitled Kits and Components in the *Kits and Components Information* manual, TI part number 2571639-0001, allow you to do this.

Connecting an Existing Ethernet LAN

4.5.4 Figure 4-7 shows an Ethernet LAN connected to the Ethernet interface connector on the LAN communication board. If you are connecting an existing Ethernet LAN to the board, you may want to use this alternate arrangement instead of the Cheapernet connection described in paragraph 4.5.1.

To connect the LAN to the Ethernet interface connector, set the LAN board configuration jumpers for Ethernet operation as shown in Figure 4-3, and then install an Ethernet cable assembly, TI part number 2239133-000*n*, between the Ethernet interface connector and the transceiver connector as shown in Figure 4-7. Paragraph 4.5.1 describes the Ethernet cable.

Figure 4-7 **Connecting an Existing Ethernet LAN**



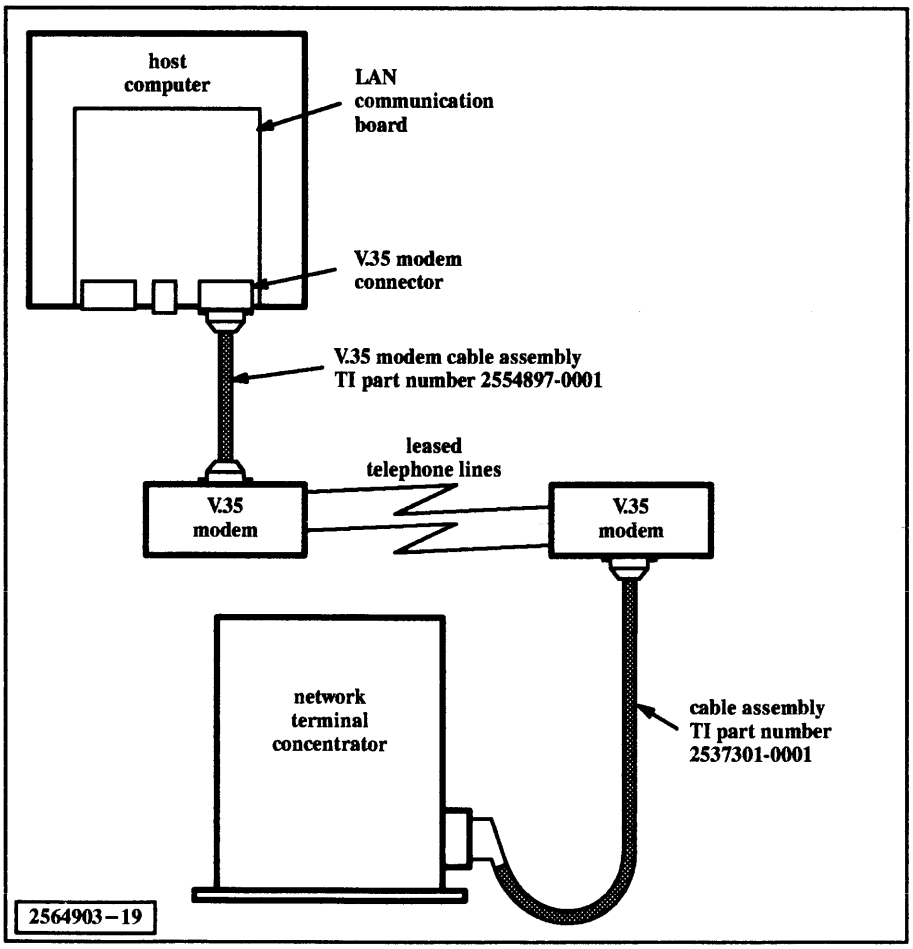
Connecting a V.35 Modem

4.5.5 The V.35 modem (commercially available) can be used to provide a link between your system and any V.35-compatible device or system via a commercial telephone system (normally leased lines). A 98.4-foot (30-meter) cable assembly, TI part number 2554897-0001, provides a connection between the LAN communication board and the V.35 modem.

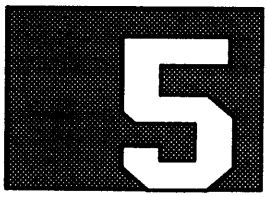
NOTE: The V.35 modem can operate at data transfer rates in the range of 56 kilobits to 1 megabit per second.

Figure 4-8 shows an example of a V.35 modem connected between the host computer LAN communication board and an NTC. To connect the modem to the board, set the configuration jumpers for V.35 operation and then connect the cable as shown in Figure 4-8.

Figure 4-8 **V.35 Modem Connected to the LAN Communication Board**



MULTIDROP COMMUNICATION OPTION



Introduction

5.1 The multidrop communication option board, TI part number 2561115-0001, provides information exchange between the host computer communication processor and a multidrop communication subsystem. This board also provides an interface to a V.35 modem and a parallel printer.

The multidrop communication board, operating under control of the system software, receives parallel command and data information from the host and processes this information as required for the currently selected interface. The board receives information (interrupt requests, data, and status) from devices connected to the interfaces, processes the information as required, and sends it to the host communication processor via the parallel port bus.

The multidrop interface provides a connection to one or more multidrop terminal concentrators (MTCs), to which peripheral devices (such as terminals, printers, and modems) can be connected. This interface transfers specially encoded serial data between the multidrop communication board and the MTC.

The V.35 interface provides the functions required by the CCITT standard for a V.35 modem. This interface provides control signals and encoded serial data from the host computer to the V.35 modem and receives encoded serial data and status information from the modem.

NOTE: The multidrop communication board provides all the hardware necessary to support the options described in this section. However, the software does not currently support the V.35 modem interface.

The parallel printer interface provides data, command, and control information from the host computer to a parallel printer. The interface receives data and status information from the printer and passes it to the host via the parallel port bus.

CAUTION: All boards, options, and peripherals contain components that are sensitive to static electricity. When handling any of these items, protect against static electricity by using wrist grounding straps and grounded working mats. When moving or storing items, use the antistatic bags supplied with the items.

Physical Description

5.2 Figure 5-1 shows the multidrop communication board, TI part number 2561115-0001. Three connectors on the board provide interfaces to the multidrop subsystem, the V.35 modem, and the parallel printer. A 112-pin edge connector at the bottom of the board provides a direct interface to the single-board computer (SBC) main logic board. The multidrop communication board is part of the following kits:

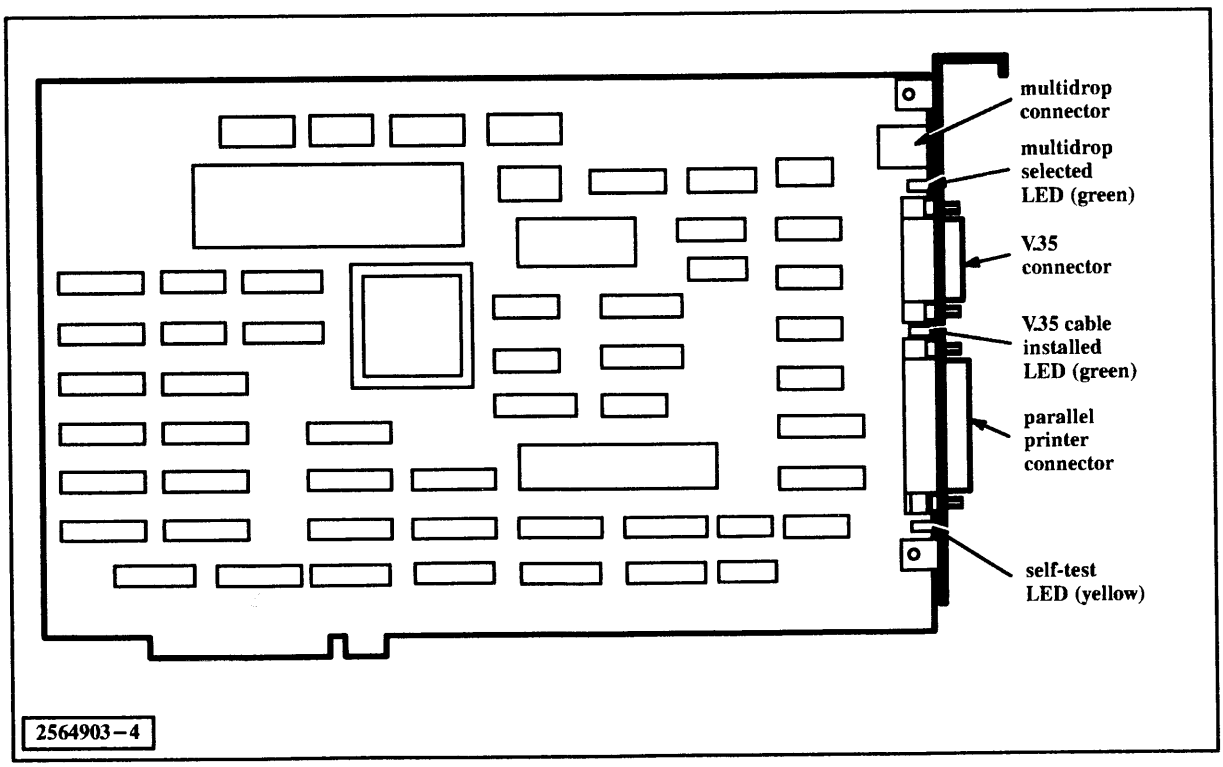
- Factory-installed CC202 multidrop communication kit, TI part number 2561360-0002
- Field-installable CC202 multidrop communication kit, TI part number 2561360-0001

The multidrop communication board requires no hardware configuration other than connecting devices to the board. The multidrop interface is always active unless a V.35 modem cable is connected to the board. Under this condition, the V.35 interface is active and the multidrop interface cannot be used. The parallel printer interface is always active.

Two green light-emitting diodes (LEDs) associated with the multidrop and V.35 interfaces indicate which interface is currently connected. A yellow LED functions as a self-test indicator. These LEDs are visible through apertures in the option panel.

At power-up, the host computer executes a self-test to verify that all major system elements, including the option boards, are functioning properly. During this self-test, the self-test LED lights to indicate that the self-test is in progress. If the board fails the self-test, the LED remains on at the completion of self-test execution.

Figure 5-1 Multidrop Communication Board



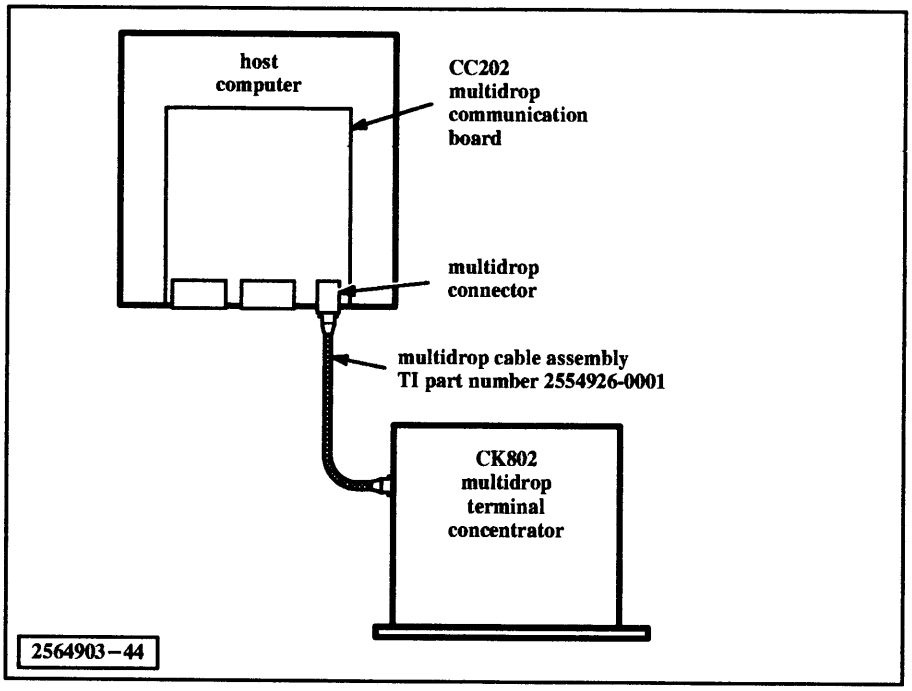
Connecting Devices to the Board

5.3 After you have installed the multidrop communication board in a computer system, you can connect a multidrop subsystem, a V.35 modem, and a parallel printer to the board. The following paragraphs explain how to connect these devices.

Connecting a Multidrop Subsystem

5.3.1 The CC802 MTC starter kit, TI part number 2561361-0002 (domestic) or 2561361-0004 (international), provides a multidrop communication board and all the components necessary to connect a single MTC to the board as shown in Figure 5-2.

Figure 5-2 **Basic Multidrop Subsystem**



The factory-installed domestic CC802 MTC starter kit consists of the CC202 multidrop communication kit, TI part number 2561360-0002 and the CK802 MTC kit, TI part number, 2554930-0001. Table 5-1 lists the components of these kits. The module entitled Kits and Components in the *Kits and Components Information* manual, TI part number 2571639-0001, lists factory-installed and field-installable versions of both domestic and international kits.

Table 5-1 Cable Assemblies and Adapters for Connecting Devices to the Multidrop Communication Board

Item	TI Part Number	Description
1	2561115-0001	Multidrop communication board. Figure 5-2 shows a diagram of the board installed in the host computer.
2	2554854-0002	CK802 MTC assembly. This assembly serves as an interface between the multidrop communication board and up to 8 peripheral devices. (The *Terminal Concentrator Installation and Operation* manual, TI part number 2557938-0001 provides instructions for connecting peripherals to the MTC.)
3	2554926-0001	Multidrop cable assembly. This cable assembly is 29.5 feet (9 meters) long, and has a standard modular jack (MJ) connector at each end to allow connection between the MJ connector on the multidrop board and an MJ connector on the MTC. This cable also has a terminator at each end to ensure proper data transfer operations.
4	2248371−0001	12-volt dc adapter. The circuits of the MTC require a 12-volt dc operating voltage. The 12-volt dc adapter plugs directly into a 120-volt ac line outlet and functions as a 120-volt-ac-to-12-volt-dc converter for the MTC.
5	2248376-0001	Junction box. The junction box is used for connecting devices to the CK802 MTC assembly as described in the manual entitled *Terminal Concentrator Installation and Operation*, TI part number 2557938-0001.

To install the multidrop starter kit, follow these steps:

1. Turn off your computer, disconnect the ac power cord, and remove the computer front panel and main access panel as described in Section 1 of this module.

2. Install the multidrop communication board in any available option board position and reinstall the panels. (Section 1 of this module explains how to install option boards in a host computer.)

3. Connect one end of the multidrop cable assembly, TI part number 2554926-0001, to the multidrop connector on the option board, and the other end to the host interface connector on the CK802 MTC. These jacks and connectors mate in the same manner as commercial telephone jacks and connectors.

NOTE: If you need help in locating the MTC connectors, refer to the manual entitled *Terminal Concentrator Installation and Operation*, TI part number 2557938-0001. This manual also provides information about connecting peripheral devices to the MTC.

4. Connect the peripherals (up to eight) to the MTC.
5. Connect the 12-volt dc adapter, TI part number 2248371-0001, to the dc power connector on the MTC, and plug the adapter into a 120-volt ac wall outlet.
6. Reconnect the computer ac power cord and turn on the power switches for all peripheral devices, the MTC, and the computer.

Expanding a Multidrop Subsystem

5.3.2 You can expand the multidrop subsystem by cutting the multidrop cable between the two terminated junction boxes and adding a multidrop junction box. This junction box provides a connection to a second MTC. You can use this method to add as many MTCs as you want, provided you do not exceed the maximum number of terminals recommended for your system. Also, when splicing junction boxes into the multidrop cable, they must be spaced at least 3 feet (0.9 meter) apart on the cable.

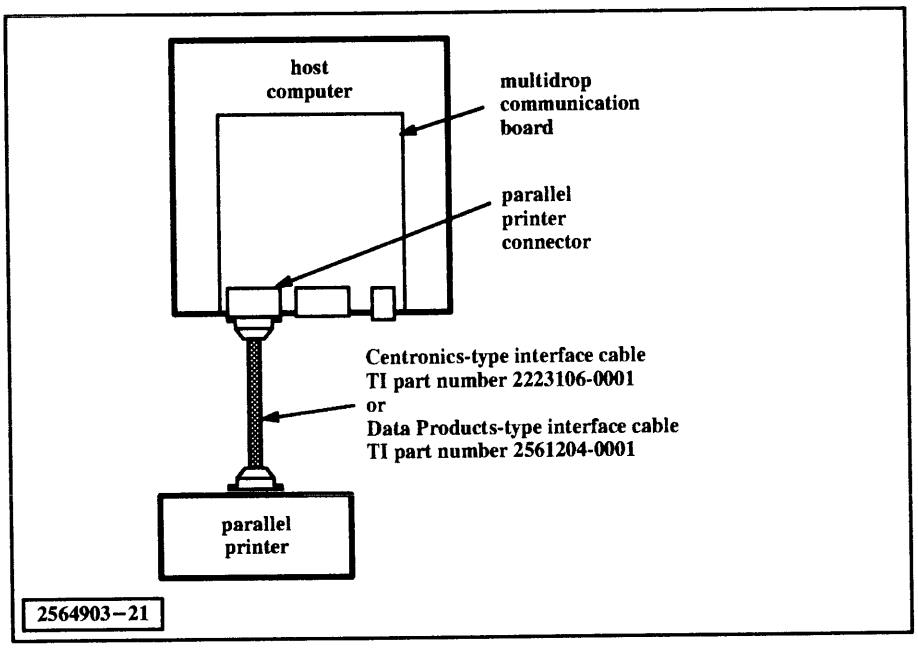
An MTC kit, TI part number 2554930-0001, contains the add-on MTCs and junction boxes for expanding the multidrop subsystem. For detailed information about expanding the subsystem, refer to the manual entitled *Terminal Concentrator Installation and Operation*, TI part number 2557938-0001.

Connecting a Parallel Printer

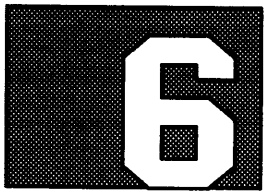
5.3.3 Figure 5-3 shows a parallel printer connected to the multidrop communication board. The parallel printer interface on the board can support both Data Products and Centronics-type parallel printers. The board automatically recognizes the type of printer by the type of cable used and sets the interface accordingly. The following cables are available for connecting the printers to the interface:

- 6-foot (1.8-meter) Centronics-type printer interface cable, TI part number 2223106-0001, used to connect any of the following printers to the multidrop communication board: TI Models 810, 830, 835, 875, 877, 880, 885, 8920, and 8930 (dot-matrix impact printers); TI Models 210, 2015, 2106, 2108, and 2115 (laser printers). (For more information about TI printers, refer to the manual entitled *Terminal/Printer Information*, TI part number 2557939-0001.)
- 16.6-foot (5.05-meter) Data Products-type printer interface cable, TI part number 2561204-0001, used with printers having Data Products-type parallel interfaces.

Figure 5-3 **Parallel Printer Connected to the Multidrop Communication Board**



MULTIFUNCTION COMMUNICATION OPTION



Introduction

6.1 The multifunction communication option board provides information exchange between the host computer communication processor and an EIA or V.35 modem. This board also provides an interface to a parallel printer.

The multifunction communication board, operating under control of the system software, receives parallel command and data information from the host and processes this information as required for the currently selected interface. The board receives interrupt requests, data, and status information from devices connected to the interfaces; it processes the information as required, and sends it to the host communication processor via the parallel port bus.

The modem interface provides a connection to either an EIA-232 modem or a V.35 modem, depending upon the type of interface cable used. This interface transfers serial data between the multifunction communication board and the modem.

NOTE: The V.35 modem transfers data via leased telephone lines at data transfer rates in the range of 56 kilobits to 1 megabit per second. The EIA-232 modem transfers data via dial-up telephone lines at a data transfer rate of 38.4 kilobits per second.

The parallel printer interface provides data, command, and control information from the host computer to a parallel printer. The interface receives data and status information from the printer and passes it to the host via the parallel port bus.

CAUTION: All boards, options, and peripherals contain components that are sensitive to static electricity. When handling any of these items, protect against static electricity by using wrist grounding straps and grounded working mats. When moving or storing items, use the antistatic bags supplied with the items.

Physical Description

6.2 Figure 6-1 shows the multifunction communication board, TI part number 2561110-0001. Two connectors on the board provide the modem and parallel printer interfaces. A 112-pin edge connector at the bottom of the board provides a direct interface to the single-board computer (SBC) main logic board. The multifunction communication board is part of the following kits:

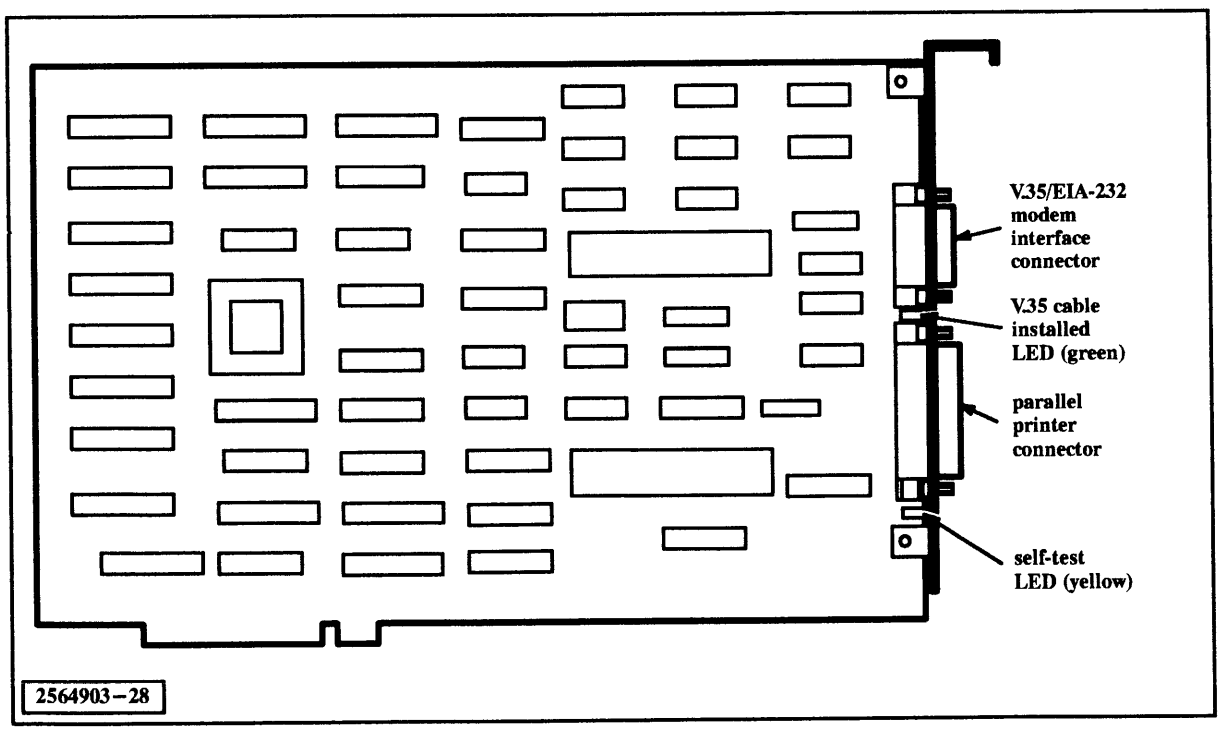
- Factory-installed CC301 multifunction communication kit, TI part number 2561359-0002
- Field-installable CC301 multifunction communication kit, TI part number 2561359-0001

The multifunction communication board requires no hardware configuration other than connecting devices to the board. The parallel printer interface is always active. The modem interface recognizes the type of modem by the type of cable connected and sets its configuration register accordingly. The host computer then reads the configuration register to determine the type of modem installed.

A green light-emitting diode (LED), associated with the EIA-232 and V.35 modem interfaces, indicates which interface is currently active. When on, this LED indicates that the V.35 interface is active; when off, it indicates that the EIA-232 interface is active. A yellow LED functions as a self-test indicator. These LEDs are visible through apertures in the option panel.

At power-up, the host computer executes a self-test to verify that all major system elements, including the option boards, are functioning properly. During this test, the self-test LED lights to indicate that the self-test is in progress. If the board fails the self-test, the LED remains on at the completion of self-test execution.

Figure 6-1 Multifunction Communication Board



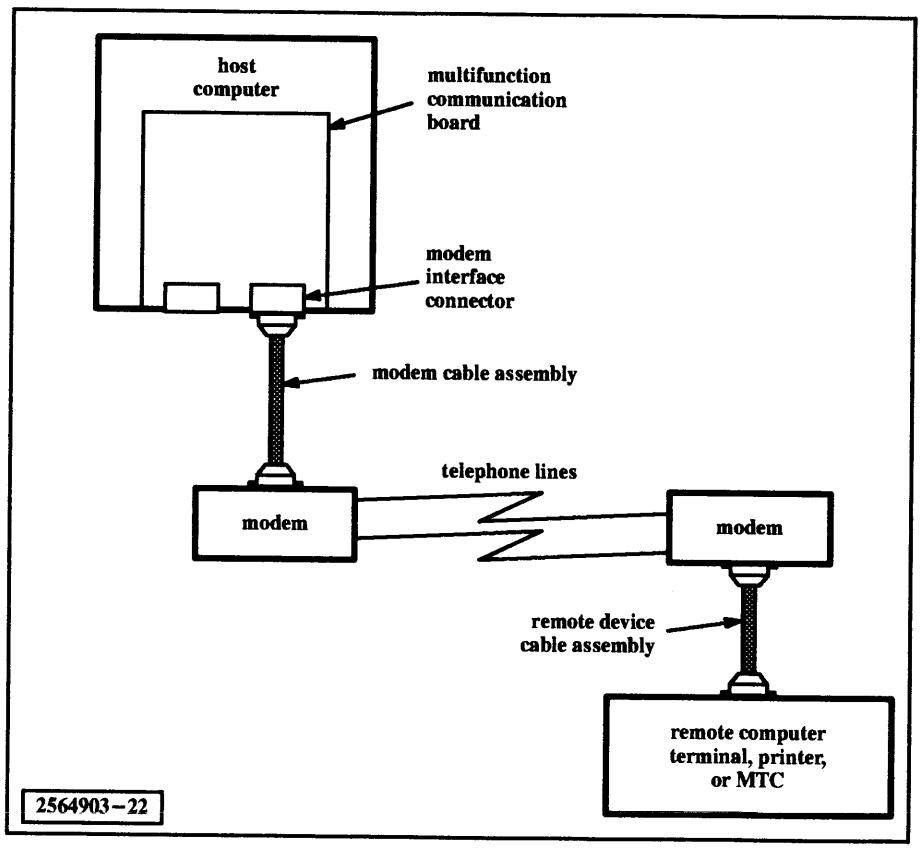
Connecting Devices to the Board

6.3 After you have installed the multifunction communication board in a computer system, you can connect an EIA-232 modem or a V.35 modem and a parallel printer to the board. The following paragraphs explain how to connect these devices.

Connecting a Modem

6.3.1 Both the EIA-232 modem and the V.35 modem are commercially available. The procedures for connecting these modems are identical except for the cable assembly used. Figure 6-2 shows a modem connected to the 26-pin, female, D-type modem interface connector on the multifunction board.

Figure 6-2 **Modem Connected to the Multifunction Communication Board**



To connect a modem to the multifunction communication board, follow these steps:

1. Turn off your computer power, disconnect the ac power cord, and remove the front panel and main access panel.

2. Install the multifunction communication board in any available option board position and reinstall the panels. (Section 1 of this module explains how to install option boards in a host computer.)

3. Connect one end of the modem cable assembly to the modem connector on the option board and the other end to the modem. Use a screwdriver to secure the captive screws provided. Use one of the following cable assemblies:

   - EIA-232 modem — Cable assembly, 10-foot (3-meter) with an EIA-232 modem interface connector on one end and a 26-pin, male, D-type connector at the other end, TI part number 2554896–0001.
   - V.35 modem — Cable assembly, 10-foot (3-meter) with a V.35 modem interface connector at one end and a 26-pin, male, D-type connector on the other end, TI part number 2554897–0001

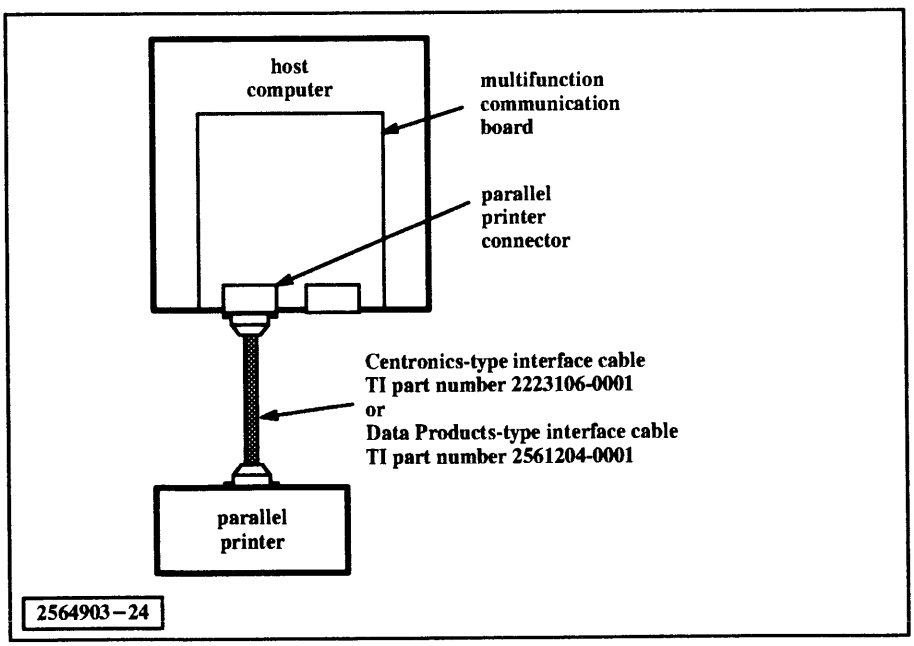
4. Turn on the computer and modem power switches.

Connecting a Parallel Printer

6.3.2 Figure 6-3 shows a parallel printer connected to the multifunction communication board. The parallel printer interface on the board can support both Data Products and Centronics-type parallel printers. The board automatically recognizes the type of printer by the type of cable used and sets the interface accordingly. The following cables are available for connecting the printers to the interface:

- 6-foot (1.8-meter) Centronics-type printer interface cable, TI part number 2223106-0001, used to connect any of the following printers to the multifunction communication board: TI Models 810, 830, 835, 875, 877, 880, 885, 8920, and 8930 (dot-matrix impact printers); TI Models 210, 2015, 2106, 2108, and 2115 (laser printers). (For more information about TI printers, refer to the manual entitled *Terminal/Printer Information*, TI part number 2557939-0001.)
- 16.6-foot (5.05-meter) Data Products®-type printer interface cable, TI part number 2561204-0001, used with printers having Data Products-type parallel interfaces.

Figure 6-3 **Parallel Printer Connected to the Multifunction Communication Board**



Data Products is a registered trademark of Data Products Corporation.

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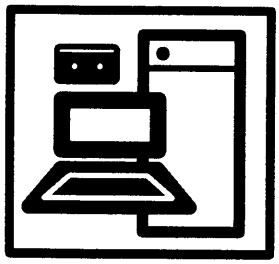
SCSI MASS STORAGE DEVICES



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1 OVERVIEW

Introduction

1.1 The small computer system interface (SCSI) mass storage devices include disk drives and cartridge tape drives that operate on the industry-standard small computer system interface bus.

All SCSI mass storage devices are classed according to physical height (excluding the front panel), as full-height devices (3.4-inches high), half-height devices (1.7-inches high), and 1.0-inch high devices. The devices are further classes according to the physical diameter of the built-in disks as 5.25-inch or 3.5-inch disk drives. Each SCSI mass storage device contains a built-in formatter that allows it to be connected directly to a SCSI bus without the need for any external formatting.

Some computer systems let you install several SCSI mass storage devices inside the system enclosure. These internal devices provide the primary mass storage functions, such as file handling, data and software installation and storage, system backup, and information archiving.

In computer systems that do not provide internal mass storage devices, or require additional mass storage devices, specially designed mass storage enclosures are available that connect to the computer via a SCSI bus cable. Each mass storage enclosure can accommodate several mass storage devices. These mass storage enclosures are useful for upgrading or expanding your computer data-handling capabilities.

This module provides general descriptions, installation information, and other essential information about the SCSI mass storage devices that are available from Texas Instruments.

SCSI Bus Connectors

1.2 Each SCSI mass storage device contains a standard 50-pin SCSI bus connector, which provides termination power, control, and data lines. These data lines transfer input and output (I/O) data between the host computer and the mass storage device (disk drive or tape drive) via the SCSI bus. They also carry command information from the host computer to the mass storage device and status information from the mass storage device to the host computer.

SCSI Mass Storage Device Addresses

1.3 The SCSI bus address scheme provides a maximum of eight addresses (0 through 7) on the bus. Each device on the bus, including the host computer, occupies one of these addresses. Thus, each SCSI bus can support up to seven SCSI mass storage devices, including those installed both internally (within the system enclosure) and externally.

When the host computer has control of the SCSI bus, it can communicate with any one of the available mass storage devices by specifying the appropriate address. Also, a mass storage device on the SCSI bus can communicate with the host computer by specifying the host computer address.

Each SCSI device contains a group of jumpers that allows you to set the device address. These addresses are normally set at the factory for devices included in the initial system installation. However, when you add a device to the system, you must ensure that its address does not conflict with any existing device address.

Sections 2 and 3 of this module provide information about setting SCSI disk drive addresses and SCSI tape drive addresses, respectively.

Some SCSI devices have power-up sequencing jumpers that also need to be installed in order to prevent dc current overloading of the power supply when the main power switch on the computer chassis or the mass storage chassis is set to the on position.

SCSI Bus Termination

1.4 For proper operation of a SCSI bus, a terminating device must be installed at the end of the bus. Each of the SCSI mass storage devices provides one or more terminator sockets for this purpose.

In a mass storage subsystem consisting of one or more mass storage devices, a terminator must be installed at the end of the bus; the terminator must be omitted in all drives. The computer system provides a special plug-in terminator that is installed external to the final SCSI mass storage devices.

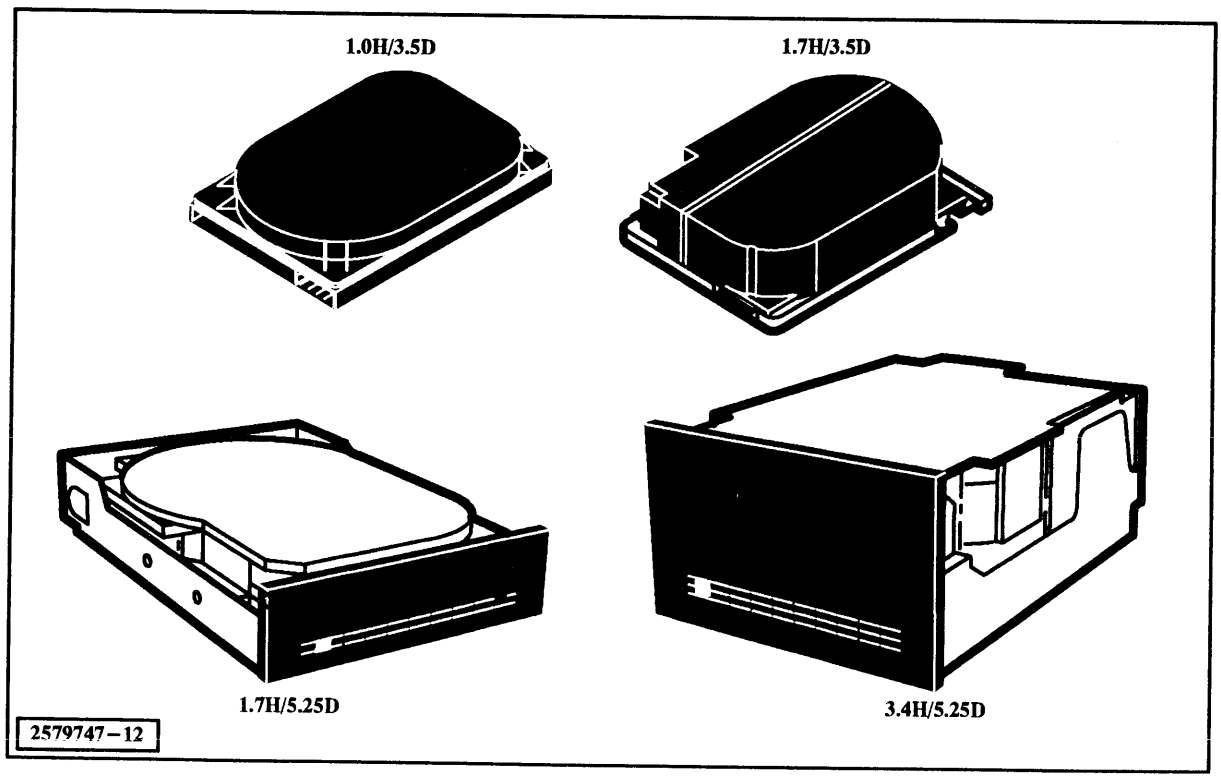
2 DISK DRIVES

Introduction

2.1 Figure 2-1 shows examples of the small computer system interface (SCSI) disk drives described in this manual. These disk drives are Winchester-type, random-access storage devices that are available in a variety of data storage capacities and a variety of physical shapes and sizes. The following disk drive designations are used in this manual:

Designation	Description
1.0H/3.5D	1.0 inches high, 3.5 inches platter diameter
1.7H/3.5D	1.7 inches high, 3.5 inches platter diameter
1.7H/5.25D	1.7 inches high, 5.25 inches platter diameter
3.4H/5.25D	3.4 inches high, 5.25 inches platter diameter

Figure 2-1 Disk Drives



Each disk drive contains a group of disk platters stacked on a spindle on which they rotate. Each platter contains two surfaces to which the host computer can write information, or from which it can read previously stored information. In some disk drives, one platter surface is dedicated as a servo surface that contains information used by the disk drive servo system to control basic disk drive functions. The disk platters and their associated read/write heads are contained in a sealed unit to protect them from dust particles and other forms of contamination.

Each disk drive contains a SCSI bus connector, a 4-pin power connector, and a set of SCSI bus address jumper terminals. In addition, some disk drives provide other jumper terminals that let you set or select various operating parameters and options. Each disk drive also contains one or more removable terminator resistor packs. The terminator resistor packs must always be removed in this installation.

The following common features characterize the SCSI disk drives described in this section:

- The disk drives operate on the industry-standard SCSI bus and contain an embedded SCSI formatter.
- A closed-loop servo system and a rotary voice-coil head actuator in each disk drive provide precise track location, thus allowing very high track density.
- A nondata head landing zone on each disk platter protects stored data and maximizes disk drive reliability. An automatic actuator shipping lock provides added protection when a disk drive is moved or shipped.
- Low audible noise emanation from the disk drives makes them suitable for use in office environments.
- The disk drives require no adjustments and no preventive maintenance.

Disk Drive Operation

2.2 The disk drives have no operator controls or switches. An external power supply (within the computer system or mass storage subsystem) supplies operating power. The system or subsystem power on/off switch controls power to the drives.

Some disk drives have an activity indicator located on the drive front panel. The activity indicator lights when the drive is selected by the host computer, when the drive is transferring data to or from the host computer, and when the drive is performing any SCSI-initiated activity.

At power-up, each disk drive performs a self-test operation to verify the disk drive hardware integrity. This test checks the major disk drive components for full functionality.

If a disk drive does not function properly following installation, verify that all installation procedures have been performed properly and that all cables are connected securely before contacting service personnel.

1.0H/3.5D DB160

2.3 This disk drive is TI part number 2562291-0001. All user-accessible connectors are located at the front and rear of the disk drive as shown in Figure 2-2. The SCSI address jumpers are located on the circuit board on the bottom of the drive. Table 2-1 lists the specifications of the disk drive.

Before you install the disk drive, check that the SCSI bus address jumpers are installed correctly and that the terminator resistor packs are removed.

The disk drive that has address 0 begins spin-up operation immediately when power is applied. Drives set for other addresses delay spin-up by three seconds between each address number.

Figure 2-2 1.0H/3.5D DB160 (Bottom View)

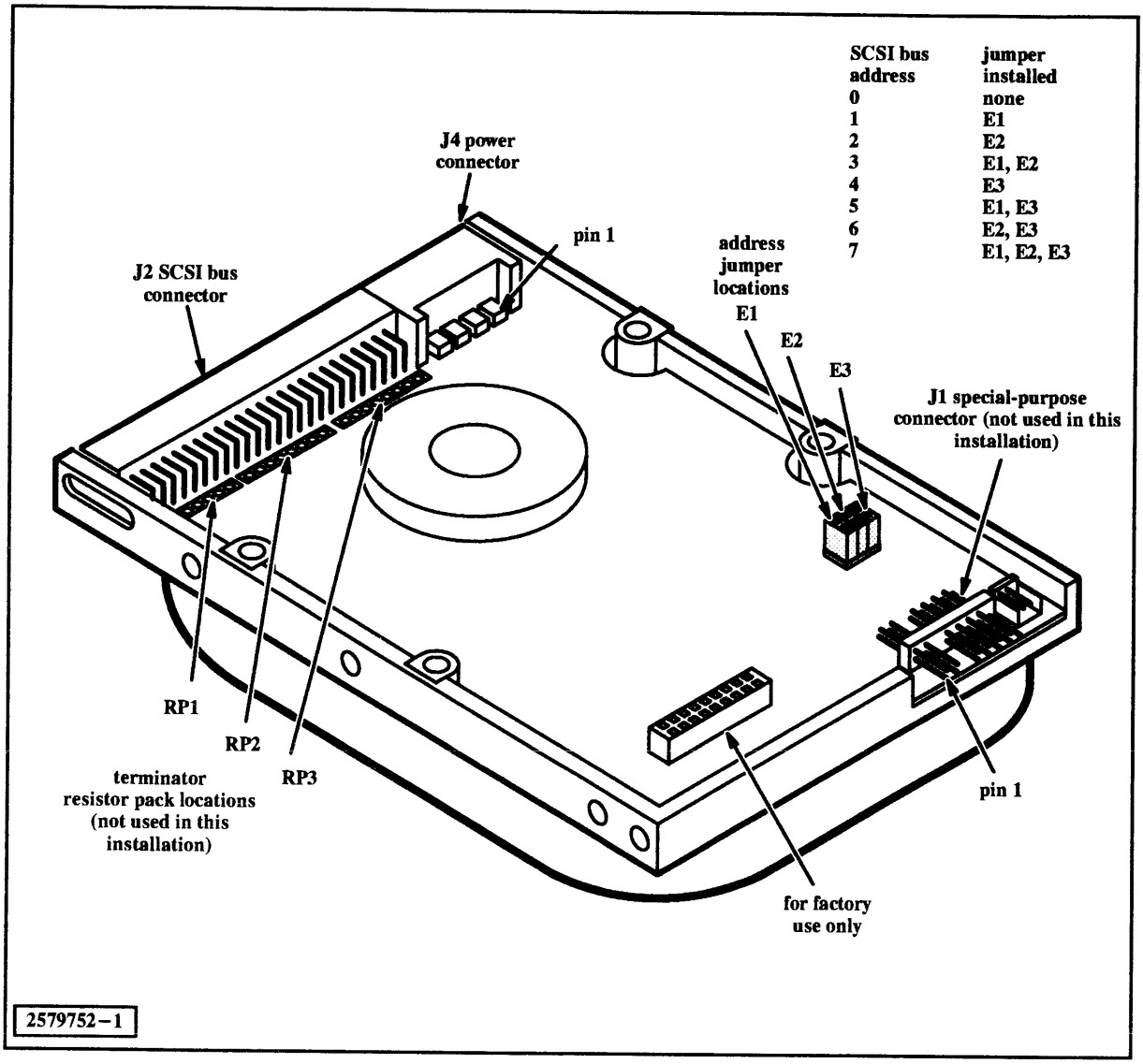


Table 2-1 1.0H/3.5D DB160 Specifications

Item	Specification
Power Requirements	
Voltage	5 Vdc +/−5 % and 12 Vdc +/−5 %
Read/write mode	280 ma at 5 Vdc and 200 ma at 12 Vdc
Seek mode	150 ma at 5 Vdc and 260 ma at 12 Vdc
Ready mode	150 ma at 5 Vdc and 175 ma at 12 Vdc
Spin-up mode	380 ma at 5 Vdc and 1.1 A at 12 Vdc
Heat Dissipation	
Read/write mode	5.5 W
Seek mode	4.5 W
Ready mode	3.5 W
Functional Operation	
Unformatted capacity (megabytes)	161.2
Formatted capacity (megabytes)	121.7
Read/write heads	4
Servo heads	N/A (see note)
Platters	2
Cylinders	1524
Sectors per track	39
Bytes per sector	512
Bytes per track	19,468
Track density (tracks per inch)	1857
Recording density (bits per inch)	33,184
Track-to-track seek time (ms)	6.5
Average seek time (ms)	17.5
Maximum seek time (ms)	35
Average rotational latency (ms)	8.8
Rotational speed, +/-0.5 % (rpm)	3400
Rotational period, +0.2, -0 % (ms)	17.64
Internal data transfer rate (megabits/sec)	12

Notes:
This disk drive does not have a dedicated servo surface as do the other SCSI disk drives described in this section. The servo information is imbedded in sectors of the data surfaces where it is read by the data read/write heads.

1.7H/3.5D DB260

2.4 This disk drive is TI part number 2562276-0001. All user-accessible connectors are located at the front and rear of the disk drive as shown in Figure 2-3. The SCSI address jumpers are located on the bottom of the drive. Table 2-2 lists the specifications of the disk drive.

Before you install the disk drive, check that the SCSI bus address jumpers are installed correctly, and that the terminator resistor packs are removed.

The disk drive that has address 0 begins spin-up operation immediately when power is applied. Drives set for other addresess delay spin-up by three seconds between each address number.

Figure 2-3 1.7H/3.5D DB260 (Bottom View)

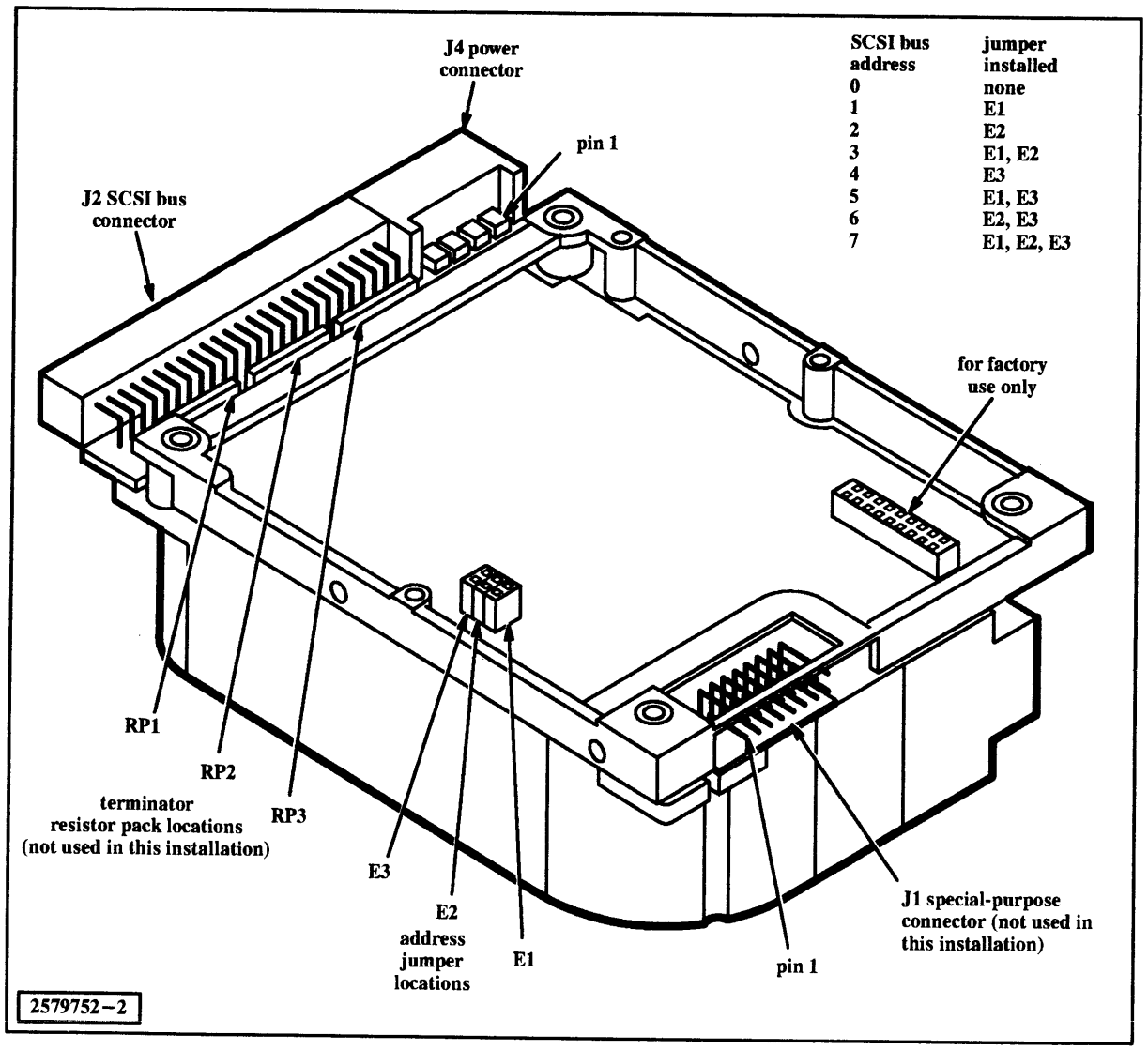


Table 2-2 1.7H/3.25D DB260 Specifications

Item	Specification
Power Requirements	
Voltage	5 Vdc +/−5 % and 12 Vdc +/−5 %
Read/write mode	570 ma at 5 Vdc and 320 ma at 12 Vdc
Seek mode	390 ma at 5 Vdc and 400 ma at 12 Vdc
Ready mode	380 ma at 5 Vdc and 220 ma at 12 Vdc
Spin-up mode	160 ma at 5 Vdc and 2.0 A at 12 Vdc
Heat Dissipatio n	
Read/write mode	5.5 W
Seek mode	4.5 W
Ready mode	3.5 W
Functional Operation	
Unformatted capacity (megabytes)	260
Formatted capacity (megabytes)	212.6
Read/write heads	8
Servo heads	N/A (see note)
Platters	4
Cylinders	1368
Sectors per track	38
Bytes per sector	512
Bytes per track	19,456
Track density (tracks per inch)	1700
Recording density (bits per inch)	31,800
Track-to-track seek time (ms)	5
Average seek time (ms)	16
Maximum seek time (ms)	35
Average rotational latency (ms)	8.33
Rotational speed, +/-0.5 % (rpm)	3600
Rotational period, +0.2, -0 % (ms)	16.67
Internal data transfer rate (megabits/sec)	12

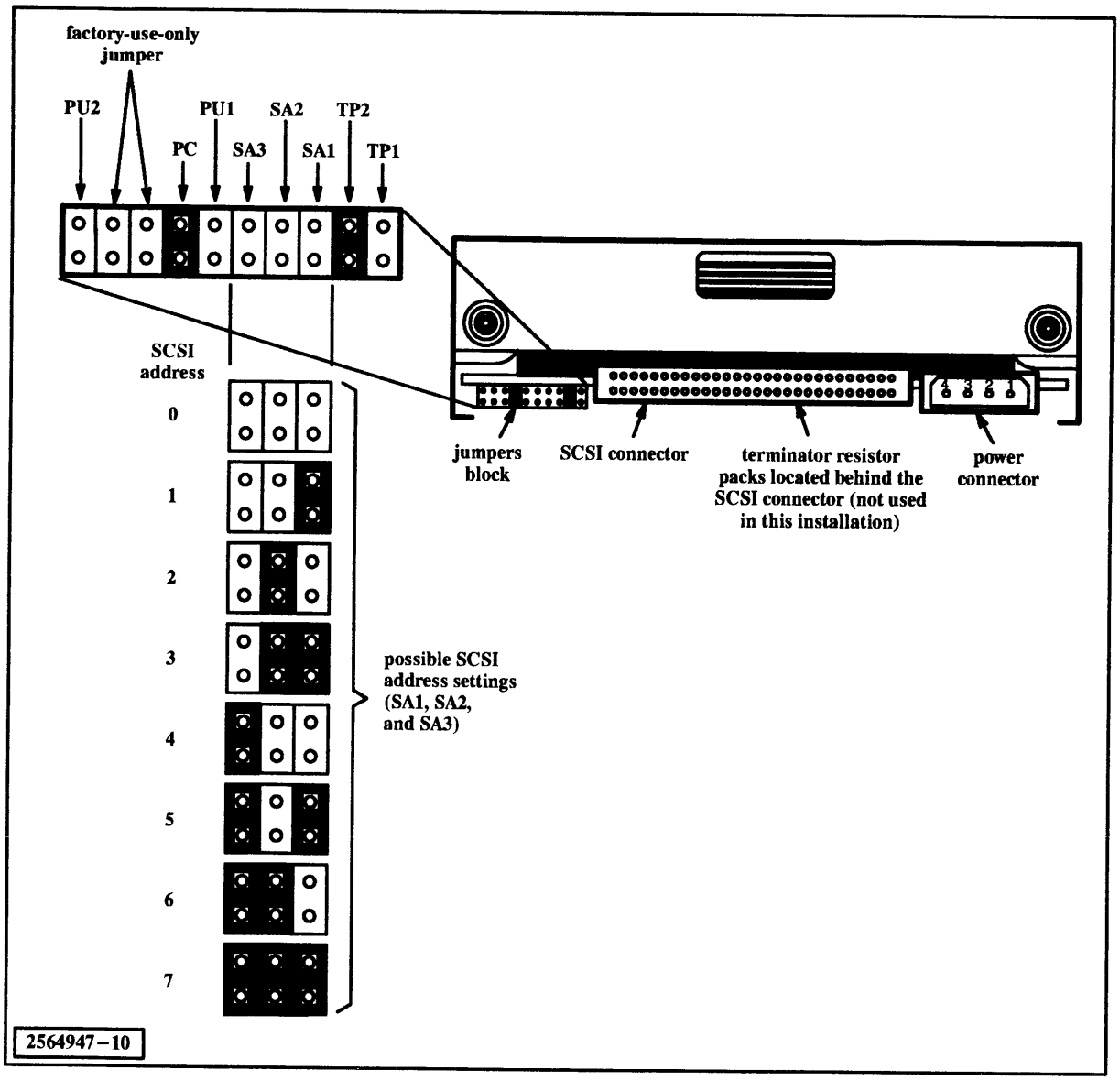
Notes:
This disk drive does not have a dedicated servo surface as do the other SCSI disk drives described in this section. The servo information is imbedded in sectors of the data surfaces where it is read by the data read/write heads.

1.7H/5.25D DB380

2.5 This disk drive is TI part number 2554667-0001. Figure 2-4 shows a rear view of the disk drive. The power connector and the SCSI interface connector, respectively, provide connections to the host system power source and SCSI bus. Table 2-3 lists the disk drive specifications.

Before you install the disk drive, check that the SCSI bus address jumpers are installed correctly, and that the terminator resistor packs are removed.

Figure 2-4 1.7H/5.25D DB380 (Rear View)



The configuration jumpers and their functions are as follows:

- PC — Parity checking. A jumper installed on the PC terminals enables the disk drive parity-checking function. This function allows the disk drive to check the integrity of all data received from the SCSI bus.
- TP1 and TP2 — Terminator power. These terminals determine the source of power for the SCSI bus terminator. You can install the TP jumper in either of the following positions:
  - TP1 — With the jumper installed vertically at TP1, the disk drive provides SCSI terminator power via the power connector.
  - TP2 — With the jumper installed vertically at TP2, the disk drive provides SCSI terminator power via an isolation resistor and fuse network.
  - TP1 and TP2 — With the jumper installed horizontally between the bottom terminals of TP1 and TP2, the SCSI interface provides SCSI terminator power via interface connector pin 26.
- SA1, SA2, and SA3 — SCSI bus address. Refer to Figure 2-4 for SCSI bus address jumper information.
- PU1 and PU2 — Power-up option. These terminals let you configure the disk drive for one of the following power-up modes:
  - PU1 and PU2 not installed — In this mode, the disk drive starts its motor automatically when power is applied to the host system.
  - PU1 installed and PU2 not installed — In this mode, the disk drive waits for a Start Unit command from the host before starting its motor.
  - PU2 installed and PU1 not installed — This mode must be implemented when more than one drive is used. In this mode, the disk drive waits 16 times the drive ID (SCSI address) in seconds and then starts its motor. For example, disk drive 0 starts immediately at system power-up, drive 1 starts 16 seconds after power-up, drive 2 starts 32 seconds after power-up, and so on.

Table 2-3 1.7H/5.25D DB380 Specifications

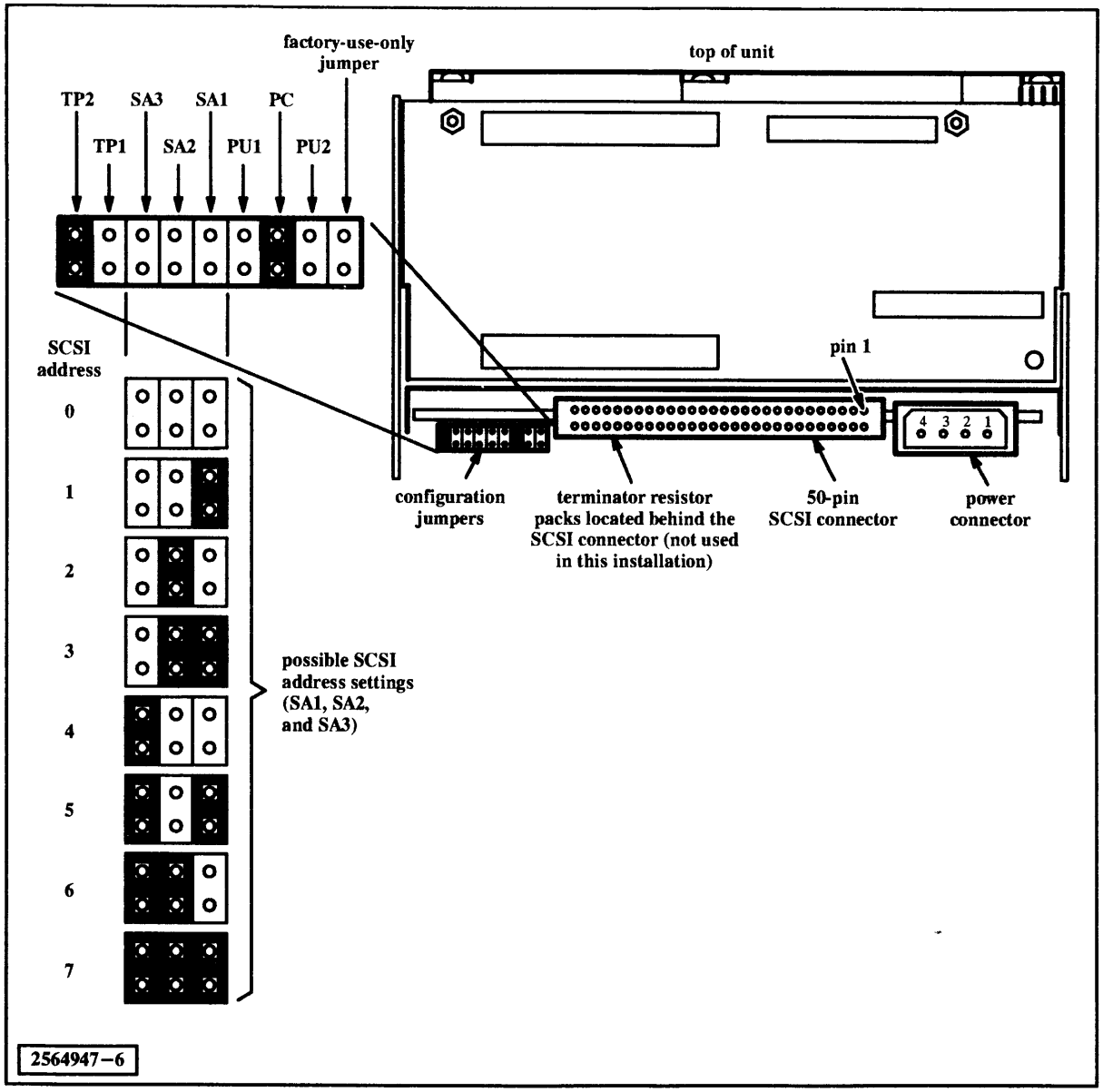
Item	Specification
Power Requirements	
Voltage	5 Vdc +/−5 % and 12 Vdc +/−5 %
Maximum starting current	1.9 A at 5 Vdc and 4.5 A at 12 Vdc
Maximum operating current	1.9 A at 5 Vdc and 2.3 A at 12 Vdc
Typical operating current	1.7 A at 5 Vdc and 1.6 A at 12 Vdc
Heat Dissipation	
Maximum	35 Watts
Typical	30 Watts
Functional Operation	
Unformatted capacity (megabytes)	383
Formatted capacity (megabytes)	331
Read/write heads	7
Servo heads	1
Platters	4
Cylinders	1261
Sectors per track	73 (avg.)
Bytes per sector	512
Bytes per track	43,392
Track density (tracks per inch)	1459
Recording density (bits per inch)	31,674 (max.)
Track-to-track seek time (ms)	3
Average seek time (ms)	14
Maximum seek time (ms)	33
Average rotational latency (ms)	8.3
Rotational speed, +/-0.5 % (rpm)	3600
Rotational period, +0.2, -0 % (ms)	16.67
Internal data transfer rate (megabits/sec)	18−22

3.4H/5.25D DB760

2.6 This disk drive is TI part number 2554669-0001. Figure 2-5 shows a rear view of the disk drive. The power connector and the SCSI interface connector, respectively, provide connections to the host system power source and SCSI bus. Table 2-4 lists the disk drive specifications.

Before you install the disk drive, check that the SCSI bus address jumpers are installed correctly, and that the terminator resistor packs are removed.

Figure 2-5 3.4H/5.25D DB760 Rear View



The configuration jumpers and their functions are as follows:

- PC — Parity checking. A jumper installed on the PC terminals enables the disk drive parity-checking function. This function allows the disk drive to check the integrity of all data received from the SCSI bus.

- TP1 and TP2 — Terminator power. These terminals determine the source of power for the SCSI bus terminator. You can install the TP jumper in either of the following positions:

  - TP2 — With the jumper installed vertically at TP2, the disk drive provides SCSI terminator power via the power connector.

  - TP1 and TP2 — With the jumper installed horizontally between the bottom terminals of TP1 and TP2, the SCSI interface provides SCSI terminator power via interface connector pin 26.

- SA1, SA2, and SA3 — SCSI bus address. Refer to Figure 2-5 for SCSI bus address jumper information.

- PU1 and PU2 — Power-up option. These terminals let you configure the disk drive for one of the following power-up modes:

  - PU1 and PU2 not installed — In this mode, the disk drive starts its motor automatically when power is applied to the host system.

  - PU1 installed and PU2 not installed — In this mode, the disk drive waits for a Start Unit command from the host before starting its motor.

  - PU2 installed and PU1 not installed — In this mode, the disk drive waits 16 times the drive ID (SCSI address) in seconds and then starts its motor. For example, disk drive 0 starts immediately at system power-up, drive 1 starts 16 seconds after power-up, drive 2 starts 32 seconds after power-up, and so on.

Table 2-4 3.4H/5.25D DB760 Specifications

Item	Specification
Power Requirements	
Voltage	5 Vdc +/−5 % and 12 Vdc +/−5 %
Maximum starting current	1.9 A at 5 Vdc and 4.5 A at 12 Vdc
Maximum operating current	1.9 A at 5 Vdc and 2.3 A at 12 Vdc
Typical operating current	1.7 A at 5 Vdc and 1.6 A at 12 Vdc
Heat Dessipation	
Maximum	35 Watts
Typical	30 Watts
Functional Operation	
Unformatted capacity (megabytes)	766
Formatted capacity (megabytes)	663
Read/write heads	15
Servo heads	1
Platters	8
Cylinders	1632
Sectors per track	54
Bytes per sector	512
Bytes per track	31,320
Track density (tracks per inch)	1459
Recording density (bits per inch)	30,500
Track-to-track seek time (ms)	3
Average seek time (ms)	16
Maximum seek time (ms)	35
Average rotational latency (ms)	8.34
Rotational speed, +/-0.5 % (rpm)	3597
Rotational period, +0.2, -0 % (ms)	16.68
Internal data transfer rate (megabits/sec)	15

1.7H/3.5D DB620

2.7 This disk drive is TI part number 2606476-0001. All user-accessible connectors are located at the front and rear of the disk drive as shown in Figure 2-6. The SCSI address jumpers are located on the bottom of the drive. Table 2-5 lists the specifications of the disk drive.

Before you install the disk drive, check that the SCSI bus address jumpers are installed correctly, and that the terminator resistor packs are removed.

The disk drive that has address 0 begins spin-up operation immediately when power is applied. Drives set for other addresess delay spin-up by two seconds between each address number.

Figure 2-6 1.7H/3.5D DB620 (Bottom View)

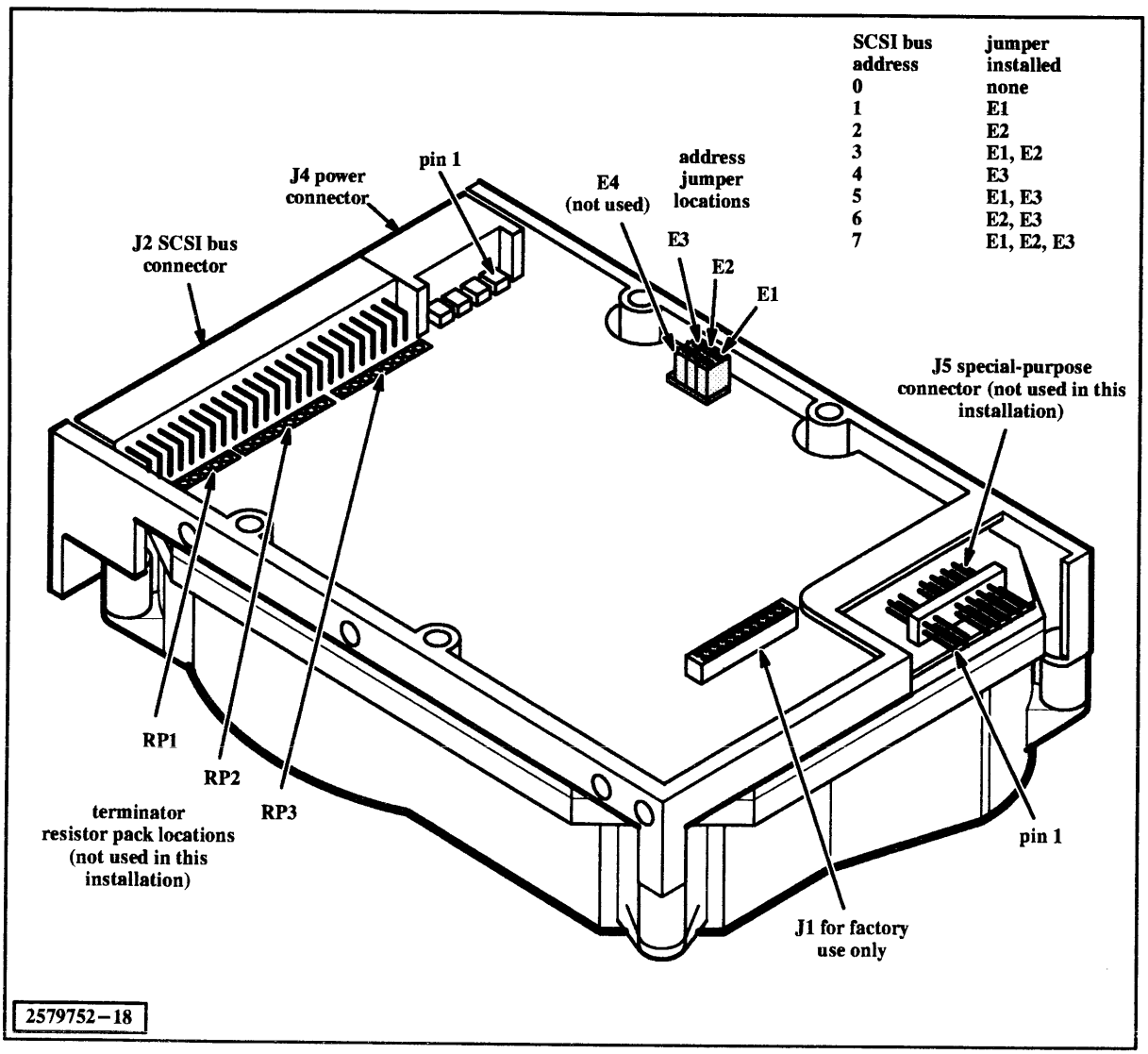


Table 2-5 1.7H/3.5D DB620 Specifications

Item	Specification
Power Requirements	
Voltage	5 Vdc +/−5 % and 12 Vdc +/−5 %
Read/write mode	475 ma at 5 Vdc and 300 ma at 12 Vdc
Seek mode	375 ma at 5 Vdc and 490 ma at 12 Vdc
Ready mode	380 ma at 5 Vdc and 280 ma at 12 Vdc
Spin-up mode	600 ma at 5 Vdc and 2.5 A at 12 Vdc
Heat Dissipation	
Read/write mode	6.0 W
Seek mode	7.8 W
Ready mode	5.3 W
Functional Operation	
Unformatted capacity (megabytes)	620
Formatted capacity (megabytes)	543
Read/write heads	12
Servo heads	N/A (see note)
Platters	6
Cylinders	1806
Sectors per track	49
Bytes per sector	512
Bytes per track	25,088
Track density (tracks per inch)	2150
Recording density (bits per inch)	44,325
Track-to-track seek time (ms)	3
Average seek time (ms)	12
Maximum seek time (ms)	30
Average rotational latency (ms)	6.7
Rotational speed, +/-0.5 % (rpm)	4500
Rotational period, +0.2, -0 % (ms)	13.33
Internal data transfer rate (megabits/sec)	20

Notes:
This disk drive does not have a dedicated servo surface as some of the other SCSI disk drives described in this section. The servo information is imbedded in sectors of the data surfaces where it is read by the data read/write heads.

1/4-INCH TAPE CARTRIDGE DRIVES

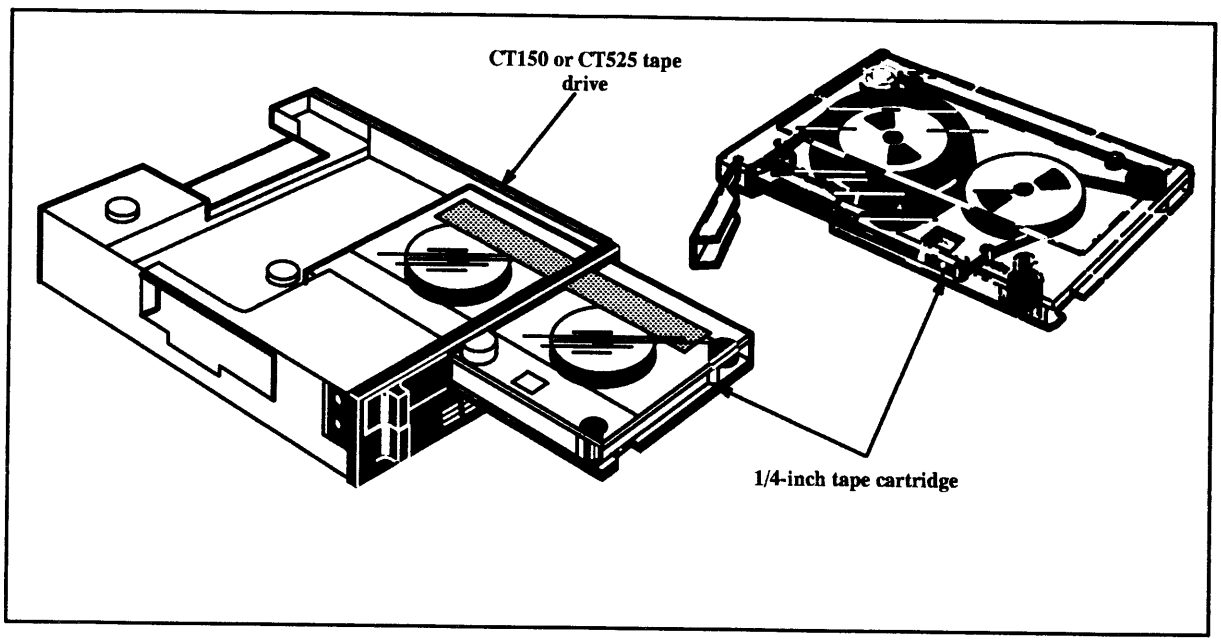
3

Introduction

3.1 This section describes the following 1/4-inch tape cartridge drives which are shown in Figure 3-1.

- 150-megabyte tape drive designated CT150
- 525-megabyte tape drive designated CT525

Figure 3-1 Operator Access Drives



CT150 Tape Drive

3.2 The CT150 1/4-inch tape cartridge drive, TI part number 2562301-0002, is a half-height, 5 1/4-inch mass storage device. This tape drive is designed for backing up small computer system interface (SCSI) mass storage systems. It also provides a means of transporting data and software from one computer system to another. The tape drive can transfer up to 150 megabytes of data in less than 25 minutes and it can be mounted in the standard mounting outline defined for 5 1/4-inch SCSI mass storage devices.

The CT150 tape drive records 18 tracks on a 1/4-inch wide tape in serpentine fashion. That is, the drive records from the beginning to the end of the odd-numbered tracks and from the end to the beginning of even-numbered tracks. All data is transferred in bit-serial fashion, starting with the first track, and continues in serpentine fashion on subsequent tracks.

CT150 Features

3.2.1 The following key features characterize the CT150 tape drive:

- Operates on the industry-standard SCSI bus and contains an embedded SCSI formatter and a standard 50-pin SCSI interface connector.
- Has interface, format, and power requirements compatible with industry-standard tape drives produced in accordance with the Quarter Inch Compatibility standard QIC-150.
- Provides serial, 18-track, read-after-write, serpentine-mode recording.
- Includes an error detection and error recovery scheme that screens errors before the data appears on the SCSI bus. This scheme is self-contained in the tape drive and does not require any system-level or other programming.
- Has a closed-loop servo capstan speed control system for precise tape speed of 90 inches per second.
- Has low audible noise output that makes the drive suitable for use in office environments.
- Requires no adjustments and no preventive maintenance other than cleaning of the read/write head.

CT150 Specifications

3.2.2 Table 3-1 lists CT150 tape drive specifications. These specifications are based on the DC6150, 600-foot tape cartridge, TI part number 2562302-0001.

Table 3-1 CT150 Tape Drive Specifications

Item	Specification
Power Requirements:	
Voltage	5 Vdc +/-5% 12 Vdc +/-5%
Typical operating current (while running tape)	1.0 A at 5 Vdc 1.6 A at 12 Vdc
Maximum starting current	1.0 A at 5 Vdc 4.4 A at 12 Vdc
Heat Dissipation:	
Continuous streaming mode	32 watts
During start surge	59 watts
Formatted capacity[1] (megabytes)	150 (min)
Bytes per block	512
Blocks per track	16,276 (min)
Tracks per cartridge	18
Tape speed	2286 mm (90 in) per second
Data transfer rate	112.5K bytes per second

Table 3-1 CT150 Tape Drive Specifications (Continued)

Item	Specification
Recording or rewind time (per track)	1.3 minutes, provided the host computer buffers the data adequately to maintain streaming
Recording or rewind time per cartridge	24 minutes, provided the host computer buffers the data adequately to maintain streaming
Format standard*	Write: QIC-150 Read: QIC-11, QIC-24, QIC-120, and QIC-150
Overwrite capability	Not available except from beginning of medium (BOM) with full erase while writing on track 0

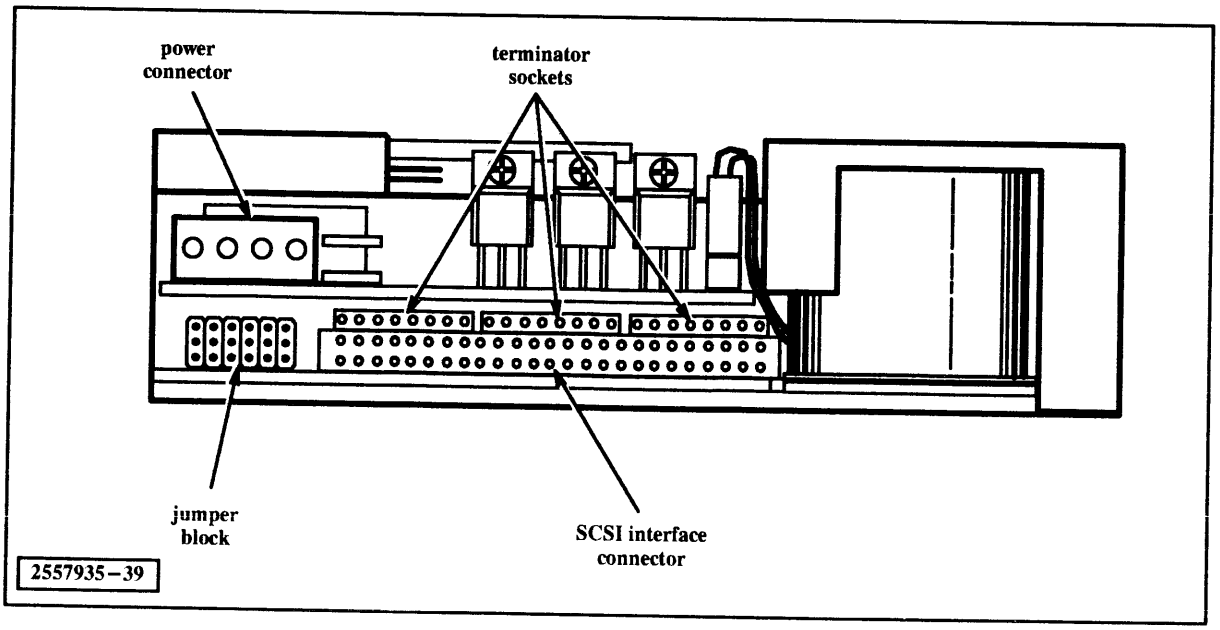
Note:
* There are older types of tape cartridges in general use that do not have the precision for 150-megabyte service. When one of these cartridges is used in the CT150 tape drive, the tape drive automatically switches to the QIC-120 write format. Thus, the use of these older tapes limits the tape capacity to 120 megabytes.

CT150 Connectors and Terminators

3.2.3 Figure 3-2 shows a rear view of the CT150 tape drive. The following connectors and terminator sockets are located at the rear of the tape drive:

- Power connector — Provides power from the system or subsystem power supply to the tape drive.
- SCSI interface connector — Connects the tape drive to the SCSI bus.
- SCSI terminator sockets — Be sure there are no terminator resistors in the terminator sockets on the tape drive.

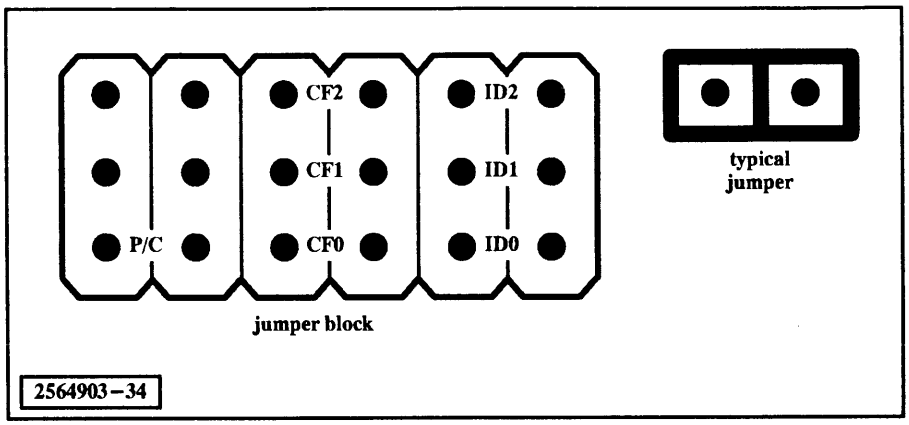
Figure 3-2 CT150 Tape Drive (Rear View)



CT150 Configuration

3.2.4 The jumpers on the CT150 tape drive (Figure 3-2 and Figure 3-3) are preset at the factory for the most common type of installation. It may be necessary to reconfigure these jumpers, depending upon your system configuration. These jumpers must be installed horizontally on the jumper block terminals. Figure 3-3 shows a typical jumper.

Figure 3-3 **CT150 Tape Drive Jumper Configuration**



The jumper terminals and their functions are as follows:

- P/C — Parity checking. A jumper installed in this position enables the tape drive parity-checking function. This function allows the tape drive to check the integrity of all data received from the SCSI bus.
- CF0, CF1, and CF2 — Maximum data transfer size. These terminals allow you to set the maximum size of each data transfer operation to any one of eight different values by installing jumpers in one of the following configurations:
  - 2K bytes — No jumpers installed.
  - 4K bytes — Jumper installed at CF0.
  - 6K bytes — Jumper installed at CF1.
  - 8K bytes — Jumpers installed at CF0 and CF1.
  - 12K bytes — Jumper installed at CF2.
  - 16K bytes — Jumpers installed at CF0 and CF2.
  - 24K bytes — Jumpers installed at CF1 and CF2.
  - 32K bytes — Jumpers installed at CF1, CF2, and CF3.

    During lengthy data transfer operations, this feature periodically frees the SCSI bus for other operations.

- ID0, ID1, and ID2 — SCSI address. These terminals allow you to set the tape drive to any one of eight possible SCSI addresses (0 through 7) by installing jumpers in one of the following configurations:
  - SCSI address 0 — No jumpers installed.
  - SCSI address 1 — Jumper installed at ID0.
  - SCSI address 2 — Jumper installed at ID1.
  - SCSI address 3 — Jumpers installed at ID0 and ID1.
  - SCSI address 4 — Jumper installed at ID2.
  - SCSI address 5 — Jumpers installed at ID0 and ID2.
  - SCSI address 6 — Jumpers installed at ID1 and ID2.
  - SCSI address 7 — Jumpers installed at ID1, ID2, and ID3.

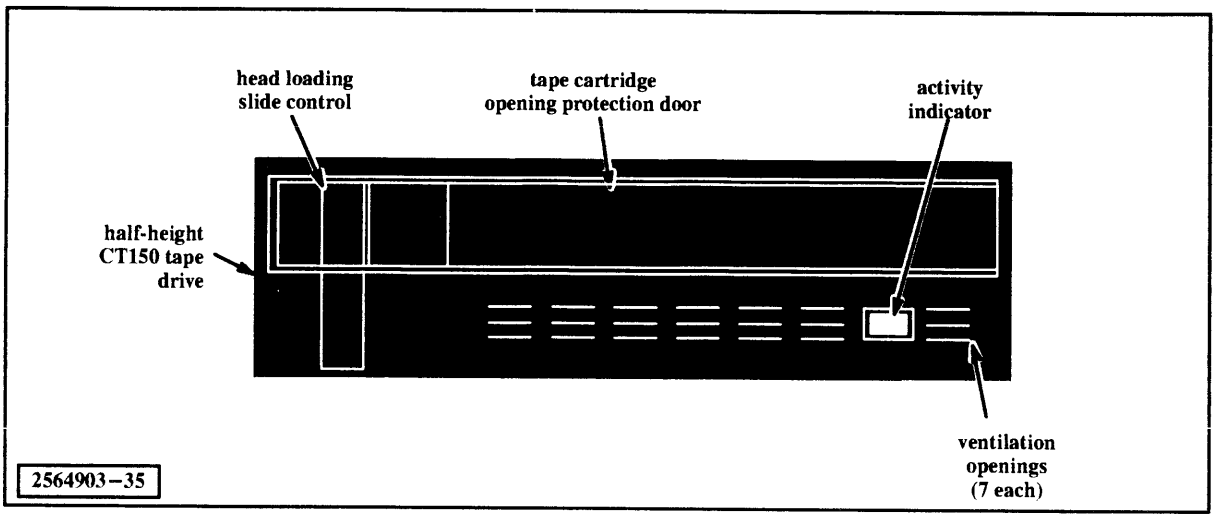
CT150 Operation

3.2.5 Figure 3-4 shows a front view of the CT150 tape drive. The tape drive has an activity indicator located on the drive front panel. The activity indicator lights any time the tape is away from the beginning of tape (BOT) position.

The head-loading slide control, when moved to the right, moves the head into contact with the tape in the tape cartridge. This action also locks the CT150 tape in the drive. When the head loading control is moved to the left, the heads are moved away from the tape and the cartridge is ejected from the drive.

Check the operation of the tape drive after you have installed it. If you find it does not function properly, verify that all installation procedures have been performed properly and that all cables are connected securely before contacting service personnel.

Figure 3-4 CT150 Tape Drive Front Panel



CT525 Tape Drive

3.3 The CT525 1/4-inch tape cartridge drive, TI part number 2562307-0002, is a half-height, 5 1/4-inch mass storage device. This tape drive is designed for backing up small computer system interface (SCSI) mass storage systems. It also provides a means of transporting data and software from one computer system to another. The tape drive can transfer up to 525 megabytes of data in less than 45 minutes and it can be mounted in the standard mounting outline defined for 5 1/4-inch SCSI mass storage devices.

The CT525 tape drive records 26 tracks on a 1/4-inch wide tape in serpentine fashion. That is, the drive records from the beginning to the end of the odd-numbered tracks and from the end to the beginning of even-numbered tracks (track numbering starts from 1). All data is transferred in bit-serial fashion, starting with the first track, and continues in serpentine fashion on subsequent tracks.

CT525 Features

3.3.1 The following key features characterize the CT525 tape drive:

- Operates on the industry-standard SCSI bus and contains an embedded SCSI formatter and a standard 50-pin SCSI interface connector.
- Has interface, format, and power requirements compatible with industry-standard tape drives produced in accordance with the Quarter Inch Compatibility standard QIC-525.
- Provides serial, 26-track, read-after-write, serpentine-mode recording.
- Includes an error detection and correction scheme that screens errors before the data appears on the SCSI bus. This scheme is self-contained in the tape drive and does not require any system-level or other programming.
- Has a closed-loop servo capstan speed control system for precise tape speed of 120 inches per second (ips), or 90 ips on cartridges not rated for 120 ips.
- Has low audible noise output that makes the drive suitable for use in office environments.
- Requires no adjustments and no preventive maintenance other than cleaning of the read/write head.

CT525 Specifications

3.3.2 Table 3-2 lists the CT525 tape drive specifications. These specifications are based on the DC6525, 1000-foot tape cartridge, TI part number 2562308-0001.

Table 3-2 CT525 Tape Drive Specifications

Item	Specification
Power Requirements:	
Voltage	5 Vdc +/- 5% 12 Vdc +/- 10%
Typical operating current (while running tape)	0.8 A at 5 Vdc 1.8 A at 12 Vdc
Maximum starting current	0.8 A at 5 Vdc 2.5 A at 12 Vdc
Heat Dissipation:	
Continuous streaming mode	27 watts
During start surge	34 watts
Formatted capacity[1] (megabytes)	525
Bytes per block[2]	1024
Blocks per frame	14 data + 2 ECC = 16 total
Frames per track	1408
Tracks per cartridge	26
Tape speed	3048 mm (120 in) per second
Data transfer rate	197K bytes per second
Recording or rewind time (per track)	1.7 minutes, provided the host computer buffers the data adequately to maintain streaming
Recording or rewind time per cartridge	45 minutes, provided the host computer buffers the data adequately to maintain streaming
Format standard[1]	Write: QIC-150, QIC-525 Read: QIC-24, QIC-120, QIC-150, and QIC-525
Overwrite capability	Not available except from beginning of medium (BOM) with full width erase while writing on track 0

Notes:

1 There are older types of tape cartridges in general use that do not have the precision for 525-megabyte service. When one of these cartridges is used in the CT525 tape drive, the tape drive automatically switches to an older write format. Thus, the use of these older tapes limits the tape capacity. See Table 4-1.

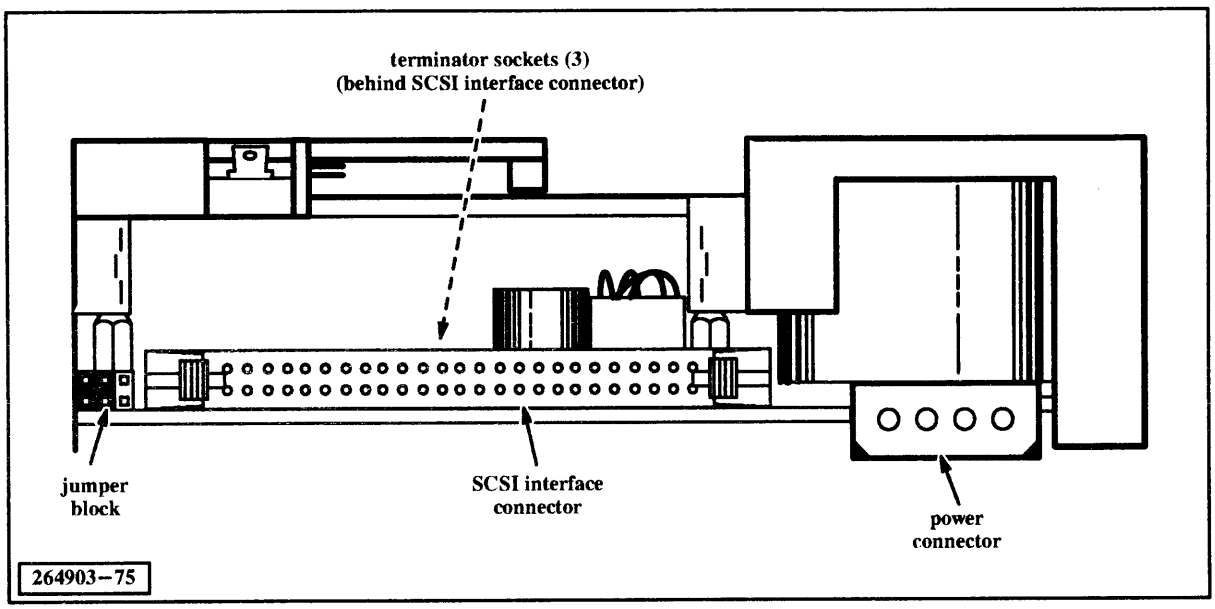
2 Within TI systems, the block size at the SCSI interface to the CT525 disk drive is 512 bytes. The tape drive concatenates two 512-byte interface data blocks into each 1024-byte tape data.

CT525 Connectors and Terminators

3.3.3 Figure 3-5 shows a rear view of the CT525 tape drive. The following connectors are located at the rear of the tape drive:

- Power connector — Provides power from the system or subsystem power supply to the tape drive.
- SCSI interface connector — Connects the tape drive to the SCSI bus.
- SCSI terminator sockets — Be sure there are no terminator resistors in the terminator sockets on the tape drive.

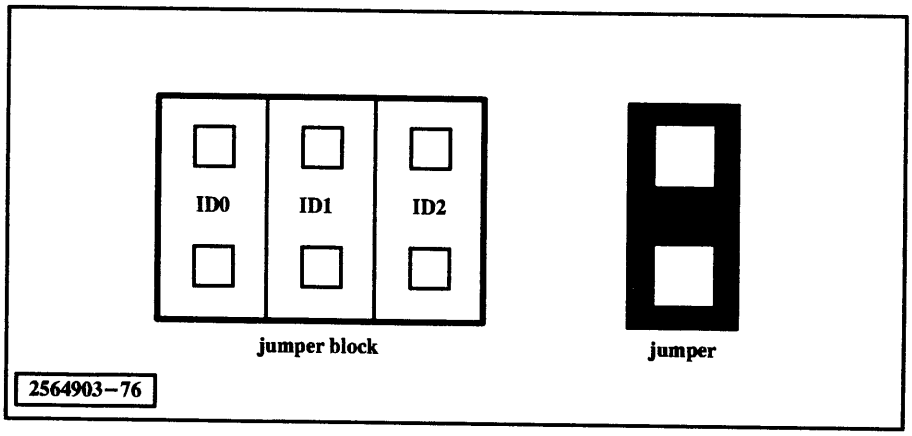
Figure 3-5 CT525 Tape Drive (Rear View)



CT525 Configurations

3.3.4 The jumpers on the CT525 tape drive (Figure 3-6) are preset at the factory for the most common type of installation. It may be necessary to reconfigure the SCSI address jumpers, depending upon your system configuration. These jumpers must be installed vertically on the jumper block terminals.

Figure 3-6 **CT525 Jumper Configuration**



The SCSI address jumper terminals and their functions are as follows:

- ID0, ID1, and ID2 — SCSI address. These terminals allow you to set the tape drive to any one of eight possible SCSI addresses (0 through 7) by installing jumpers in one of the following configurations:
  - SCSI address 0 — No jumpers installed.
  - SCSI address 1 — Jumper installed at ID0.
  - SCSI address 2 — Jumper installed at ID1.
  - SCSI address 3 — Jumpers installed at ID0 and ID1.
  - SCSI address 4 — Jumper installed at ID2.
  - SCSI address 5 — Jumpers installed at ID0 and ID2.
  - SCSI address 6 — Jumpers installed at ID1 and ID2.
  - SCSI address 7 — Jumpers installed at ID1, ID2, and ID3.

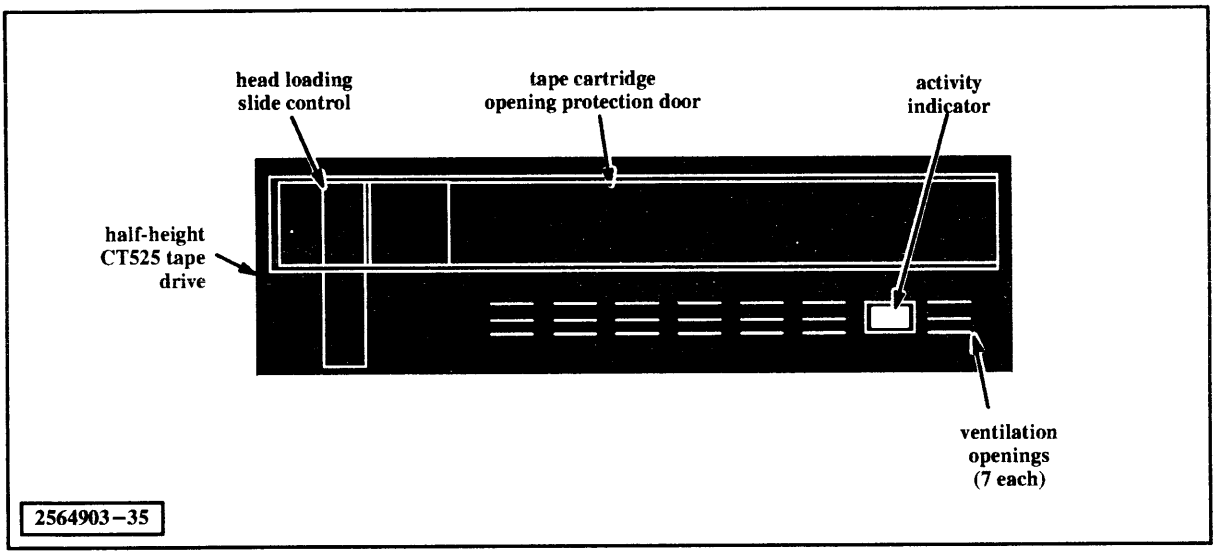
CT525 Operation

3.3.5 Figure 3-7 shows a front view of the tape drive. The tape drive has an activity indicator located on the drive front panel. The activity indicator lights any time the tape is away from the beginning of tape (BOT) position.

The head-loading slide control, when moved to the right, moves the head into contact with the tape in the tape cartridge. This action also locks the tape cartridge in the drive. When the head loading control is moved to the left, the heads are moved away from the tape. The cartridge is ejected from the drive when the head loading control is forced to the extreme left.

Check the operation of the tape drive after you have installed it. If you find it does not function properly, verify that all installation procedures have been performed properly and that all cables are connected securely before contacting service personnel.

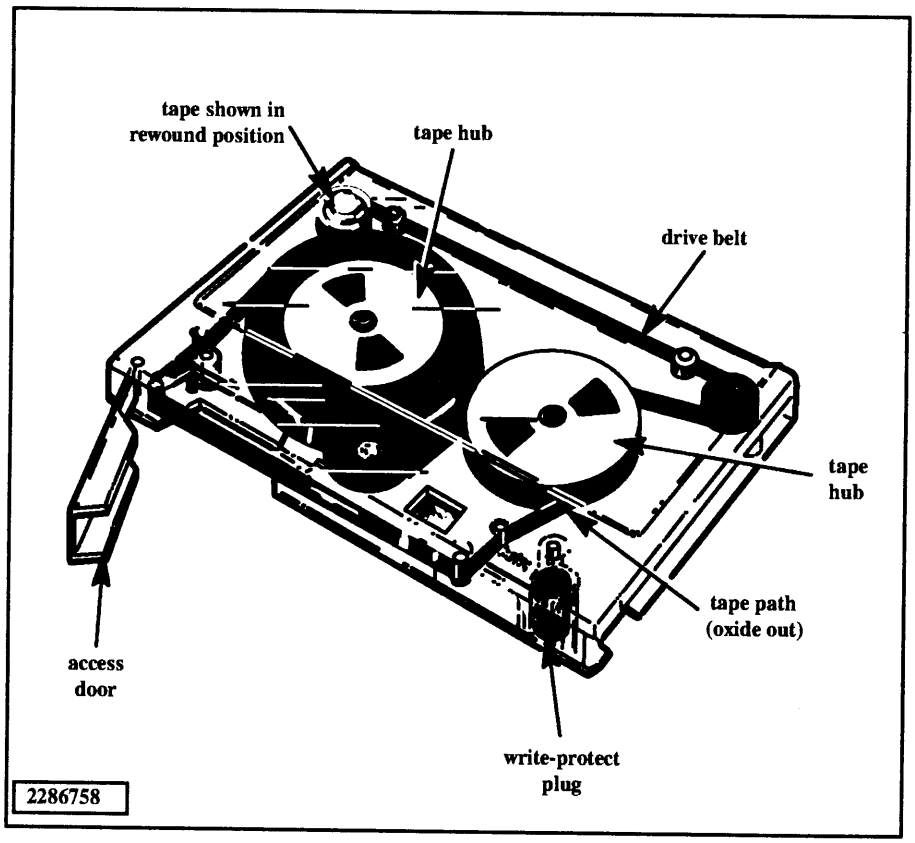
Figure 3-7 CT525 Front Panel



1/4-Inch Tape Cartridges

3.4 Figure 3-8 shows the 1/4-inch tape cartridge features. The cartridge has two coplanar reels called the *supply hub* and the *take-up hub* that drive the tape through the cartridge. An internal drive belt drives the supply hub and the take-up hub. Refer to Table 3-3 for tape cartridge capacities.

Figure 3-8 **1/4-Inch Tape Cartridge Functional Features**



A two-position write-protect plug determines whether the drive can write over the data on the tape. When the arrow points to the word SAFE, the tape is write-protected. The arrow points away from the SAFE position to allow data recording.

When the tape is inserted into the drive and a write or read command is received, the tape is automatically driven to its BOT position, where record and read operations always begin. When new data is recorded over old data, the old data is erased.

Table 3-3 Capacities (in Megabytes) of the 1/4-Inch Tape Cartridges

Cartridges	CT150 Drives*	CT525 Drives*
DC300XL, DC300XL/P	45 read only	45 read only
2270391-0001 — CT450	45 read only	45 read only
2270391-0002 — CT600	60 read only	60 read only
DC600A	120	120
2249438-0001 — CT600	120	120
DC600XTD	150	150
DC6150	150	150
2562302-0001	150	150
DC6525	150	525
2562308-0001	150	525

Note:
* In read operations, each drive automatically adjusts to read all cartridges written by drives of the same or lower capacity, but not of higher capacity. An exception is the CT525 drive which can be caused to write a format readable by the CT150 drive either by utilizing a DC6150 cartridge or by issuing a special setup command.

1/4-Inch Tape Cartridge Operating Precautions

3.4.1 To prevent the loss of data and extend the life of your equipment, observe the following precautions when using a tape cartridge:

- Ensure that the tape drive is not in use before you remove a tape cartridge.
- Issue a Rewind command from your computer to prepare the tape for removal from the drive. This command places blank leader tape under the access door, helping to prevent contamination of the recording media. Refer to your applicable computer application software documentation to execute a rewind operation.
- Store tape cartridges in a dust-free location with temperatures in the range of 5° to 45° degrees C (41° to 113° degrees F) and humidity in the range of 10 to 80 percent.
- Keep tape cartridges away from magnets and machines that produce magnetic fields, such as fans, typewriters, and X-ray machines.
- Avoid exposing tape cartridges to heat, moisture, or direct sunlight.
- Keep tape cartridges away from sticky, oily, or abrasive substances.
- If a tape cartridge is stored at a temperature significantly different from that of the tape drive, let the tape cartridge reach room temperature before using it.
- If a tape cartridge has been exposed to extreme temperatures or if you perform a number of small data transfers, the tape should be retensioned as explained in your system operating instructions.

1/4-Inch Tape Cartridge Insertion/Removal

3.4.2 Before you insert a tape cartridge, verify that the write-protect mechanism is set properly. To write on the tape, set the write-protect plug so that the arrow points away from the word SAFE. When the arrow points to the word SAFE, the tape is write protected.

When the tape cartridge is inserted, the drive automatically verifies that the cartridge is inserted correctly; then, before executing a write or read command, the drive rewinds the tape to the BOT.

The tape drive allows the tape cartridge to be loaded in only one orientation. Push the cartridge through the loading aperture until it reaches a hard stop. As the cartridge is inserted, it encounters a slight resistance from the ejector assembly. This resistance cushions the loading action.

Just before the cartridge reaches the stopping point, the cartridge protective door opens to expose the tape. The stopping point is reached when the cartridge metal base drops behind the lip of the front bezel aperture on the drive. Move the head loading control as far as it will move toward the right. This action secures the cartridge and loads the head assembly into operating position.

To remove a cartridge, slide the loading control to the left. The head assembly retracts, and the cartridge ejection system pushes the cartridge up and out of the drive.

CT150 or CT525 Preventive Maintenance

3.5 Preventive maintenance of the CT150 or CT525 tape drive consists of cleaning the front panel and read/write heads. This maintenance is normally done by the user and not by TI. The following paragraphs describe the preventive maintenance procedures.

Cleaning the Front Panel

3.5.1 When the front panel needs cleaning, wipe it with a damp (not wet) cloth and mild detergent.

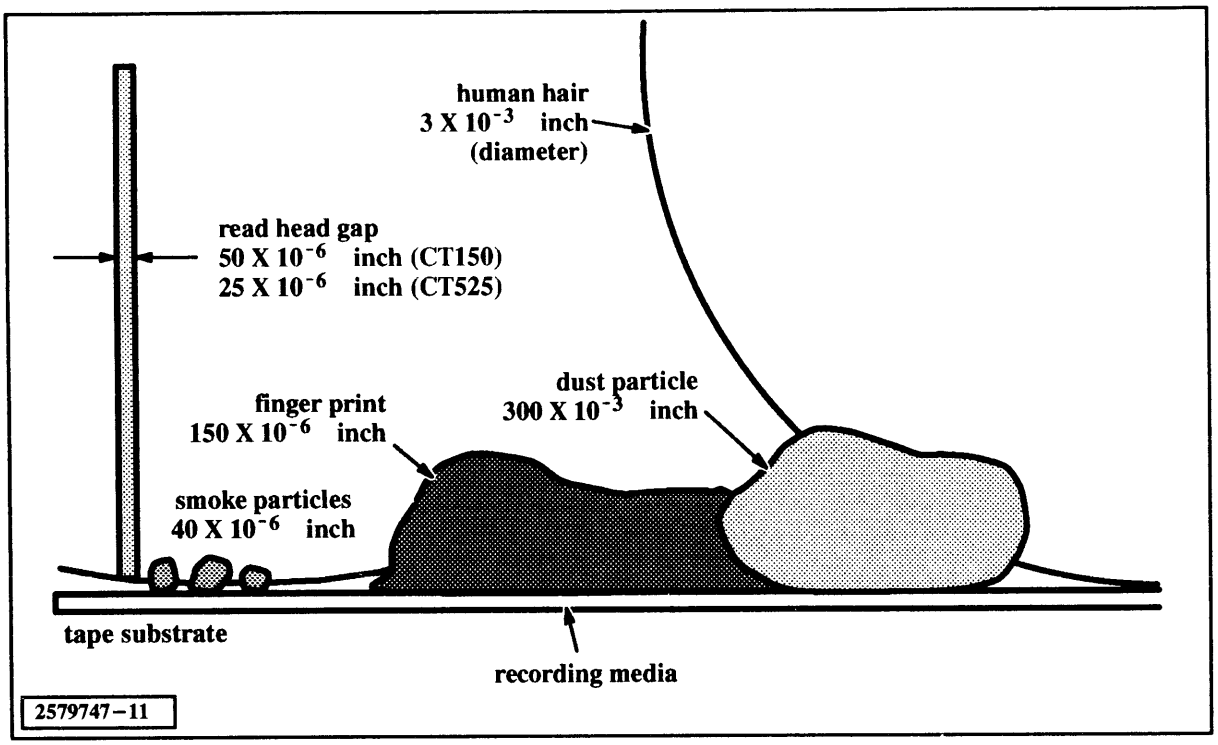
CAUTION: Strong detergents or solvents can damage the front panel finish. Do not use these materials on the front panel.

Cleaning the Read/Write Heads

3.5.2 The CT150 or CT525 tape drive read/write heads can accumulate metal oxides and dust. Figure 3-9 shows how particles of dust, smoke, and fingerprints can block the gap between the heads and the tape substrate and cause errors during read/write operations.

A large accumulation of material on the read/write heads can also cause poor performance. To ensure reliable tape drive performance, clean the read/write heads after each 8 hours of use. If you are using only new 1/4-inch tape cartridges, you should clean the heads after each initial pass of a new tape cartridge to remove the accumulation of metal oxides.

Figure 3-9 Relative Contamination Particle Sizes for CT150 and CT525



Using the Head Cleaning Kit

3.5.2.1 A standard head-cleaning kit, TI part number 2538701-0001, provides the most convenient way to clean the CT150 or CT525 tape drive read/write heads. You can obtain this kit or a refill kit, TI part number 2538702-0001 by calling toll free 1-800-TI-PARTS.

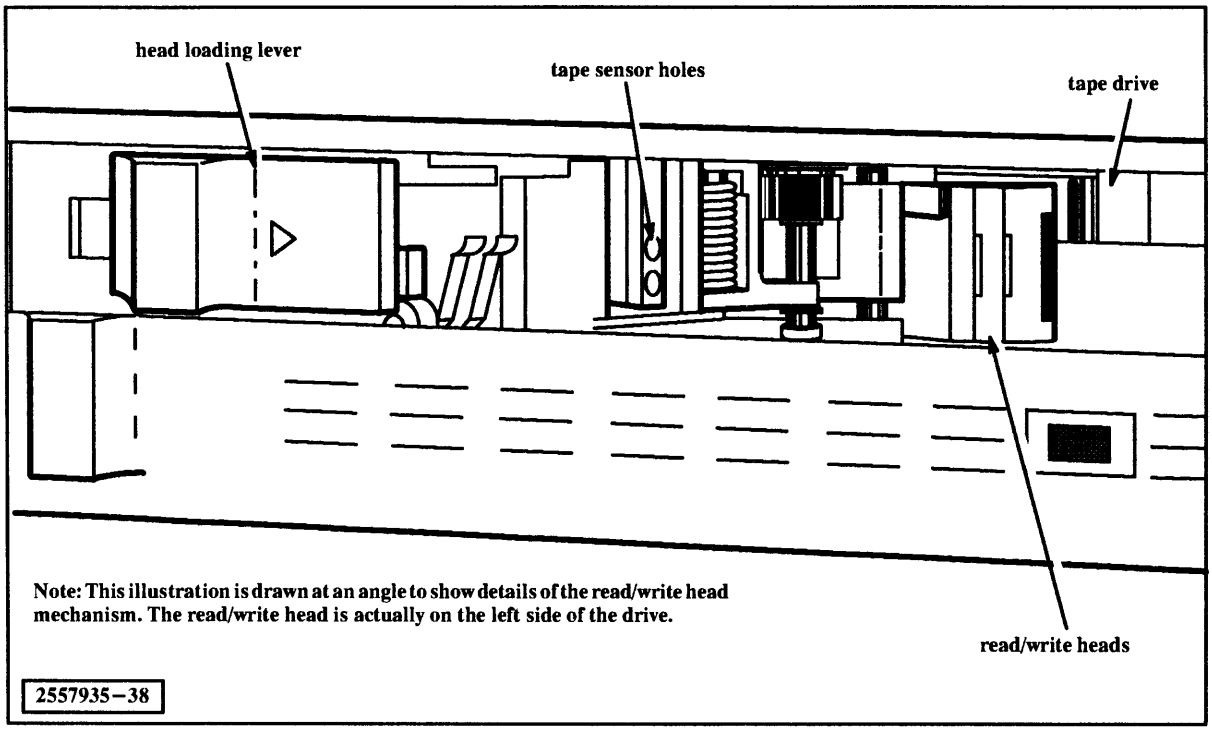
The cleaning kit includes a special cleaning cartridge with replaceable head cleaning pads, a supply of pads, and cleaning solution. Refer to Figure 3-10 and use these steps to clean the read/write heads with the head-cleaning kit:

1. Remove power from the tape drive and remove the tape cartridge (if one is installed).
2. Visually inspect the tape cavity. If contamination is visible in the tape sensor holes or within the cavity, carefully blow out visible dust or debris from these areas with low-pressure air from an aerosol can.
3. Install a cleaning pad on the cleaning cartridge as described in the cleaning kit instructions. Do *not* use excessive amounts of cleaning solution.

CAUTION: Do not substitute cleaning solutions. Use only the solution provided in the tape cleaning kit or the refill kit. Observe all cautions and warnings in the kit instructions.

Do not fail to dampen the pads. A dry pad will not clean properly, and the abrasion could shorten the usable life of the read/write heads.

Figure 3-10 CT150 or CT525 Read/Write Head Location



4. Insert the cleaning cartridge into the drive, and move the head-loading lever to the load position.

5. A lever on the cleaning cartridge lets you move the cleaning pad across the heads. Gently move the cleaning lever back and forth as described in the cleaning kit instructions.

6. Remove the cleaning cartridge and discard the head cleaning pad. You may need to clean the heads a second time to ensure that all residue has been removed from the head surface. Refer to the cleaning kit instructions.

7. Allow one or two minutes of drying time before inserting a tape cartridge into the drive.

Using Commercial Cleaning Material

3.5.2.2 If a Texas Instruments tape cleaning kit is not available and dirty read/write heads are degrading tape cartridge performance, other commercially available tape head cleaning products may be used. The following materials are recommended:

- Archive streaming head-cleaning fluid, Archive part number 14917-001.
- Six-inch long swabs made from lintless cotton or equivalent non-abrasive material, or any industry-acceptable head-cleaning swabs.

Use these steps to clean the read/write heads with commercial cleaning materials:

1. Remove power from the CT150 or CT525 tape drive and remove the tape cartridge (if one is installed).
2. Slide the tape-loading lever to the right until the heads are extended into the tape cavity. The heads are part of the brass-colored rectangular piece that measures about 13 millimeters (1/2-inch) by 19 millimeters (3/4-inch).
3. Visually inspect the tape cavity. If contamination is visible in the tape sensor holes or within the tape cavity, carefully blow out visible dust or debris from these areas with low pressure air from an aerosol can.
4. Moisten a swab with head-cleaning solution until it is saturated but not dripping. It is best to pour the solution on the swab rather than to dip the swab into the bottle.

CAUTION: Do not touch the tape capstan with the cleaning swab. Do not get any cleaning fluid on the capstan or in the motor.

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5. Gently wipe the swab across the heads in the direction that the tape moves. Do not wipe the heads in the direction perpendicular to the tape movement as residue can collect in minute crevices of the head. Do not use a scrubbing, circular motion.
6. Discard the first swab, and then moisten a second swab and repeat the wiping motion until all residue has been removed from the head surface.
7. Discard the second swab. With a clean, dry swab, wipe the head using the same motions described in step 6, until the head is clean and dry.
8. Allow one or two minutes of drying time before inserting a tape cartridge into the tape drive.

8-MM TAPE CARTRIDGE DRIVES

4

Introduction

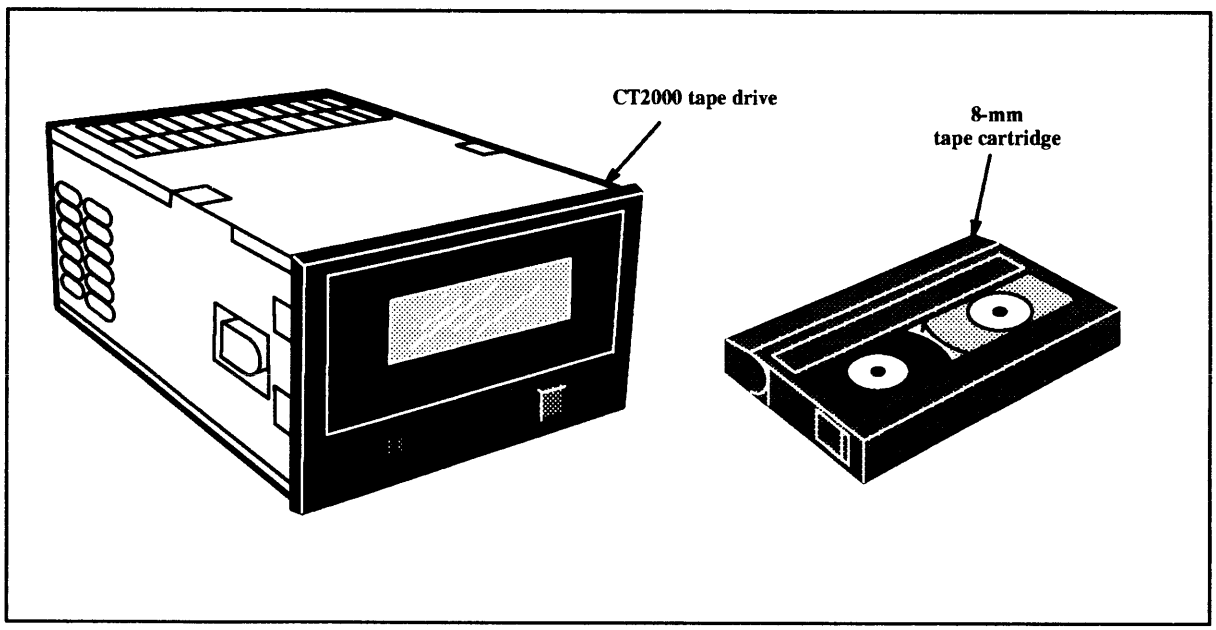
4.1 This section describes the 8-mm tape cartridge drive that is designated CT2000.

CT2000 Tape Drive

4.2 The CT2000 tape drive (Figure 4-1) is a compact, high-capacity data storage device that provides convenient, fast backup for large Winchester disks. The CT2000 uses helical scan technology to record up to 2 gigabytes of data on a single 8-mm tape cartridge. The standard tape cartridge has a capacity of 2044 megabytes; shorter cartridges are available. Tape cartridges are suitable for backup, archiving, program/data distribution, and other tasks normally associated with physically larger tape media.

The CT2000 tape drive consists of an EXABYTE™ EXB-8200 8-mm tape cartridge drive that meets rigid Texas Instruments performance specifications and quality requirements. The CT2000 fits in the standard mounting outline defined for full-height 5 1/4-inch disk drives and includes a microprocessor-controlled formatter for operation on the industry-standard small computer system interface (SCSI) bus.

Figure 4-1 CT2000 Operator Access Tape Drive



EXABYTE is a trademark of EXABYTE Corporation.

CT2000 Features

4.2.1 Key features of the CT2000 tape drive include the following:

- Provides primary backup for Winchester disk drives and a facility for program loading and data transportation.
- Operates on the industry-standard SCSI bus with an embedded SCSI formatter and standard 50-conductor connector.
- Has physical dimensions, mounting footprint, and power connections identical to those of industry-standard full-height 5 1/4-inch disk drives.
- Provides tape formatting dynamically during tape write operations, eliminating time-consuming preformatting operations.
- Adapts 8-mm helical-scan recording and metal-particle magnetic tape technology to a sophisticated digital data storage subsystem.
- Has a proprietary track-following servo system for precise control of tape speed and track alignment to the heads.
- Includes a 256-kilobyte data buffer to adjust host-to-tape data transfer timing to allow SCSI burst data rates up to 1.5 megabytes per second and to maintain streaming at the 240 kilobytes per second tape data rate.
- Provides read-after-write error detection and automatic rewrite transparent to the host and without disruption to tape streaming. Also provides transparent read error detection and correction of multiple burst and random errors.
- Provides file search capability at 10 times normal read/write tape speed, tape rewind at 75 times normal tape speed.
- Requires no adjustments and no preventive maintenance other than cleaning of the read/write head.
- Has on-board self-tests that verify drive operation and aid in fault isolation.

CT2000 Specifications

4.2.2 Table 4-1 summarizes the specifications for the CT2000 tape drive. These specifications are independent of the type of cartridge in use.

The CT2000 is a streaming tape drive, and includes an internal buffer memory to maintain streaming operation. The CT2000 determines an early warning (EW) point as it nears the end of a tape. On reaching the early warning point during a write, the drive completes writing the buffer contents and drops out of the high-speed buffered mode. It notifies the host SCSI controller so the host may append volume-closing data and filemarks.

Automatic read-after-write and write-retry features rerecord any bad data blocks without suspending streaming and without repositioning the tape. These rewrites reduce the total storage capacity of the tape, typically by about one percent.

Filemarks also reduce available storage capacity at the rate of two megabytes of storage per filemark.

Table 4-1 CT2000 Specifications

Item	Specifications
Power requirements:	
Voltage	+5 Vdc (+/−5%) +12 Vdc (+/−5% normal operation) +12 Vdc (+/−10% during power up)
Typical operating current (while running tape)	1.8 A at 5 Vdc 0.3 A at 12 Vdc
Tape start or stop surge current	2.0 A at 5 Vdc 0.4 A at 12 Vdc
Power consumption	13 W (continous streaming mode) 15 W (during start or stop power surges)
Host interface standard	Small computer system interface (SCSI)
SCSI bus data transfer rate	1.5M bytes per second maximum (asynchronous)
Tape data transfer rate	240K bytes per second continuous (while streaming)
Read/write buffer size	256K bytes
Recording code	Run-length-limited code (4, 5)
Format standard	Rotary digital computer tape (RDCT) — proposed ANSI standard
Tape block size	1024 bytes
Logical block size	1 to 245,760 bytes, fixed or variable
Head arrangement	Write, servo, read on circular drum rotating at 1800 rpm, recording 2.8-inch diagonal tracks at a 4.9-degree angle to the direction of tape motion
Effective head-to-tape speed	150 inches per second, read or write
Linear tape speed:	
Read/Write	0.429 inches per second
Filemark search	4.29 inches per second (10X read/write speed)
Rewind	32.2 inches per second (75X read/write speed)
Linear recording density	54,000 flux transitions per inch (FTPI)
Transverse recording density	819 tracks per inch (TPI)
Overwrite after backspacing over a filemark	Not available except from beginning of medium (BOM) and
Tape reposition time (after loss of streaming)	1.1 second
Recording or rewind time	See tape cartridge specifications

High quality computer-grade cartridges designated by length in meters (15 m, 54 m, and 112 m) are recommended for use in the CT2000 tape drive. These cartridges are available from Texas Instruments and the Exabyte Corporation. Lower quality entertainment-grade cartridges designated P5 and P6 are commercially available and can be used at the user's discretion.

Commercial manufacturers of 8-mm cartridges size them in terms of approximate recording time for use in video applications. Cartridges commercially available in the US are designated as P6 cartridges. They are available in various sizes from P6-15 through P6-120. The European market, with higher resolution video standards, requires a cartridge with more tape for an equivalent playing time. European cartridges are designated as P5 cartridges, and are available in sizes from P5-15 through P5-90. The CT2000 drive uses P5 and P6 cartridges interchangeably. However, the recording times in the CT2000 do not correspond to the recording times for video cameras.

As shown in Table 4-2, there are five 8-mm cartridge sizes available in the P6 series, with data storage capacities ranging from 258 megabytes to 2044 megabytes when used in the CT2000 tape drive. Table 4-3 shows the four 8-mm cartridges available in the P5 series. Backup times, search times, erase times, and rewind times depend on the cartridge in use.

Table 4-2 CT2000 Specifications – USA Tape Cartridge Version P6

Cartridge Type	15 m P6-15	P6-30	54 m P6-60	P6-90	2048* P6-120
Capacity (M bytes) to early warning, EW	258	368	753	1484	2044
Backup time (minutes) to EW	19	26	54	106	146
Maximum file mark search time (minutes)	3	5	10	14	18
Erase time (minutes)	25	47	89	132	174
Maximum rewind time (seconds)	35	50	78	105	135

Notes:

Rewrites and filemarks reduce recording capacity.

1 M byte = 1,048,576 bytes.

* The 2048 cartridge designation is used on earlier tape cartridges. It is listed for reference only, and has been replaced by the 112 m designation. Refer to Table 4-3 on page 4-5.

Table 4-3 CT2000 Specifications – European Tape Cartridge Version P5

Cartridge Type	P5-15	P5-30	P5-60	112 m P5-90
Capacity (M bytes) to early warning, EW	368	753	1484	2044
Backup time (minutes) to EW	26	54	106	146
Maximum file mark search time (minutes)	4	7	13	19
Erase time (minutes)	35	65	124	183
Maximum rewind time (seconds)	42	62	100	141

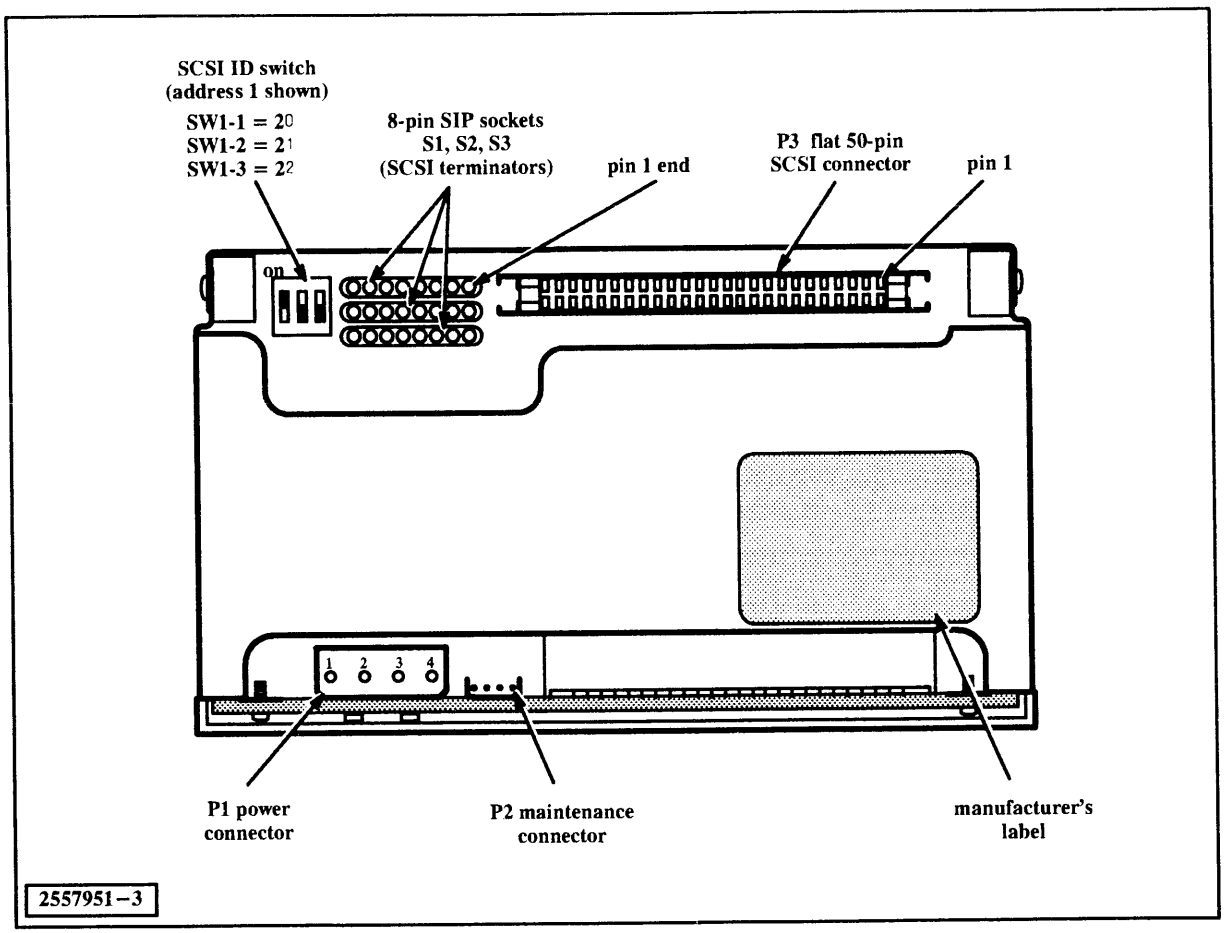
Notes:
Rewrites and filemarks reduce recording capacity.
1 M byte = 1,048,576 bytes.

CT2000 Connectors and Terminators

4.2.3 Figure 4-2 shows a rear view of the CT2000 tape drive. The following connectors are located at the rear of the tape drive:

- Power connector — Provides power from the system or subsystem power supply to the tape drive.
- SCSI interface connector — Connects the tape drive to the SCSI bus.
- SCSI terminator sockets — Be sure there are no terminator resistors in the terminator sockets on the tape drive.

Figure 4-2 CT2000 Tape Drive (Rear View)



CT2000 Configurations

4.2.4 The jumpers on the CT2000 tape drive are preset at the factory for the most common type of installation. It may be necessary to reconfigure the SCSI address jumpers, depending upon your system configuration. As shown in Figure 4-2, the SCSI ID for the CT2000 drive is set by a group of three miniature slide switches adjacent to the terminator sockets.

The switches are on when up, and off when down. Table 4-4 shows the switch positions and the corresponding SCSI ID numbers. By convention in TI systems, the primary tape cartridge drive is set at ID = 3. In systems that contain a CT150 or CT525 and a CT2000 drive, the CT150 or CT525 drive is the first drive, which is assigned ID 3, and the CT2000 drive is the second tape drive, which is assigned ID 1.

Table 4-4

Switch SW1 SCSI ID Setting on CT2000

SW1-1	SW1-2	SW1-3	ID
Off	Off	Off	0
On	Off	Off	1 (secondary tape drive)
Off	On	Off	2
On	On	Off	3 (primary tape drive)
Off	Off	On	4
On	Off	On	5
Off	On	On	6
On	On	On	7 (third tape drive)

Note:
Factory setting is ID = 1

CT2000 Operation

4.2.5 The following paragraphs contain information related to the CT2000 tape drive operation:

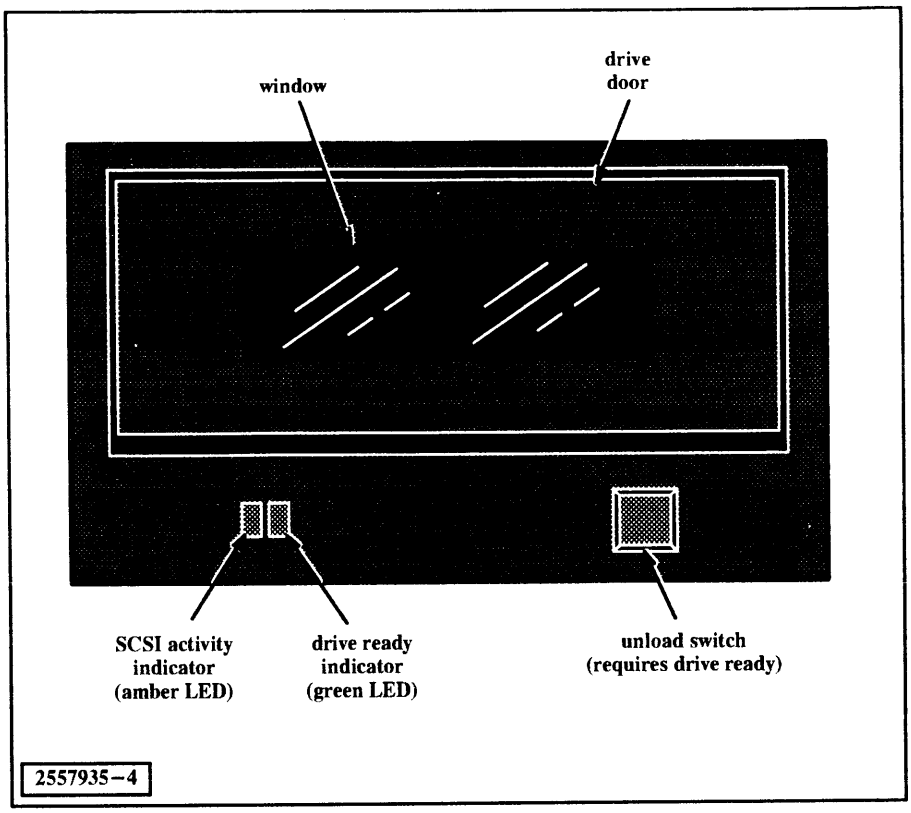
All CT2000 operating controls and indicators are located on the front panel, as shown in Figure 4-3. The main features of the front panel are the drive door, the tape unload switch, and the two status indicators. An external power supply provides operating power to the CT2000, and there is no power on/off switch on the drive.

The drive door serves as a protective dust seal and as a switch to initiate the tape cartridge loading sequence. The door locks when closed, and must be opened by pressing the tape unload/eject switch.

There are two light-emitting diode (LED) indicators on the front panel—the amber SCSI bus activity indicator and the green drive-ready indicator. These indicators will flash alternately if the drive fails its self-test.

The tape unload/eject switch is located at the lower right corner. This switch controls the opening of the tape door and the unloading/ejecting of a tape cartridge. The switch is a momentary-contact push button that initiates a drive-controller sequence. The CT2000 must have power applied, must be idle, and must indicate drive ready before you can open the door to insert or remove a tape cartridge.

Figure 4-3 CT2000 Front Panel Controls and Indicators



Efficient Use of the CT2000

4.2.6 A CT2000 drive has two important operating delays that affect efficient use of the drive as a backup/restore and file transfer device. These delays are:

- A 30-second delay from the time you insert a cartridge until the drive will accept a read or write command. This is the initial tape loading and positioning time.
- After inserting or rewinding a cartridge, a 30-second delay from accepting the first write command (that exceeds buffer capacity) to accepting the next write command. This delay does not occur on a read command.

Both of these delays occur once during a disk backup (tape write) procedure, and only the first of these delays occurs during a disk restore (tape read). These delays are negligible compared to the time required to back up or to restore a full 100-megabyte, 300-megabyte, or 1 gigabyte drive. However, users who wish to back up or copy small files may notice these delays. Texas Instruments recommends use of the CT150 or CT525 tape drive for faster backup and copying of small files or small groups of files. The CT2000 is the recommended drive for backup and restore of partitions and large files.

The CT2000 drive erases ahead of the write head; there is no reason to send an explicit erase command to the CT2000 except for security purposes. Once initiated, an erase command proceeds to the physical end of tape, beyond the early warning (EW). Erase time exceeds three hours for the largest standard cartridge size as shown in Table 4-2 and Table 4-3. Erase is not interruptible except through a power-down cycle or a system reboot.

8-mm Tape Cartridge

4.3 Figure 4-4 shows an 8-mm tape cartridge. This compact cartridge measures approximately 2.45 in. by 3.6 in. (62.3 mm by 91.4 mm). A hinged tape access door protects the tape from mechanical damage when the cartridge is not installed in the drive.

The write-protect shutter is visible on the end view, just to the right of the user label. The cartridge is write-protected when the shutter is at the full left position (closed), displaying a red rectangle. Write and erase operations are enabled when the shutter is at the full right position (open), showing a thin red tab at the right of the black window.

The supply reel, at the left, and the take-up reel are visible through the window on the top of the cartridge. The manufacturer's label identifies the capacity of the cartridge in megabytes or the nominal video recording time in minutes. (This recording time does not reflect accurate recording time for digital data recording.)

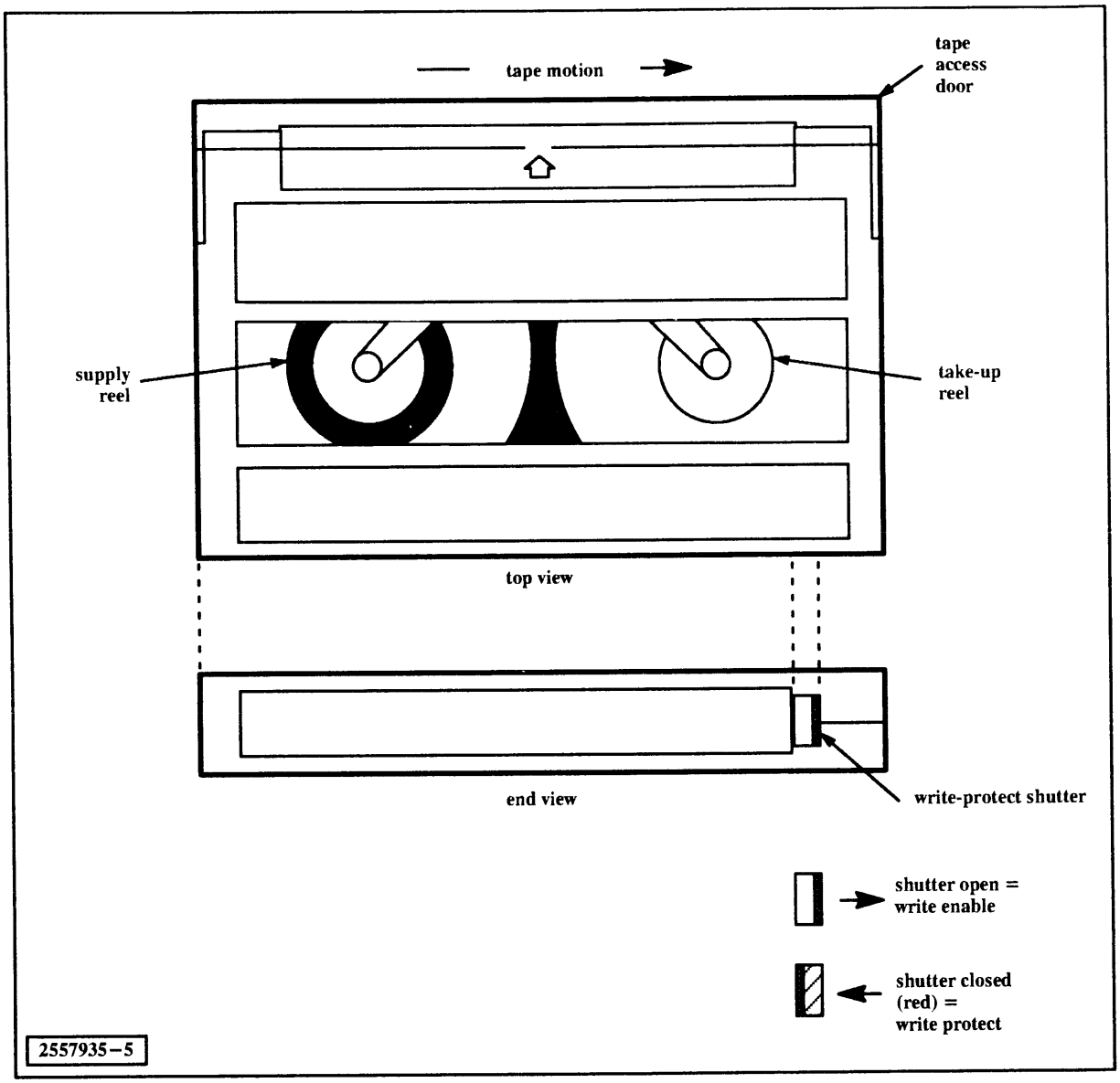
Table 4-5 lists the 8-mm tape cartridges that are available from Texas Instruments and from commercial sources. Commercially available entertainment-grade cartridges are generally satisfactory; however, cartridges with the Texas Instruments or EXABYTE part numbers are computer grade, and rated specifically for data service. Refer to the Texas Instruments price list or TI Express catalog for price and availability information on cartridges from Texas Instruments.

Table 4-5 8-mm Tape Cartridge Identification Information

Location Where Commercially Available	Sony® Corp. Cartridge Designation	Exabyte Cartridge Designation	Nominal Capacity	TI Part Number
USA and Eastern Asia	P6-120		2044 MB	
	P6-90		1484 MB	
	P6-60	54 m	753 MB	
	P6-30		368 MB	
	P6-15	15 m	258 MB	
Europe, Australia, and New Zealand	P5-90	112 m	2044 MB	2554627-0001
	P5-60		1484 MB	
	P5-30		753 MB	
	P5-15		368 MB	

Sony is a registered trademark of Sony Corporation.

Figure 4-4 8-mm Tape Cartridge



8-mm Tape Cartridge Operating Precautions

4.3.1 To prevent the loss of data and to extend the life of your tape cartridges and equipment, observe the following precautions when using and handling tape cartridges:

- Unload or rewind the tape cartridge before powering down the CT2000.
- Keep your tape cartridge away from magnets and machines that produce magnetic fields, such as fans, typewriters, X-ray machines, and other power machines.
- Do not expose your tape cartridge to heat, direct sunlight, or moisture.
- Keep your tape cartridge away from sticky, oily, or abrasive substances.
- Store the tape cartridge in its protective case when it is not installed in the tape drive. Return the cartridge to the case immediately on removal from the drive.
- Do not leave the CT2000 drive door open longer than necessary to remove or insert a tape cartridge.
- Store your tape cartridge in a dust-free location with temperatures in the range of −20 to +50 degrees Celsius (−4 to +122 degrees Fahrenheit) and humidity in the range of 10 to 90 percent. Note that the operating humidity is limited to a range of 20 to 80 percent.
- If a tape cartridge is stored at a temperature significantly different from that of the tape drive, let the tape cartridge reach room temperature before using it.

Inserting an 8-mm Tape Cartridge

4.3.2 Refer to Figure 4-5, which shows the details of inserting a cartridge in the CT2000 tape drive. A pair of molded guides at the left and right sides of the drive door guide the cartridge into a load/eject tray. The tray is spring-loaded, and moves the cartridge into position as the door closes. To insert a cartridge, follow these steps:

1. If the CT2000 drive door is closed, press the unload switch on the front panel. The door pivots open and the load/eject tray moves outward.

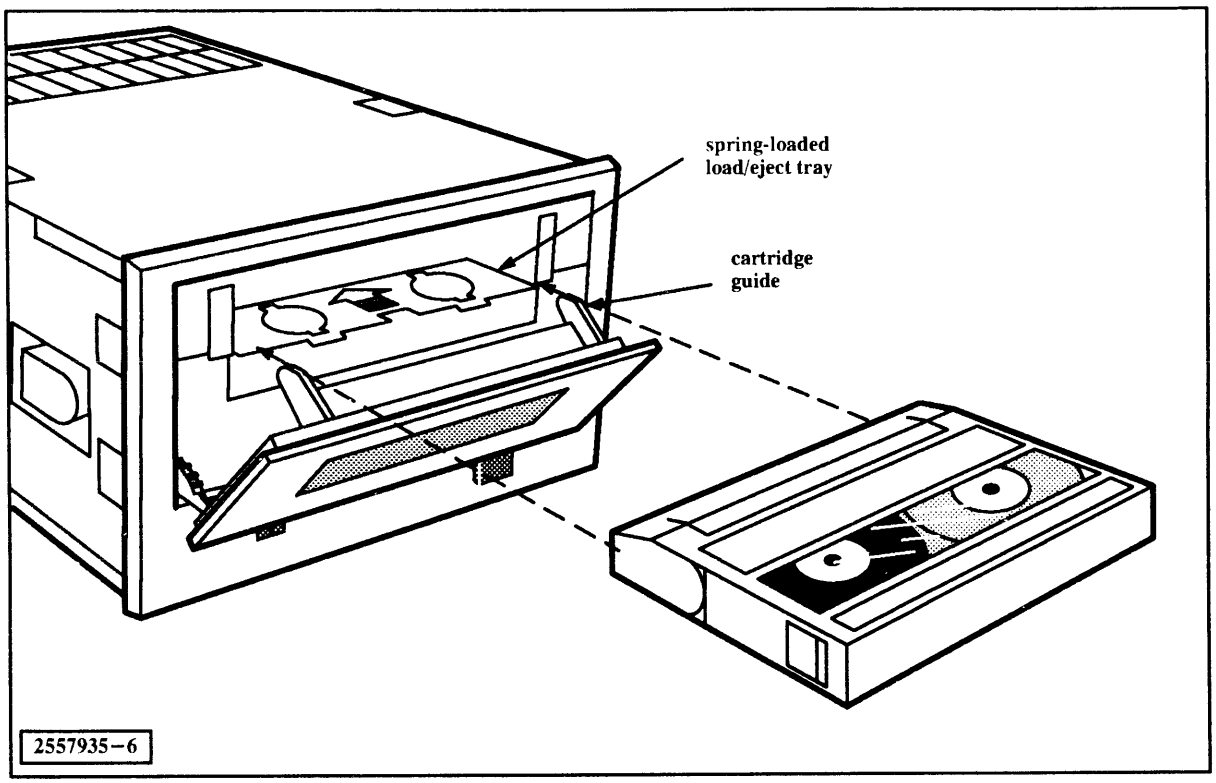
NOTE: The drive must be ready (green light on) and not executing a command for the unload switch to function.

2. Orient the cartridge as shown in the figure, with the label and window at the top and the tape access door pointed to the drive. There is a small arrow molded on the cartridge that shows the direction of insertion.

3. Slide the cartridge over the guides and all the way into the load/eject tray.

4. Close the drive door by pressing at the top until the door latches in the closed position. The drive automatically performs a sequence of self-test and tape positioning operations, and will not accept a software read or write command for approximately 30 seconds.

Figure 4-5 Loading the 8-mm Tape Cartridge



Removing an 8-mm Tape Cartridge

4.3.3 To remove a cartridge, follow these steps:

1. Press the unload switch on the front panel. If the tape is not in use, the drive initiates an unload and rewind sequence. Upon completion, the door pivots open and the load/eject tray moves outward. Slide the cartridge straight outward from the drive.

2. If you are not going to immediately insert another cartridge, push the drive door closed to prevent any dust from entering the drive.

Write Protecting an 8-mm Tape Cartridge

4.3.4 To prevent erasing or overwriting of data files recorded on a cartridge, slide the write-protect shutter closed so that the window to the right of the user label shows all red.

CT2000 Preventive Maintenance

4.4 Preventive maintenance for the CT2000 consists of cleaning the front panel as needed and cleaning the read/write heads, capstan, and tape guides with an approved cleaning cartridge. This is normal operator maintenance and should be performed by the user, not by Texas Instruments service personnel.

Cleaning the Front Panel

4.4.1 Keep the front panel clean and dust-free by wiping the exterior with a damp (not wet) lint-free cloth and mild detergent as needed.

CAUTION: Do not use strong detergents, cleaners, or solvents to clean the drive exterior.

Cleaning the Heads and Tape Path

4.4.2 CT2000 drives should seldom require head and tape path cleaning when operated in a normal office environment. However, dust and smoke particles from the atmosphere and metal oxide particles from the tape may occasionally contaminate the heads or the tape path. Certain symptoms may result, including an increase in the time required for a given backup or restore operation, reduced cartridge capacity when writing, and write faults reported by the system.

Except in unusual environmental circumstances, an adequate cleaning schedule should be once every 24 hours of tape motion. Tape operation that consists of a one-hour backup per business day requires one cleaning per month.

Cleaning with the approved cleaning cartridge kit is nondestructive. However, using any cleaning fluid or cartridge other than that provided in the approved kit may damage tape path components.

CAUTION: Using an unapproved cleaning fluid, cartridge, or other cleaning procedure voids the manufacturer's warranty on your CT2000 tape drive.

Additionally, if you use any other cartridge, the CT2000 may not recognize it as a cleaning cartridge. In this instance, the CT2000 will load and unload the cartridge in normal mode with no cleaning cycle performed.

The following cleaning procedure requires an approved dry cleaning cartridge kit, Texas Instruments part number 2554628-0001, available either from TI Express (1-800-TI-PARTS) or from EXABYTE Corporation. The kit contains the following:

- Dry cleaning cartridge
- Instructions

To clean the read/write heads and the tape path, perform the following steps:

1. With the power on and the drive ready, press the unload switch on the front panel. Any existing cartridge unloads and rewinds, and then the door opens. Remove the existing cartridge if present.

2. Insert the cleaning cartridge into the drive and close the door.

3. The drive automatically loads the cleaning cartridge without rewinding it, advances the tape through the tape path for approximately 15 seconds, and automatically unloads the cleaning cartridge without rewinding it.

4. Return the cleaning cartridge to the cleaning kit for future use. Mark the kit label to indicate one usage of the cleaning cartridge. The drive is now ready for use.

In rare cases, a single cleaning will not fully eliminate write faults. In such cases, one repeat cleaning should be performed.

Unless otherwise indicated by the manufacturer's instructions included with the cleaning kit, each cartridge has tape length for twelve cleaning usages. The user must keep track of how many usages are left in a cartridge because the drive cannot sense whether a complete cleaning cycle is possible with the remaining length of tape within the cartridge. Do not use the cartridge more than the allowed number of times.

Do not attempt to rewind the cartridge and reuse it, because contamination that has accumulated on the cleaning tape may be transferred back to the tape path.

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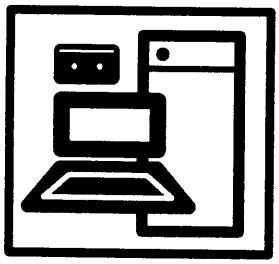


ERROR CODES

CONTENTS

1 ERROR CODES

Introduction

1.1 This module contains tabulated information about various system error codes. Some of these error codes are displayed on the system maintenance terminal (SMT) under certain conditions; others are never actually displayed but serve to convey error and status information to different parts of the system. The following is a list of tables contained in this module.

Acronyms and Abbreviations

1.2 Table 1-1 defines the acronyms and abbreviations that are used throughout this module.

Table 1-1 **Acronyms and Abbreviations**

Item	Definition
ARB	Arbitration
ASCII	American standard code for information interchange
BOP	Byte-oriented protocol
CIP	Command in progress
COSI	Communication option/small computer system interface
CPU	Central processing unit
CRC	Cyclic redundancy check
DCD	Data carrier detect
DES	Data encryption standard
DMA	Direct memory access
DMAC	Direct memory access controller
DTACK	Data acknowledge
DSR	Device service routine
ECC	Error-correcting code
EIA	Electronic Industries Association
EOM	End of media
EXECADR	Execute address
EXECBUFF	Execute buffer
EXECSCSI	Execute SCSI command

Table 1-1 **Acronyms and Abbreviations (Continued)**

Item	Definition
FM	File mark
FOB	Firmware
FPU	Floating point unit
IBCOA	Intermediate break point clear on acknowledge
ICC	Interrupt controller chip
ID	Identification
I/O	Input/output
IRQ	Interrupt request
ISCP	Interrupt system configuration pointer
LAN	Local area network
LCC	Leaded chip carrier
LCI	Last command ignored
LSB	Least significant bit
MFP	Multiple function peripheral
MPCC	Microprocessor common control
MSB	Most significant bit
NCR	National Cash Register
NDB	Name definition block
NRZI	Nonreturn to zero change on ones
NVRAM	Nonvolatile random-access memory
OS	Operating system
PAL	Programmable array logic
PIT	Programmable interval timer
PROM	Programmable read-only memory
PSCB	Primitive system communication block
RAM	Random-access memory
ROM	Read-only memory
RTC	Real-time clock
SBC	Single-board computer
SCB	System control block
SCSI	Small computer system interface
SELAINT	Interrupt select
SPA	Software protection adapter
SPC	SCSI peripheral controller
STBM	System test boot master
UART	Universal asynchronous receiver-transmitter
µP	Microprocessor
WD	Winchester disk

CPU Self-Test Error Codes

1.3 If an error occurs during the time that the CPU is executing the system self-test, the SMT displays one of the error codes listed in Tables 1-2 through 1-5. The special codes (K1 through K5), listed in Table 1-1, are kernel mortal fault errors. These errors prevent the CPU from completing the self-test.

Table 1-2 **Kernel Fatal Fault Errors**

Code	Definition
K1	Incorrect CRC
K2	Functional memory not available (local or expansion)
K3	Unexpected bus error
K4	Unexpected interrupt
K5	Illegal instruction trap

Table 1-3 **Kernel Critical Fault Errors**

Code	Definition
0001	Unexpected bus error (18 different types)
0002	Address error
0003	Unexpected interrupt
0004	Control register data miscompare
0005	Space 3 control register data miscompare
0006	Power-fail interrupt
0007	Over temperature interrupt
0008	Uninterruptible power supply engaged interrupt
0009	Uninterruptible power supply power-fail interrupt

Table 1-4 **Kernel Fault Errors**

Code	Definition
0010	Bus error received during expansion RAM access
0011	Expansion RAM data miscompare
0012	Expected bus error did not occur
0013	Incorrect bus error source
0014	Bus error/time-out registers do not clear
0015	Illegal bus error/time-out register bits
0016	Bus error flag bit not set: flagname

Table 1-5 **Non-Kernel Fault Errors**

Code	Definition
0020	Address uniqueness data miscompare
0021	Code execution data miscompare
0022	Previous data or bus error during expansion RAM access
0023	Pattern data miscompare
0024	Refresh data miscompare
0025	Byte access data miscompare
0026	Word access data miscompare
0027	Long word access data miscompare
0028	Memory parity error(s) latched
0029	Cache and memory parity errors latched
0030	No bus error received upon access past available memory
0031	Memory configuration error
0032	Cache parity error(s) latched
0033	Illegal cache parity error bits
0034	No memory byte-in-error bits latched
0035	Incorrect error latch fixed bits
0036	1-megabyte SIMM found in 4-megabyte system
0040	ICC interrupt request D5 not reset
0041	ICC register data miscompare
0042	ICC event RAM data miscompare
0043	Unexpected event interrupt
0044	Event interrupt failed
0045	Spurious interrupt failed
0046	Overrun interrupt failed
0047	Failure to set status bit for spurious interrupt
0048	Failure to set status bit for overrun interrupt
0049	PIT interrupt failed
0050	Failure to set status bit for PIT interrupt
0051	Event interrupt failed (IBCOA mode)
0052	Incorrect interrupt level
0060	Parity map corrupted or not initialized
0061	Parity map full
0062	No byte-in-error bits latched to log in parity map
0063	Soft memory error(s) logged in parity map
0064	Long word test of parity error location failed
0065	Hard memory error(s) logged in parity map
0066	Received parity error during logging of previous error
0067	Hard memory errors logged in parity map

Table 1-5 **Non-Kernel Fault Errors (Continued)**

Code	Definition
0080	Incorrect bank-in-error bits latched
0081	Expected memory parity error did not occur
0082	Incorrect byte-in-error bits latched
0083	Parity test data miscompare
0084	Unexpected cache error with forced memory parity error
0085	Memory parity invert failed
0086	Swap failed
0120	Cache tag RAM data miscompare
0121	Cache flush failed
0122	Cache disturbed on flush of other
0123	Cache control failed: Test case No. *nn* (longword)
0124	Cache control failed: Test case No. *nn* (word)
0125	Cache control failed: Test case No. *nn* (byte)
0126	Cache tag valid bit not cleared: Test case No. *nn*
0127	Cache data miscompare
0128	Bus error in cache parity test failed
0129	Cache parity read test failed (System 1505 only)
0130	Cache parity write test failed
0131	XCPFLG bit not set in bus error register
0132	Cache tag valid bit not cleared on read with cache error latched
0133	Forced cache parity error not latched
0134	No size bus error on 3-byte write
0135	Cache valid after memory parity error
0136	Special cache RAM test failed
0140	FPU not installed (System 1505 only)
0141	FPU longword data miscompare (System 1505 only)
0142	FPU word data miscompare (System 1505 only)
0143	FPU byte data miscompare (System 1505 only)
0144	FPU save failed (System 1505 only)
0150	NVRAM data miscompare
0151	NVRAM battery low, initial write failed
0153	WARNING: NVRAM not initialized
0160	Accounting timer failed
0161	Accounting timer reset failed
0162	Accounting timer rollover interrupt failed
0163	Accounting timer bits not toggling

Table 1-5 **Non-Kernel Fault Errors (Continued)**

Code	Definition
0165	RTC register data miscompare
0166	PIT time-out failed
0167	Accounting timer/PIT elapsed time failed
0168	Test mode: Accounting timer reset failed
0169	Test mode: Accounting timer bits not toggling
0170	Incorrect SPA ID, space 3 control register
0171	Incorrect SPA CRC
0180	Incorrect configuration ROM CRC
0190	MFP ones register failed
0191	MFP zeros register failed
0192	MFP SPA ID register failed
0193	MFP accounting timer register failed
0194	MFP SBC bus flag register failed
0195	MFP SBC configuration register failed
0196	MFP scratch pad register failed
0198	MFP PIT interval register failed
0199	MFP PIT counter register failed
0200	MFP PIT prescale register failed
0201	MFP PIT time-out failed
0202	MFP accounting timer/PIT elapsed time failed
0203	MFP accounting timer failed
0204	MFP accounting timer reset failed
0205	µP crystal failed
0250	COMM and SCSI not found: SBC failure
0251	Self-test busy bit failed

Communication Error Codes

1.4 User terminals attached either directly to a communication option board or to a terminal concentrator can display the messages listed in Table 1-6.

Table 1-6 **Communication Errors**

Code	Definition
Kernel Errors:	
03	Invalid command
04	Standard command (05) failed
05	Address error
06	Illegal instruction
07	Zero divide
08	Check error
09	Trap on overflow instruction
0A	Privilege violation
0B	Trace error
0C	Format error
0D	Spurious exception error
0E	Unsupported exception error
SBC Bus and Communication Bus Errors:	
10	Unable to generate an M68K bus time-out error
11	Unable to generate a protocol bus error
12	Unable to generate an SBC bus disabled error
13	SBC interface test failed (parameters returned)
14	SBC interface test DMA failed
15	Unable to generate an SBC bus time-out error
16	Unexpected no-enable error
17	Unexpected bus error
18	Unexpected COSI slave interrupt
19	Invalid SBC interface test parameter
1A	SBC bus enabled at the wrong time
1B	Unexpected program error
1E	Unexpected time-out error
1F	No illegal operation error when expected
20	Unable to generate a program error
21	SBC bus test failed
22	SBC bus not enabled
23	Invalid PSCB command detected
24	Invalid command after emit bit set
25	Invalid subtest number in PSCB

Table 1-6 **Communication Errors (Continued)**

Code	Definition
SBC Bus and Communication Bus Errors (Continued):	
26	Invalid option card installed
27	Cannot convert character to ASCII
28	Invalid port ID
I/O Errors:	
29	Unable to find terminal
2A	Transmitter does not go ready
2B	DSR lost
2C	New option board ROM CRC error
2D	FOB self-test time-out
2F	Timed out waiting for STBM
ROM and RAM Errors:	
30	ROMs MSB and LSB do not match
31	ROM code area failed CRC test
32	ROM configuration area failed CRC test
33	RAM test 1 failed
34	RAM bit test failed
35	RAM test 3 failed
36	Static RAM failure during power-up
3F	SBC compare error
COSI Errors:	
40	COSI interrupt test register error
41	Unexpected COSI timer interrupt
42	PIT register failed the data test
47	No DMA interrupt when expected
48	COSI read register test
49	COSI DMA error
4A	Event error
4B	Unexpected DMA interrupt
ICC Errors:	
50	ICC timer error
51	First ICC timer interrupt did not occur
52	Second ICC timer interrupt did not occur
53	ICC counter too slow

Table 1-6

Communication Errors (Continued)

Code	Definition
ICC Errors (Continued):	
54	ICC counter too fast
55	Unexpected ICC timer exception
56	ICC register failed write/read/compare test
57	ICC spurious interrupt error
58	ICC RAM interrupt generation error
59	All ICC RAM interrupts did not occur
5A	ICC interrupt but no source
5B	ICC RAM bit not clear
5C	ICC RAM bit not set
5D	Expected exception did not occur
5E	More than one RAM bit set
5F	Unexpected ICC RAM bit exception
ARB Test Errors:	
60	Asynchronous receive ARB error
61	LCC ARB verify data error
62	Port 0 has errors
63	Port 1 has errors
64	Port 0 dead
65	Port 1 dead
66	Communication processor compare data error
Multidrop Option Board Errors:	
71	Invalid self-test number
72	Invalid port base
73	Invalid adapter installed
74	MC68230 no DTACK — local time-out occurred
75	MC68440 no DTACK — local time-out occurred
76	MC68606 no DTACK — local time-out occurred
77	Miscellaneous output register no DTACK — local time-out occurred
78	MC68230 write/read/compare error
79	MC68440 write/read/compare error
7A	Expected timer interrupt did not occur
7B	Timer accuracy test failed
7C	Timer issued an unexpected interrupt
7D	Test did not complete on time
7E	Interrupt level does not match the SELAINT state
7F	MC68440 DMA transfer compare error
80	Spurious interrupt received for MC68440

Table 1-6 **Communication Errors (Continued)**

Code	Definition
Multidrop Option Board Errors (Continued):	
81	MC68440 issued a severe interrupt
82	MC68440 issued an unexpected interrupt
83	Command issued to MC68606 did not complete
84	MC68606 transfer compare error
85	Expected MC68606 transmit interrupt did not occur
86	Expected MC68606 receive interrupt did not occur
87	MC68606 protocol mode initialization error
88	Spurious interrupt received for MC68606
89	MC68606 interrupt queue overflowed
8A	MC68606 issued an unexpected interrupt
8B	MC68606 issued a severe interrupt
8C	Unexpected DCD interrupt
8D	Expected DCD interrupt did not occur
8E	MC68230 issued a spurious interrupt
Local Area Network Errors:	
A0	Installed adapter does not support internal loopback
A1	LAN ID checksum error
A2	LAN ID PROM all zeros
A3	LAN ID PROM all ones
A4	LAN ID contains a multicast ID
A5	LCC time-out — no interrupt
A6	No interrupt from LCC after reset and channel attention
A7	LCC not in idle state after interrupt clear
A8	LCC failed to clear an interrupt
A9	Incorrect LCC completion status
AA	ISCP busy byte not cleared
AB	SBC status error in ISCP routine
AC	Running off LAN board at the wrong time
AD	Compare blocks failed
AE	Maximum retry failure
AF	Link error
B0	Status did not compare during frame check
B1	Configuration command returned incorrect status
B2	Receive frame DES status error
B3	Installed adapter not valid for this test
B4	Unexpected LAN interrupt
B5	Error occurred during CRC test
B6	LAN board not installed

Table 1-6

Communication Errors (Continued)

Code	Definition
Local Area Network Errors (Continued):	
B7	Receive status error
B8	Time-out during network port access
B9	LAN still active after interrupt acknowledge
BA	LAN SCB zero at interrupt time
BB	Invalid frame length
Eight-Channel Asynchronous Communication Board Errors:	
C6	No DTACK — bus time-out occurred
C7	Installed option board not valid for this test
C8	Test 1: write and read MC68681 control registers test
C9	Test 2: transmit, receive, and timer interrupts test
CA	Test 3: baud rates test
CB	Test 4: transmit and receive character blocks test
CC	Test 5: installed adapter board test
CD	Test 6: UART read/write test
CE	No DTACK — bus time-out occurred
CF	Asynchronous control lines failed
PIT Errors:	
D0	Read and write control registers error
D1	Read and write control registers error in MPCC word mode
D2	PIT counter too slow or too fast
D3	Set PIT counter interrupt
Synchronous Adapter Board and Ports Test:	
D4	Installed adapter board test
D5	Incorrect transmit interrupt status
D6	EIA-232 port check with external loopback connector
D7	Parallel port check with external loopback connector
D8	Synchronous port fails external loopback test
D9	V.35 port check with external loopback connector
DA	-1: miscellaneous output port — no DTACK
DB	0: miscellaneous input port — no DTACK
DC	1: MC68230 counter/timer chip — no DTACK
DD	2: DMAC chip — no DTACK
DE	3: MPCC chip — no DTACK
DF	Bad receive interrupt status

Table 1-6 **Communication Errors (Continued)**

Code	Definition
Asynchronous Test:	
E0	Time-out expired
E1	Transmit/receive data compare error
E2	Unexpected or missing MPCC interrupts
E3	MPCC chip detected an error
BOP Test:	
E4	Time-out expired
E5	Transmit/receive data compare error
E6	Unexpected or missing MPCC interrupts
E7	MPCC chip detected an error
NRZI BOP Test:	
E8	Time-out expired
E9	Transmit/receive data compare error
EA	Unexpected or missing MPCC interrupts
EB	MPCC chip detected an error
Asynchronous DMAC Test:	
EC	Time-out expired
ED	Transmit/receive data compare error
EE	Unexpected or missing DMA interrupts
EF	DMA chip detected an error
BOP Array Linked DMAC Test:	
F0	Time-out expired
F1	Transmit/receive data compare error
F2	Unexpected or missing DMA interrupts
F3	DMA chip detected an error
PAL State Machine Test:	
F4	PAL state machine test time-out
F5	Transmit/receive data compare error
F6	Unexpected or missing DMA interrupts
F7	DMA chip detected an error
High-Speed BOP Test:	
F8	Time-out expired
F9	Transmit/receive data compare error
FA	Unexpected or missing DMA interrupts
FB	DMA chip detected an error

Table 1-6 **Communication Errors (Continued)**

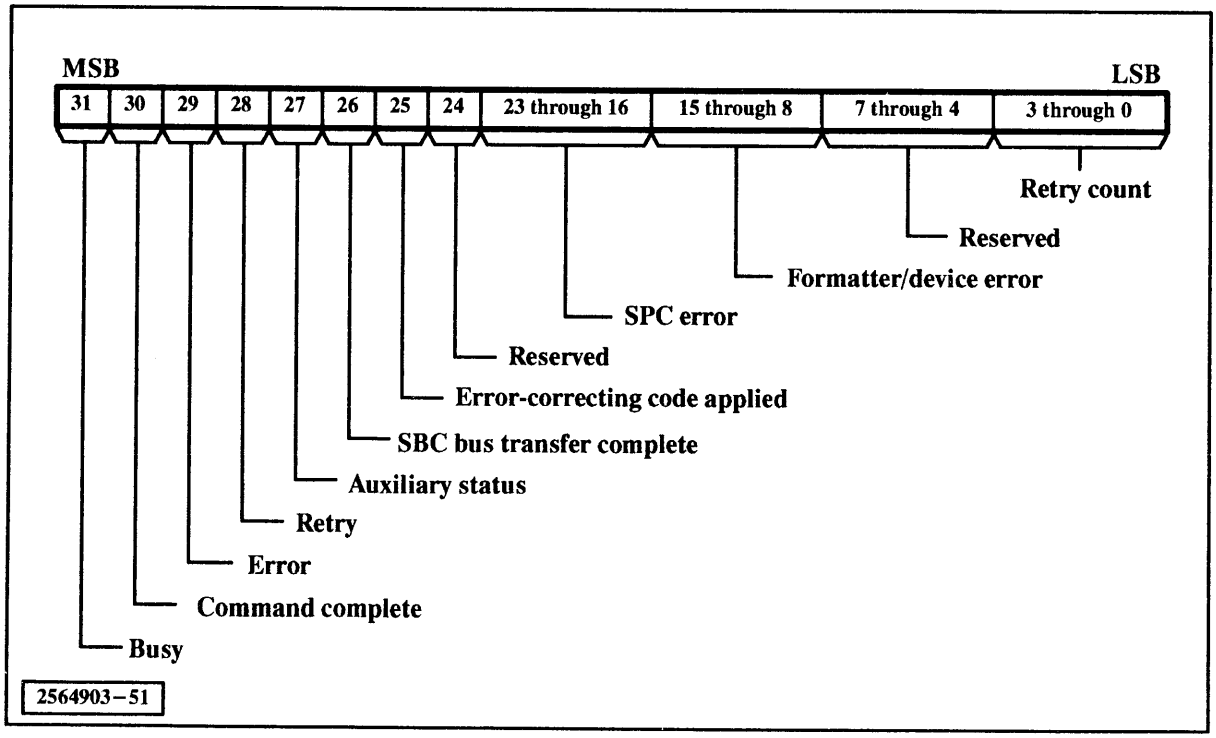
Code	Definition
Bisynchronous DMA Test:	
FC	Time-out expired
FD	Transmit/receive data compare error
FE	Unexpected or missing DMA interrupts
FF	DMA chip detected an error

Mass Storage Subsystem Errors

1.5 The SCSI mass storage subsystem uses a 32-bit status word (shown in Figure 1-1) to return command block status and command completion status to the host computer.

During SCSI command block initialization, the operating system sets the status word to zero to prevent later misinterpretation of its fields. If the operating system fails to set the word to zero, the SPC processes the command block as an illegal command. The following paragraphs provide information about the SCSI command block status word.

Figure 1-1 SCSI Command Block Status Word



Completion Status Field

1.5.1 The completion status field is an 8-bit field (bits 31 through 24) that shows the status of a currently executing or a completed command. This field contains the following bits:

- Busy (bit 31) — The SPC activates this bit to acknowledge receipt of a command. After completion of command processing, the SPC deactivates the busy bit.
- Complete (bit 30) — When active, this bit indicates completion of command execution.
- Error (bit 29) — When active, this bit indicates that an unrecoverable error has occurred.
- Retry (bit 28) — When active, this bit indicates that retries have been performed by the SPC in an effort to execute the command. If the error bit is also set, this indicates that the retries were unsuccessful. Status word bits 3 through 0 (paragraph 2.5.5) contain the number of retries to be performed by the SPC during a command execution. This bit is *not* set for retries performed by SCSI device formatters; retry information for a SCSI device is obtained only by issuing a Formatter Sense command to the device.

  The SPC retries commands for the following reasons:

  - When an SBC error occurs during a DMA operation.
  - When receiving busy SCSI status from a formatter.
  - When an invalid SCSI mode occurs.
  - When SBC bus errors occur during accesses to SBC memory for command parameters.
  - When a SCSI parity error occurs in a command to a direct-access device.
- Auxiliary status (bit 27) — When active, this bit indicates that a special event has occurred, and additional status, such as power failure detection, overtemperature detection, or command abortion without status update, is available. This bit is set only if a special event has occurred and the special event address has not been initialized, and it is reported only once. The host should issue a Request SPC Status command for special event status or for special event status with a clear special event in response to this bit.
- SBC bus transfer complete (bit 26) — This bit indicates completion of SBC bus write command operations for a mass storage device.
- ECC (bit 25) — When active, this bit indicates that error-correcting code was applied to some part of the data. SCSI device error correction application is not reported.
- Reserved (bit 24) — This bit is reserved for possible future implementation and should be set to 0.

Error Handling and Reporting

1.5.2 Any of the following types of errors can occur and be reported during normal SCSI command execution.

- Recoverable errors — These errors are indicated by a retry count in the status register. Excessive retry attempts can indicate a hardware or medium problem even though the data is probably correct. Recoverable errors do not set the error bit but can place an error code in either the SPC error field or the device error field. Errors recovered by SCSI device formatters are not included in the SPC status.
- Unrecoverable SPC errors — These errors are indicated by the error bit being active. Hexadecimal codes in the SPC error field and/or the device error field indicate the error encountered. Tables 1-7 and 1-8 list and define these error codes.
- Status information — For some commands, status information may be provided in the SPC error code and/or the device error code fields without the error bit active. These codes are provided for status information.

SPC Error Code

1.5.3 The SPC error code is an 8-bit field (bits 23 through 16) that contains an 8-bit SPC error code. Table 1-7 lists and defines these codes.

Table 1-7 **SPC Error Code Definitions**

Code	Definition
21–3F	Self-test failure (the error code bits represent the failing test number)
41–48	Reserved
49	Data count transferred is not equal to the count requested
4A–5F	Reserved
61	SBC bus time-out error
62	SBC bus error
63	SCSI bus parity error
64	SCSI formatter busy
65	SCSI rate error
66	Illegal bus error trap occurred
67–69	Reserved
6A	EXECBUFF sequence error
6B	EXECSCSI sequence error
6C	DMA EXECADR sequence error
6D	Illegal SBC bus abort vector
6E	Illegal SBC bus processor stack
6F	Illegal SBC bus status
70–7A	Reserved
7B	Target device transferred incorrect amount of data
7C	Variable read non-modulo 4 disconnect

Table 1-7 SPC Error Code Definitions (Continued)

Code	Definition
7D–7F	Reserved
80	Command aborted by abort device queue command
81	Command aborted
82	Invalid command
83	Invalid parameter
84	Incomplete data transfer
85	Reserved
86	Command timed out
87	DMA protocol error
87–9F	Reserved
A1	Illegal interrupt
A2	SCSI function-complete interrupt without cause
A3	Time-out upon NCR data register full condition
A4	Invalid SCSI controller command interrupt
A5	Microprocessor software error trap
A6	Microprocessor hardware error trap
A7	Queue overflow occurred
A8	Microprocessor address error trap
A9	Microprocessor illegal instruction trap
AA	SBC bus DMA locked up (may need hardware reset)
AB	Extended SCSI message time-out
AC	Target returned invalid synchronization message values
AD	WD33C93 posted LCI
AE	Time-out waiting for WD CIP reset
AF–BF	Reserved
C1–DF	Reserved
E1–FF	Reserved

Formatter/Device Error Code

1.5.4 The formatter/device error code is an 8-bit field (bits 15 through 8) that defines the error code status for a mass storage device or formatter in the same manner as does the SPC error code. Table 1-8 lists and defines the device and formatter error codes.

NOTE: Some of the codes of Table 1-8 are status codes that do not indicate an error condition.

Table 1-8 **Formatter and Mass Storage Device Error Code Definitions**

Code	Definition
21–3F	Self-test failure (the error code represents the failing test number)
41	No selected unit
42	Media not loaded
43	Write protection enabled
44	Power-on/reset
45	Unit attention
46	Temperature fault
47	Invalid media type
48	SCSI sense data is available (status code)
49	Incorrect tape length (status code)
4A	Tape EOM
4B	Incorrect tape length and EOM set (status code)
4C	Tape FM encountered (status code)
4D	Incorrect tape length and FM set (status code)
4E	Tape EOM and FM set (status code)
4F	Incorrect tape length, EOM, and FM set (status code)
50	SCSI bus hung up, hardware reset required
51	SCSI device does not reconnect
52	SCSI device does not complete an operation
53	Nonextended error code is 0 (status code)
54	Device has multiple block descriptors
55	Device has undefined block length
56	Media change
57–5F	Reserved
61	SCSI bus parity error
62	Mass storage device not ready
63	Rate error
64	Invalid SCSI interrupt selected
65	Device offline
66	Invalid SCSI testability interrupt
67	Invalid SCSI bus disconnect
68	Invalid mode for SCSI status
69	Invalid mode for SCSI command byte request
6A	Sequence error: SCSI completion address
6B	Sequence error: SCSI requested data
6C	Sequence error: SCSI DMA start/stop address
6D–6F	Reserved
70	Unknown message received from formatter
71	Invalid mode on input SCSI message

Table 1-8 **Formatter and Mass Storage Device Error Code Definitions (Continued)**

Code	Definition
73	Excess SCSI command bytes requested
74	Expected SCSI Restore message not received
75	Reconnected to unit not awaiting reconnect
76	Expected SCSI command complete message not received
77	Illegal SCSI message for reconnected state
78	Reselected without valid SCSI identification
79	Invalid mode on SCSI message out
7A	Invalid mode on SCSI data transfer
7B	Illegal reject message received
7C	Command complete message received prior to status phase
7D	Nonimmediate disconnect after command complete message
7E	Invalid input or output SCSI phase
7F	Reserved
80	Command aborted by SCSI reset
81	Command aborted
82	Invalid command
83	Invalid parameter
84	Illegal block address
85	Volume overflow
86–89	Reserved
8A	Formatter failed to connect to SCSI bus
8B–8D	Reserved
8E	Unknown error code returned from formatter
8F	Formatter busy
90–9F	Reserved
A1	Missing index/sector signal
A2	Seek incomplete
A3	Write fault
A4	Track 0 not found
A5	Multiple units selected
A6	Seek error
A7	Formatter hardware error
A8–BF	Reserved
C1	ID error
C2	Uncorrectable data error
C3	ID address mark not found
C4	Data address mark or synchronization character not found
C5	Block not found (sector address)

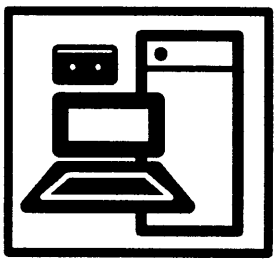
Table 1-8 **Formatter and Mass Storage Device Error Code Definitions (Continued)**

Code	Definition
C6	Bad block not found
C7	Defective format on drive
C8	Correctable data check
C9	Interleave error
CA	Media error
CB	Reserved
CC	Primary defect list not found
CD	Secondary defect list not found
CE	Spare block not found
CF–DF	Reserved
E1–FF	Reserved

Retry Status Field

1.5.5 The retry status field is a 4-bit field (bits 3 through 0) that indicates retry attempts to be made during command execution. This field contains a binary coded value indicating the number of SPC retries to be performed. The binary number 1111 indicates 15 retries, and 0000 indicates none. The operating system sets the maximum retry value; the default value is 3 (0011).

PRODUCT SAFETY INFORMATION



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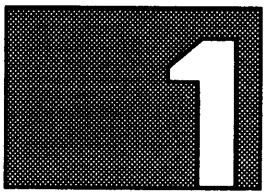

Before using your computer system, please read and comply with the following instructions:

1. Power Requirements:

   a. Check the label on the back of each system component (system enclosure, mass storage enclosure, terminal concentrator, etc.) and ensure that the available power source meets the requirements of all components.

   b. To maintain system component safety, use only power cord sets approved by the National Test House for the power source requirements of the product.

   c. All components of this product are Safety Class I devices.

   d. No component of this system may be connected to an "I.T." power system.

2. Allow at least three inches (7.5 centimeters) of non-obstructed clearance for any ventilation opening on any side of each system component.

3. Ensure that all power on/off (1/0) switches are easily accessible.

4. Service of all system components (and the logic boards) must be performed by qualified service personnel. Unauthorized alteration of these components voids safety agency approvals.

5. When connecting or disconnecting cables to a system component, ensure that its power switch is in the off (0) position. Disconnect the power cord set last.

6. For continuous safe operation, use fuses of the same types and ratings as those specified by system component labels.

7. Before moving any system component, disconnect its power cord from the power outlet. When moving a system component, exercise caution and use proper lifting procedures.

8. All components of this system are designed for data processing use. No component of this system, other than the video display terminals, is designed for use in a video display workstation.

9. It is expected that reasonable care will be exercised in the installation and operation of this computer system. Neither the manufacturer nor the distributor assumes any liability for improper installation, application, or use.

10. In some system components, fans may continue to rotate briefly after opening the access door or panel. Keep fingers away from fans until fan motion ceases.

CAUTION: Acid or alkaline cleaners can damage video display screens. Do not use these substances for cleaning the video display screens.

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11. When it is necessary to clean a video display screen, use a neutral cleaner (detergent) and a lint-free cloth. Several commercially available detergents are acceptable for cleaning video display screens.

12. Consult the appropriate equipment manuals for additional safety information. Observe all equipment safety labels and all warning and caution notes contained in equipment manuals.

SICHERHEITSINFORMATIONEN

Vor Inbetriebnahme Ihres Computersystems sollten Sie die nachstehenden Informationen lesen und den entsprechenden Anweisungen folgen:

1. Stromversorgungsanforderungen:

   a. Überprüfen Sie die Aufschriften auf der Rückseite jedes einzelnen Systembauteils (Systemgehäuse, Haupspeichergehäuse, Sammelanschluß usw.) und stellen Sie sicher, daß die vorhandenen Stromversorgungsquellen den Anforderungen der Bauteile entsprechen.

   b. Um die Sicherheit der Systembauteile zu gewährleisten, sollten nur zugelassene DIN-Stecker für die Stromversorgungsanforderungen des Produkts benutzt werden.

   c. Alle Bauteile dieses Produkts gehören zur Sicherheitsklasse 1.

   d. Geräte dieses Systems dürfen nicht an ein Stromversorgungssystem mit Isolationstransformatoren angeschlossen werden.

2. Die Systembauteile sollten zwecks ausreichender Belüftung auf allen Seiten einen Freiraum von mindestens 7,5 cm aufweisen.

3. Stellen Sie sicher, daß alle Ein-/Aus-Schalter (1/0) leicht zugänglich sind.

4. Die Wartung aller Systembauteile (und der Logikkarten) darf nur von qualifiziertem Wartungspersonal durchgeführt werden. Durch unerlaubte Änderungen der Bauteile wird deren Sicherheitdzulassung annuliert.

5. Wenn ein Kabel an ein Systembauteil angeschlossen oder davon abgetrennt wird, muß der Netzschalter auf AUS gestellt sein (0). Der Netzkabelanschluß muß zuletzt unterbrochen werden.

6. Um einen ununterbrochenen sicheren Betrieb zu gewährleisten, sollten nur Sicherungen desselben Typs und derselben Klasse verwendet werden, wie auf den Aufklebern der Systembauteile angegeben ist.

7. Vor dem Bewegen eines Systembauteils sollte das Netzkabel aus der Netzsteckdose entfernt werden. Beim Bewegen eines Systembauteils sollten Sie vorsichtig sein und das Bauteil richtig anheben und bewegen.

8. Alle Bauteile dieses Systems sind für den Gebrauch in der Datenverarbeitung vorgesehen. Nur die Bildschirmgeräte sind für den Gebrauch an einer Bildschirmarbeitsstation zu verwenden.

9. Es wird erwartet, daß bei der Installation und dem Betrieb dieses Computersystems die angemessene Sorgfalt ausgeübt wird. Hersteller and Zwischenhändler übernehmen keinerlei Haftung für falsche Installation, Bedienung oder Anwendung.

10. Bei einigen Systembauteilen kann der Ventilator nach dem Öffnen des Gehäuses oder der Konsole noch kurzfristig nachlaufen. Um Verletzungen zu vermeiden, versichein Sie sich bitte deshalb, das der Ventilator still steht.

WARNUNG: Verwenden Sie keine säurehaltigen oder alkalischen Reinigungsmittel zum Reinigen der Bildschirme, da diese dadurch beschädigt werden könnten .

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11. Zum reinigen eines Bildschirms sollten nur ein neutrales Reinigungsmittel (Geschirrspülmittel) und ein fusselfreies Baumwolltuch benutzt werden. Mehrere der handelsüblichen Geschirrspülmittel können zum Reinigen der Bildschirme benutzt werden.

12. Zusätzliche Sicherheitsinformationen entnehmen Sie bitte den entsprechenden Gerätehandbüchern. Beachten Sie alle Sicherheitsaufschriften an den Geräten und alle Warnungshinweise in den Gerätehandbüchern .

System 1505/1507 Computer Installation and Operation
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_____

Other options _____

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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

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