

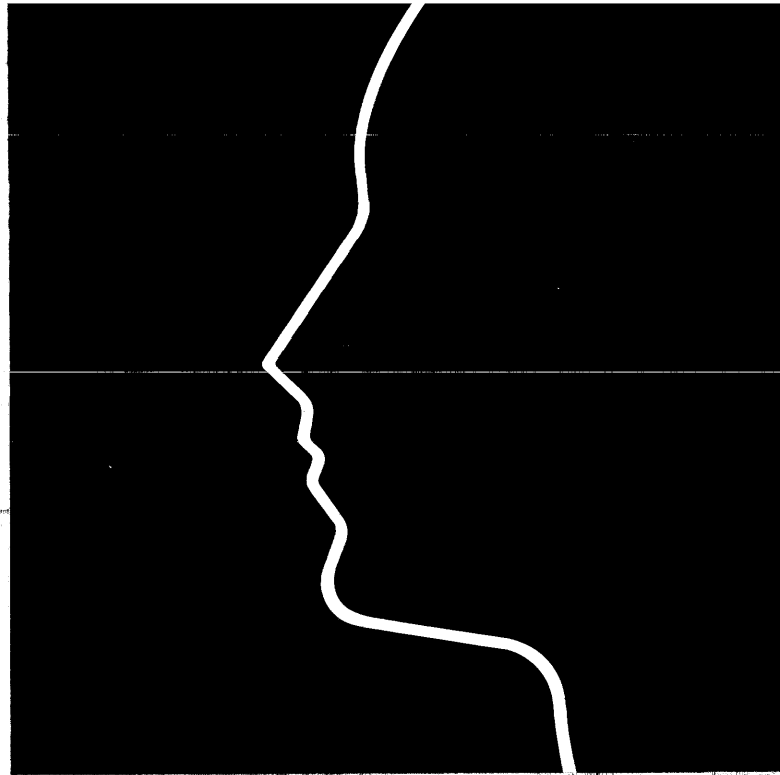
TEXAS INSTRUMENTS

EXPLORER™

COMMUNICATIONS CARRIER

BOARD AND OPTIONS

GENERAL DESCRIPTION



COMMUNICATIONS CARRIER BOARD AND OPTIONS GENERAL DESCRIPTION

WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, can cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computer device pursuant to Subpart J of Part 15 of FCC Rules, which are designated 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 the user's own expense will be required to take whatever measures necessary to correct the interference.

WARNING: High voltages are present inside the chassis of this equipment. Only qualified service personnel who are familiar with the dangers of high voltages are permitted to open the chassis of this equipment to the service access position.

MANUAL REVISION HISTORY

Communications Carrier Board and Options General Description
(2537242-0001)

Original Issue June 1987

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The system-defined windows shown in this manual are examples of the software as this manual goes into production. Later changes in the software may cause the windows on your system to be different from those in the manual.

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THE EXPLORER™ SYSTEM HARDWARE MANUALS

System Level Publications	Explorer 7-Slot System Installation 2243140-0001 Explorer System Field Maintenance 2243141-0001 Explorer System Field Maintenance Documentation Kit 2243222-0001 Explorer System Field Maintenance Supplement 2537183-0001 Explorer System Field Maintenance Supplement Documentation Kit 2549278-0001 Explorer NuBus™ System Architecture General Description 2537171-0001
System Enclosure Equipment Publications	Explorer 7-Slot System Enclosure General Description 2243143-0001 Explorer Memory General Description (8-megabytes) 2533592-0001 Explorer 32-Megabyte Memory General Description 2537185-0001 Explorer Processor General Description 2243144-0001 68020-Based Processor General Description 2537240-0001 Explorer II Processor and Auxiliary Processor Options General Description 2537187-0001 Explorer System Interface General Description 2243145-0001 Explorer NuBus Peripheral Interface General Description (NUPI board) 2243146-0001
Display Terminal Publications	Explorer Display Unit General Description 2243151-0001 CRT Data Display Service Manual, Panasonic code number FTD85055057C 2537139-0001 Model 924 Video Display Terminal User's Guide 2544365-0001
143-Megabyte Disk/Tape Enclosure Publications	Explorer Mass Storage Enclosure General Description 2243148-0001 Explorer Winchester Disk Formatter (ADAPTEC) Supplement to Explorer Mass Storage Enclosure General Description 2243149-0001 Explorer Winchester Disk Drive (Maxtor) Supplement to Explorer Mass Storage Enclosure General Description 2243150-0001 Explorer Cartridge Tape Drive (Cipher) Supplement to Explorer Mass Storage Enclosure General Description 2243166-0001 Explorer Cable Interconnect Board (2236120-0001) Supplement to Explorer Mass Storage Enclosure General Description 2243177-0001
143-Megabyte Disk Drive Vendor Publications	XT-1000 Service Manual, 5 1/4-inch Fixed Disk Drive, Maxtor Corporation, part number 20005 (5 1/4-inch Winchester disk drive, 112 megabytes) 2249999-0001 ACB-5500 Winchester Disk Controller User's Manual, Adaptec, Inc., (formatter for the 5 1/4-inch Winchester disk drive) 2249933-0001

1/4-Inch Tape Drive Vendor Publications	Series 540 Cartridge Tape Drive Product Description, Cipher Data Products, Inc., Bulletin Number 01-311-0284-1K (1/4-inch tape drive) 2249997-0001 MT01 Tape Controller Technical Manual, Emulex Corporation, part number MT0151001 (formatter for the 1/4-inch tape drive) 2243182-0001
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182-Megabyte Disk/Tape Enclosure MSU II Publications	Mass Storage Unit (MSU II) General Description 2537197-0001
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182-Megabyte Disk Drive Vendor Publications	Control Data® WREN™ III Disk Drive OEM Manual, part number 77738216, Magnetic Peripherals, Inc., a Control Data Company 2546867-0001
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515-Megabyte Mass Storage Subsystem Publications	SMD/515-Megabyte Mass Storage Subsystem General Description (includes SMD/SCSI controller and 515-megabyte disk drive enclosure) 2537244-0001
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515-Megabyte Disk Drive Vendor Publications	515-Megabyte Disk Drive Documentation Master Kit (Volumes 1, 2, and 3), Control Data Corporation 2246129-0002 Volume 1, General Description, Operation, Installation and Checkout, and Part Data 2246125-0004 Volume 2, Theory, General Maintenance, Trouble Analysis, Electrical Checks, and Repair Information 2246125-0005 Volume 3, Diagrams 2246125-0006
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1/2-Inch Tape Drive Publications	MT3201 1/2-Inch Tape Drive General Description 2537246-0001
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1/2-Inch Tape Drive Vendor Publications	Cipher CacheTape® Documentation Manual Kit (Volumes 1 and 2 With SCSI Addendum and, Logic Diagram), Cipher Data products 2246130-0001 1/2-Inch Tape Drive Operation and Maintenance (Volume 1), Cipher Data Products 2246126-0001 1/2-Inch Tape Drive Theory of Operation (Volume 2), Cipher Data Products 2246126-0002 SCSI Addendum With Logic Diagram, Cipher Data Products 2246126-0003
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Printer Publications	Model 810 Printer Installation and Operation Manual	2311356-9701
	Omni 800™ Electronic Data Terminals Maintenance Manual for Model 810 Printers	0994386-9701
	Model 850 RO Printer User's Manual	2219890-0001
	Model 850 RO Printer Maintenance Manual	2219896-0001
	Model 850 XL Printer User's Manual	2243250-0001
	Model 850 XL Printer Quick Reference Guide	2243249-0001
	Model 855 Printer Operator's Manual	2225911-0001
	Model 855 Printer Technical Reference Manual	2232822-0001
	Model 855 Printer Maintenance Manual	2225914-0001
	Model 860 XL Printer User's Manual	2239401-0001
	Model 860 XL Printer Maintenance Manual	2239427-0001
	Model 860 XI Printer Quick Reference Guide	2239402-0001
	Model 860/859 Printer Technical Reference Manual	2239407-0001
	Model 865 Printer Operator's Manual	2239405-0001
	Model 865 Printer Maintenance Manual	2239428-0001
	Model 880 Printer User's Manual	2222627-0001
	Model 880 Printer Maintenance Manual	2222628-0001
	OmniLaser™ 2015 Page Printer Operator's Manual	2539178-0001
	OmniLaser 2015 Page Printer Technical Reference	2539179-0001
	OmniLaser 2015 Page Printer Maintenance Manual	2539180-0001
	OmniLaser 2108 Page Printer Operator's Manual	2539348-0001
	OmniLaser 2108 Page Printer Technical Reference	2539349-0001
	OmniLaser 2108 Page Printer Maintenance Manual	2539350-0001
	OmniLaser 2115 Page Printer Operator's Manual	2539344-0001
	OmniLaser 2115 Page Printer Technical Reference	2539345-0001
	OmniLaser 2115 Page Printer Maintenance Manual	2539356-0001

Communications Publications	990 Family Communications Systems Field Reference	2276579-9701
	EI990 Ethernet® Interface Installation and Operation	2234392-9701
	Explorer NuBus Ethernet Controller General Description	2243161-0001
	Communications Carrier Board and Options General Description	2537242-0001

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THE EXPLORER™ SYSTEM SOFTWARE MANUALS

Mastering the Explorer Environment	Explorer Technical Summary	2243189-0001
	Introduction to the Explorer System	2243190-0001
	Explorer Zmacs Editor Tutorial	2243191-0001
	Explorer Glossary	2243134-0001
	Explorer Networking Reference	2243206-0001
	Explorer Diagnostics	2533554-0001
	Explorer Master Index to Software Manuals	2243198-0001
Explorer System Software Installation Guide	2243205-0001	

Programming With the Explorer	Explorer Programming Concepts	2549830-0001
	Explorer Lisp Reference	2243201-0001
	Explorer Input/Output Reference	2549281-0001
	Explorer Zmacs Editor Reference	2243192-0001
	Explorer Tools and Utilities	2549831-0001
	Explorer Window System Reference	2243200-0001

Explorer Options	Explorer Natural Language Menu System User's Guide	2243202-0001
	Explorer Relational Table Management System User's Guide	2243203-0001
	Explorer Grasper User's Guide	2243135-0001
	Explorer Prolog User's Guide	2537248-0001
	Programming in Prolog, by Clocksin and Mellish	2537157-0001
	Explorer Color Graphics User's Guide	2537157-0001
	Explorer TCP/IP User's Guide	2537150-0001
	Explorer LX™ User's Guide	2537225-0001
	Explorer LX System Installation	2537227-0001
	Explorer NFS™ User's Guide	2546890-0001
	Explorer DECnet™ User's Guide	2537223-0001
Personal Consultant™ Plus Explorer	2537259-0001	

System Software Internals	Explorer System Software Design Notes	2243208-0001
	Release Information, Explorer System Software	2549844-0001

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ABOUT THIS MANUAL

Purpose This manual provides a general description of the Texas Instruments communications carrier board (CCB) and related hardware options. The information in this manual is intended for use by system designers, value added resellers, maintenance personnel, and operators.

Contents of This Manual This manual is divided into three sections and an appendix:

Section 1: General Information — Provides a general overview of the CCB and includes information on features and specifications.

Section 2: Unpacking and Installing the CCB — Explains how to unpack the CCB, install any option boards, and install the CCB within the system enclosure.

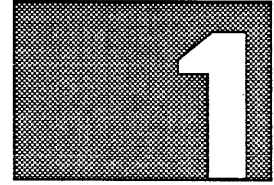
Section 3: CCB and Related Hardware Options — Provides a brief general description of the major components of the CCB.

Appendix A: Error Codes — Lists the error codes associated with the CCB and the network terminal concentrator (NTC).

Reference Documents For additional information on the CCB, refer to the following documents:

Title	TI Part Number
<i>Explorer LX™ System Installation Guide</i>	2537227-0001
<i>Explorer 7-Slot System Installation</i>	2243140-0001
<i>Explorer 7-Slot System Enclosure</i>	2243143-0001
<i>Explorer System Field Maintenance</i>	2243141-0001
<i>Explorer NuBus Peripheral Interface General Description</i>	2243146-0001
<i>Explorer SNA Communications</i>	2537281-0001
<i>System 1500 Communications Carrier Board Specification</i>	2535559-0001
<i>4-Channel Asynchronous Option Board Specification</i>	2535564-0001
<i>8-Channel Asynchronous Option Board Specification</i>	2535574-0001
<i>3-Channel Multifunction Option Board Specification</i>	2535584-0001
<i>LAN 802.3 Option Board Specification</i>	2535594-0001
<i>Terminal Concentrator Board Specification</i>	2539004-0001

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GENERAL INFORMATION

Introduction

1.1 This section discusses the features and specifications of the communications carrier board (CCB) and related hardware options, which provide optional communication interfaces for the Explorer system. This section also provides information on the network terminal concentrator.

Features

1.2 The CCB provides an intelligent peripheral controller for the Explorer system. Each CCB placed in the system enclosure supports up to two option boards. Each option board provides a high-bandwidth communication channel between the NuBus and external communication devices. The communications option boards supported by the CCB are:

- 4-channel asynchronous option board — Supports video display terminals (VDTs), serial printers, and modems.
- 8-channel asynchronous option board — Supports VDTs, smart (full duplex) modems, and serial printers. This option uses the RS-232C connector strip.
- LAN 802.3 option board — Supports local area networking through the Ethernet 802.3 adapter or V.35 protocol through the V.35 adapter. This option board allows communication with remote VDTs using the network terminal concentrator (NTC).
- 3-channel multifunction option board — Supports one parallel printer, one autocal unit, and one synchronous modem through the multifunction adapter. The synchronous modem can communicate directly with Explorer Lisp using system network architecture. The V.35 adapter can be used in place of the 3-channel multifunction adapter for V.35 protocol operation.

NOTE: The current Explorer software does not support all CCB hardware options. The Explorer (particularly Explorer LX) software manuals describe which options are supported and how they are used.

Network Terminal Concentrator

1.3 The NTC provides an intelligent control and data multiplexer that supports remote clusters of up to 16 EIA devices. The NTC utilizes either the Ethernet 802.3 LAN or a V.35 bit-oriented protocol data link for communication with the host system. The NTC offers:

- Flexible network media and protocol selection with a choice of network adapters and downloaded software.
- Data rates of up to 10 MHz, depending on the type of network selected.
- Network operation based on the industry-standard Intel® 82586 LAN coprocessor chip.

Specifications

1.4 Table 1-1 lists the environmental and power specifications for the CCB, and Table 1-2 lists the environmental and power specifications for the NTC.

Table 1-1

Communications Carrier Board Specifications

Item	Specification
Temperature:	
Operating	5 to 45 degrees C (41 to 113 degrees F)
Nonoperating	-40 to 65 degrees C (-40 to 149 degrees F)
Relative humidity:	
Operating	8% to 89% (noncondensing)
Nonoperating	5% to 95% (noncondensing)
Shock:	
Operating	15 g (3 axes, 1/2 sine, 6 ms)
Nonoperating	20 g (3 axes, 55 ips velocity change)
Vibration:	
Operating	0.0118 in. (5-20 Hz), 0.25 g (20-250 Hz) (3 axes, sine, sweep 1 octave/minute)
Nonoperating	0.0276 in. (5-20 Hz), 0.5 g (20-250 Hz) (3 axes, sine, 15 minute dwell at resonant points)
Altitude:	
Operating	-1000 to 6500 feet
Nonoperating	-1000 to 10 000 feet
Power:	
	+5 volts main, 16.3 amperes, 81.50 watts
	+12 volts, 0.4 amperes, 0.48 watts
	-12 volts, 0.0 amperes, 0.00 watts
	Total power consumption, 81.98 watts

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Table 1-2

Network Terminal Concentrator Specifications

Item	Specification
Temperature:	
Operating	5 to 45 degrees C (41 to 113 degrees F)
Nonoperating	-40 to 65 degrees C (-40 to 149 degrees F)
Relative humidity:	
Operating	8% to 89% (noncondensing)
Nonoperating	5% to 95% (noncondensing)
Shock:	
Operating	15 g (3 axes, 1/2 sine, 6 ms)
Nonoperating	20 g (3 axes, 55 ips velocity change)
Vibration:	
Operating	0.0118 in. (5-20 Hz), 0.25 g (20-250 Hz) (3 axes, sine, sweep 1 octave/minute)
Nonoperating	0.0276 in. (5-20 Hz), 0.5 g (20-250 Hz) (3 axes, sine, 15 minute dwell at resonant points)
Altitude:	
Operating	-1000 to 6500 feet
Nonoperating	-1000 to 10 000 feet
Power:	
	120 Vac, \pm 10%, 47-63 Hz, 100 watts
	220/240 Vac, \pm 10%, 47-63 Hz, 100 watts

INSTALLATION

2

Introduction

2.1 This section describes the following procedures:

- Site preparation
- Unpacking the CCB
- Unpacking the network terminal concentrator (NTC)
- Installing option boards on the CCB
- Installing the CCB in the Explorer chassis
- Installing adapters and cables
- Installing the NTC
- Power-on procedure

WARNING: Only trained service personnel are to remove and install the power supply board. Hazardous components are located behind the power supply cover. Do not attempt to service the power supply. Refer power supply problems to your TI customer representative or other TI authorized service personnel.

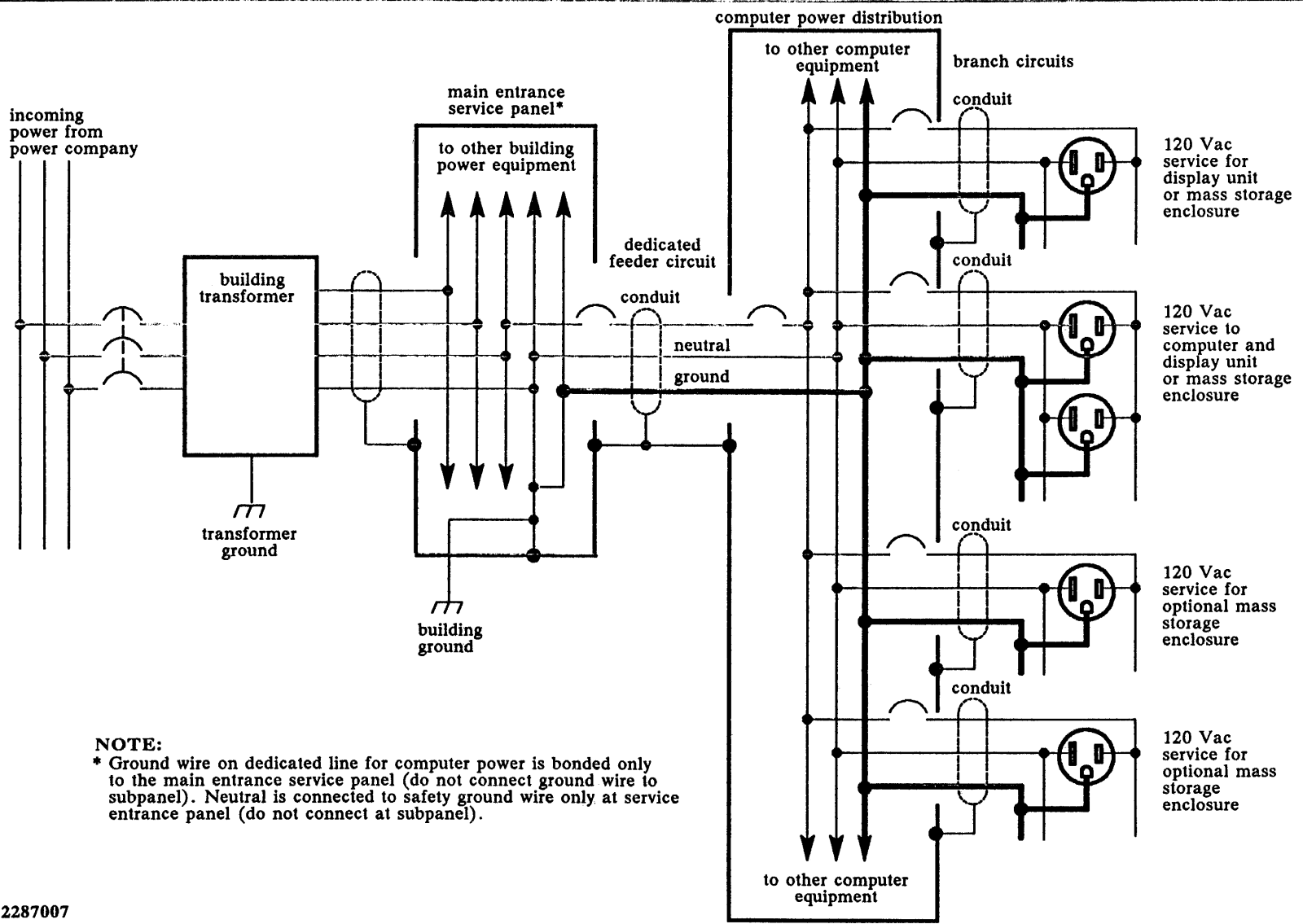
Preparing the Site

2.2 Power and environmental requirements for the installation of the NTC are listed in Table 1-2. Figure 2-1 shows an example of a properly wired 120-volt power distribution system for computer equipment. For more detailed information on power requirements, refer to the system installation manual for the computer system associated with your NTC.

Ensure that conditions at the NTC site meet the following requirements:

- Make sure there is sufficient space for air circulation around the NTC.
- Check that the environmental conditions, such as temperature, humidity, dust, vibration, and static electricity, meet the requirements specified in Table 1-2.
- If there is a conflict between the requirements of Table 1-2 and the site requirements of your computer system, the requirements in Table 1-2 should be followed.

Figure 2-1 Power Distribution Requirements for a 120-Volt System



CAUTION: All system boards, options, adapters, 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, grounded working mats, and antistatic bags for moving or storing the items.

Unpacking the Communications Carrier Board

2.3 Some system configurations are shipped with the CCB already installed. However, if you purchase the CCB separately, you will need to install the board yourself.

If your board is not already installed, locate the board packing container. If any packing instructions are attached to the exterior of the packing container, follow those instructions. If not, perform the following steps:

1. Open the packing container and carefully remove the packing material; then remove the CCB with its static protective bag in place.
2. Remove the static protective bag from the CCB.

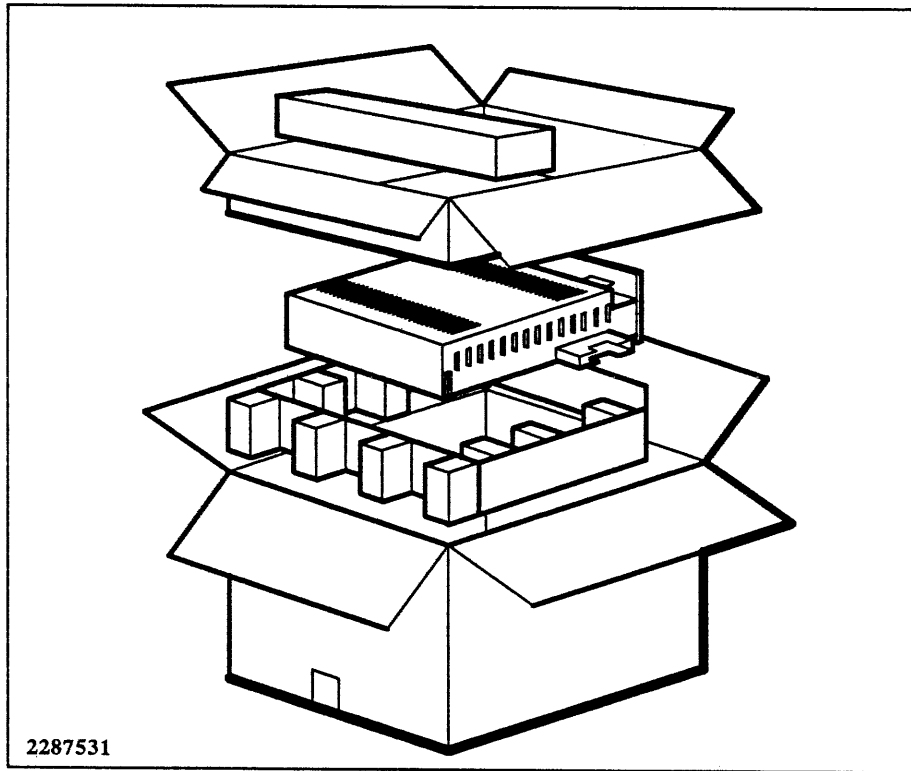
**Unpacking the
Network Terminal
Concentrator**

2.4 To unpack the NTC, refer to Figure 2-2 and proceed as follows:

1. Place the NTC shipping container on the floor in the upright position.
2. Cut the shipping container sealing tape.
3. Remove the NTC from its container.
4. Remove the protective packing from the NTC.
5. Check the NTC for damage. If it is damaged, follow your company procedure to report the damage.
6. Place the NTC in the area where it will be used.

Figure 2-2

Network Terminal Concentrator Shipping Container



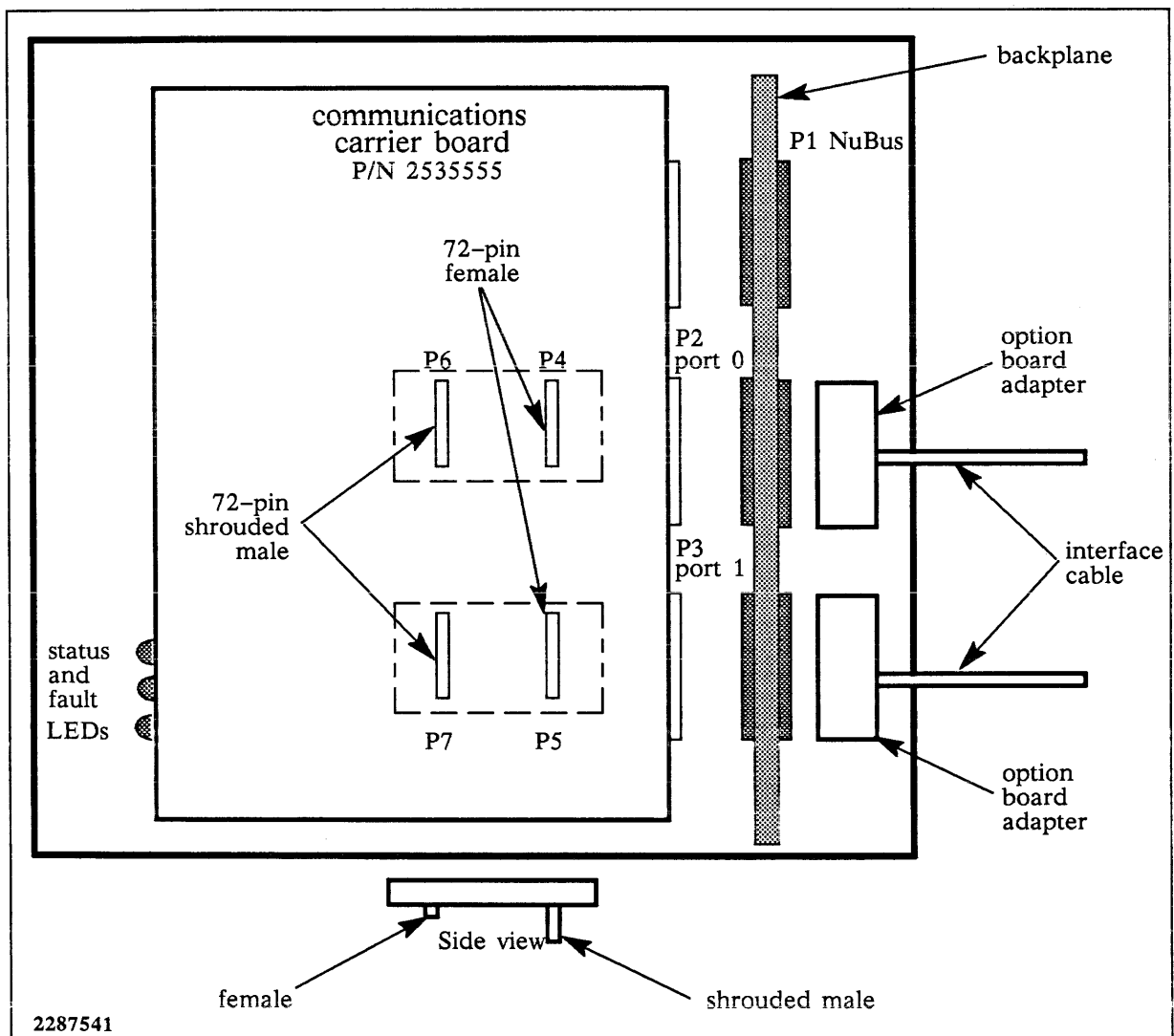
Installing Option Boards

2.5 Install the option boards by plugging them into the appropriate location on the CCB. Port 0 is located nearest the center of the CCB, and uses connectors P4 and P6, as shown in Figure 2-3. Port 1 is located nearest the bottom of the CCB and uses connectors P5 and P7.

To install an option board, perform the following procedure:

1. Align the option board with the appropriate connectors on the CCB.
2. Carefully plug the option board into the CCB connectors.

Figure 2-3 Communications Carrier Board Options and Cabling



WARNING: To eliminate the possibility of electrical shock during installation, you must isolate the system enclosure from all potential energy sources. To isolate the system enclosure:

1. Turn off power to the system enclosure and all peripherals.
 2. Disconnect the power cable from the wall outlet for all local peripherals connected to the system enclosure.
 3. Disconnect all interface cables between the system enclosure and all remote peripherals at the remote peripheral interface (modem or transceiver).
 4. Unplug the system enclosure power cable from the wall outlet.
-

Caution: Before installing the CCB, ensure that your system has a 110-amp power supply. Also ensure that the NUPI and memory board revision levels meet the requirements outlined in the *Explorer LX System Installation* guide.

Installing the Communications Carrier Board

2.6 All system boards, including the CCB, are installed in the same general manner. Use the following steps to install the CCB:

1. Open the outer and inner front system enclosure doors.
2. If an Ethernet board is located in slot 0, move it and its associated cables and adapters to slot 3.

NOTE: An Explorer LX system with both a CCB and an Ethernet board does not have space for an option memory board.

3. Install the CCB in slot 0 as follows:
 - a. Orient the board with the components facing to the right.
 - b. Slide the board into the appropriate slot, and make sure that it is seated properly in the three backplane connectors.
 - c. Press the top and bottom ejector tabs so that the board is locked into the card cage.
4. Close the two front system enclosure doors.

NOTE: The inner, metal front door and the rear door of the system enclosure must be closed for the system to be operational.

Installing the Cable and Adapter

2.7 To complete the CCB installation, you must install an adapter and cable for the CCB. Perform the following procedure:

1. Connect the adapter to the appropriate connector on the rear of the system enclosure (P2 for port 0, P3 for port 1), as shown in Figure 2-3.
2. Connect the required cable to the option adapter.
3. Reconnect the system enclosure power cable to the wall outlet.
4. Reconnect all interface cables between the system enclosure and the remote peripherals.
5. Reconnect the power cable to the wall outlet of all local peripherals connected to the system enclosure.
6. Power on the peripherals and then the system enclosure. If the system enclosure fails to power on, turn the power off and check to see that the front inner door and rear enclosure door are closed.

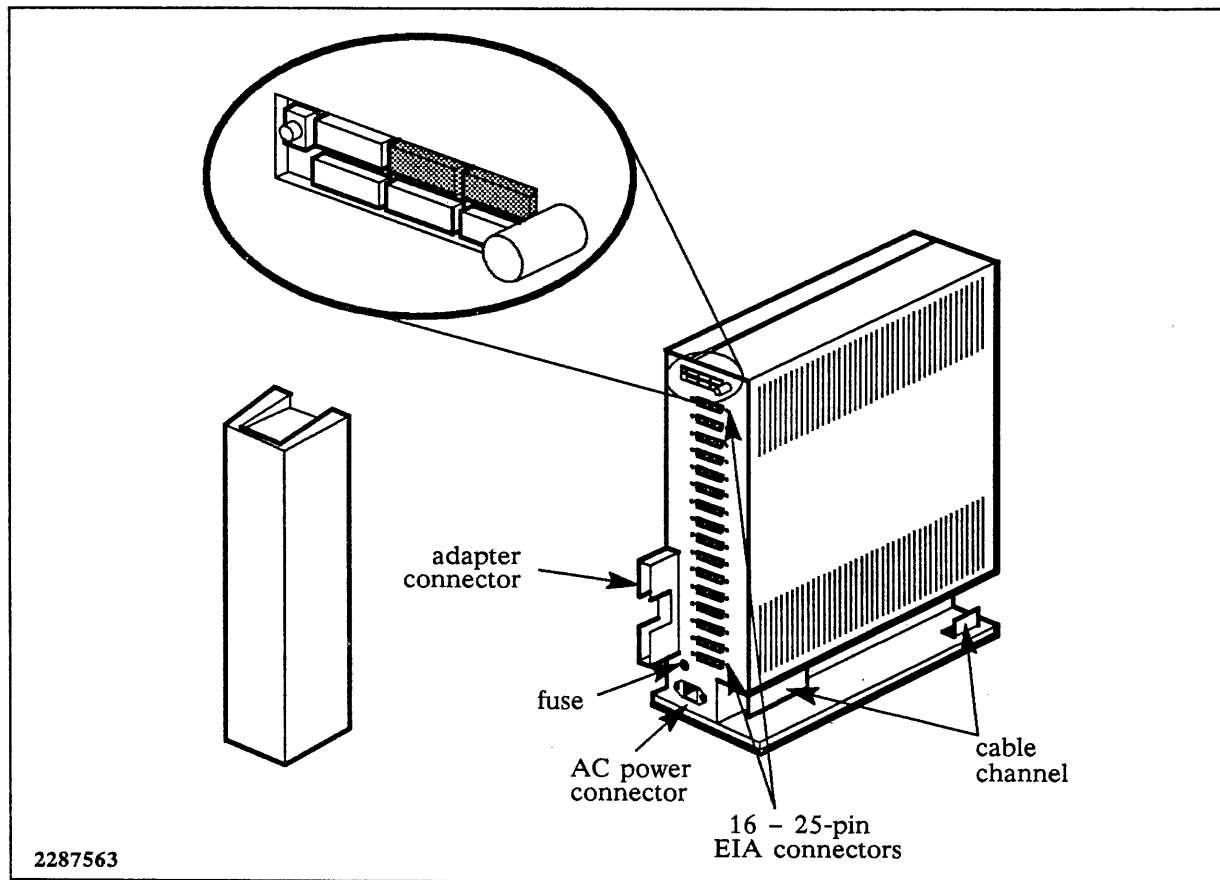
Installing the Network Terminal Concentrator

2.8 The NTC is the only communications option external to the system enclosure. It is installed in the general area of the VDTs and serial printers. Figure 2-4 shows the NTC with the front cover removed. The light-emitting diodes (LEDs) and controls of the NTC are explained in Section 3 of this manual.

To install the NTC:

1. Remove the front cover by grasping the cover on the left and right side and pulling it up and forward.
2. Locate the NTC connectors and controls:
 - Control panel (This can be accessed without removing the front panel.)
 - 16 EIA connectors for the VDTs and serial printers
 - Input adapter connector
 - Ac line fuse
 - Ac power connector
3. Set the power switch to the off position, and disconnect the ac power cable from the wall outlet and the NTC.
4. Select the Ethernet adapter and transceiver or the V.35 adapter and modem cable, and position the adapter so that its cover plate is facing to the left and the 96-pin connector is facing towards the NTC.
5. Align the adapter between the mounting guides of the adapter slot.

Figure 2-4 Network Terminal Concentrator



6. Slide the adapter into the mating connector in the NTC.
7. Insert the adapter end of the transceiver or modem cable into the connector slot on the adapter board.
8. Route the transceiver or modem cable across the bottom front and then along the bottom right side of the NTC.
9. Attach the other end of the transceiver cable to the LAN 802.3 Ethernet transceiver or the modem cable to the modem.
10. Install the RS-232C EIA (25-pin) connector to the mating connector on the NTC. As you install each cable, mark its peripheral end with its location (0 through 15) on the NTC so that you can connect the correct peripheral to the cable. The ports on the NTC are numbered from the top (0) to the bottom (15).
11. Using a small flat-bladed screwdriver, tighten the two screws that hold the EIA cable connector to the NTC EIA connector.
12. Route the EIA cables across the bottom front and then along the bottom right side of the NTC, and attach the peripheral end of the EIA cables to the peripheral devices.

13. Install the female end of the ac power cable to the ac power connector of the NTC.
14. Route the ac power cable along the cable tray. Do not connect the ac power cable to the wall outlet at this time.
15. Replace the front cover of the NTC.
16. Plug the ac power cord from the NTC into an ac outlet as shown in Figure 2-1.

Powering-On 2.9 When all peripherals are connected, power on the NTC by pressing the PWR switch on the front panel. Check that the self-test and the download of the software complete correctly, as explained in Section 3 of this manual.

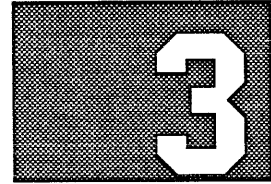
Installing the Software 2.10 Refer to the *TI System V Software Installation and Configuration* manual, TI part number 2544356-0001, for information on downloading software for the CCB and option boards.

Hardware Kits 2.11 Table 2-1 lists the hardware kits available for the CCB.

Table 2-1 Communications Carrier Board Hardware Kits

Kit	TI Part Number
8-Channel Asynchronous Communications Kits:	
8-Channel Asynchronous Connector Adapter Assembly	2535575-0001
Connector Strip Assembly, EIA	2537333-0001
Input/Output Cable Assembly, 50 Position	2537332-0001
8-Channel Asynchronous Option Assembly	2535570-0001
4-Channel Asynchronous Communications Kits:	
4-Channel Asynchronous Adapter Assembly	2535565-0001
4-Channel Asynchronous Option Assembly	2535560-0001
3-Channel Multifunction Communications Kits:	
3-Channel Multifunction Synchronous Adapter Assembly	2535585-0001
3-Channel Multifunction Option Assembly	2535580-0001
Local Area Network Kits:	
Network Terminal Concentrator	2537305-0001
LAN 802.3/Ethernet Adapter Assembly	2535600-0001
LAN 802.3/Ethernet Option Board Assembly	2535590-0001
Ethernet Transceiver Kit, 3C102	2244733-0001
LAN/Ethernet Transceiver Cable	2239129-0001
Thin Ethernet Cable Assembly, 30 meter	2239703-0001
Thin Ethernet Cable Terminator Kit	2239130-0001

COMMUNICATIONS CARRIER BOARD AND RELATED OPTIONS



Introduction

3.1 This section describes the communications carrier board (CCB) and the various add-on option boards used with the CCB. This section also describes the network terminal concentrator (NTC). Refer to the system operating manuals for descriptions of the software used with these options.

Communications Carrier Board

3.1 The CCB operates on the NuBus and provides optional communication capability to the Explorer and Explorer LX System.

Three fault indicators (LEDs) are located at the front bottom of the CCB, as shown in Figure 2-1. To view these LEDs while the system is running, open the front outer enclosure door and look through the slots in the inner door. The top LED indicates a board failure, the middle LED indicates that a failure has occurred on port 0, and the bottom LED indicates that a failure has occurred on port 1. During self-test all three LEDs are lit.

The CCB uses the Motorola 68010 16-bit microprocessor and has 512K bytes of on-board dynamic random access memory (DRAM). Other key components of the CCB are:

- 8K bytes of static RAM (SRAM) — Memory dedicated to the 68010 for stacks, control words, and other time-critical code.
- 32K bytes of read-only memory (ROM)/erasable programmable ROM (EPROM) — Memory for storage of primitive code interpreter, fixed parameters, or special-purpose code.
- 4K bytes of configuration ROM — Flag and configuration registers for system-required NuBus, self-test, and system test boot master (STBM) support.
- 68230 programmable interval/timer (PI/T) — Integrated circuit that provides software-controlled timing for most board functions.
- Interrupt controller chip (ICC) — Custom integrated circuit that provides interrupt assertion and NuBus event vector generation through a specially designed integrated circuit.

Some of the key functions provided by the CCB are:

- NuBus slave interface for high-bandwidth, slot-independent data transfer.
- NuBus master interface for CCB-initiated data transfers.
- Mounting, dc power, signal connections, and full master/slave direct memory access and interrupt support for two option boards.
- Ethernet Identification (ID) programmable ROM (PROM).

The Ethernet ID PROM provides the Ethernet ID of the option board. All Ethernet stations must have a unique address. The Ethernet address is loaded to the local area network coprocessor (also known as the local controller coprocessor, or LCC) at initialization. The Ethernet ID (station address) is used as the address for all protocol adapters supported by the local area network (LAN) 802.3 option board.

Figure 3-1 shows a block diagram of the CCB.

The CCB features powerful on-board diagnostics that are activated automatically at power-up. The diagnostic tests use internal loopback capabilities to verify proper operation of the on-board logic.

After successful completion of power-up self-test, the CCB downloads its operating software from the host Explorer system.

For additional information on the test capabilities or programming capability of the CCB, refer to the diagnostic software manual furnished with the system. Error codes for the CCB are listed in Appendix A.

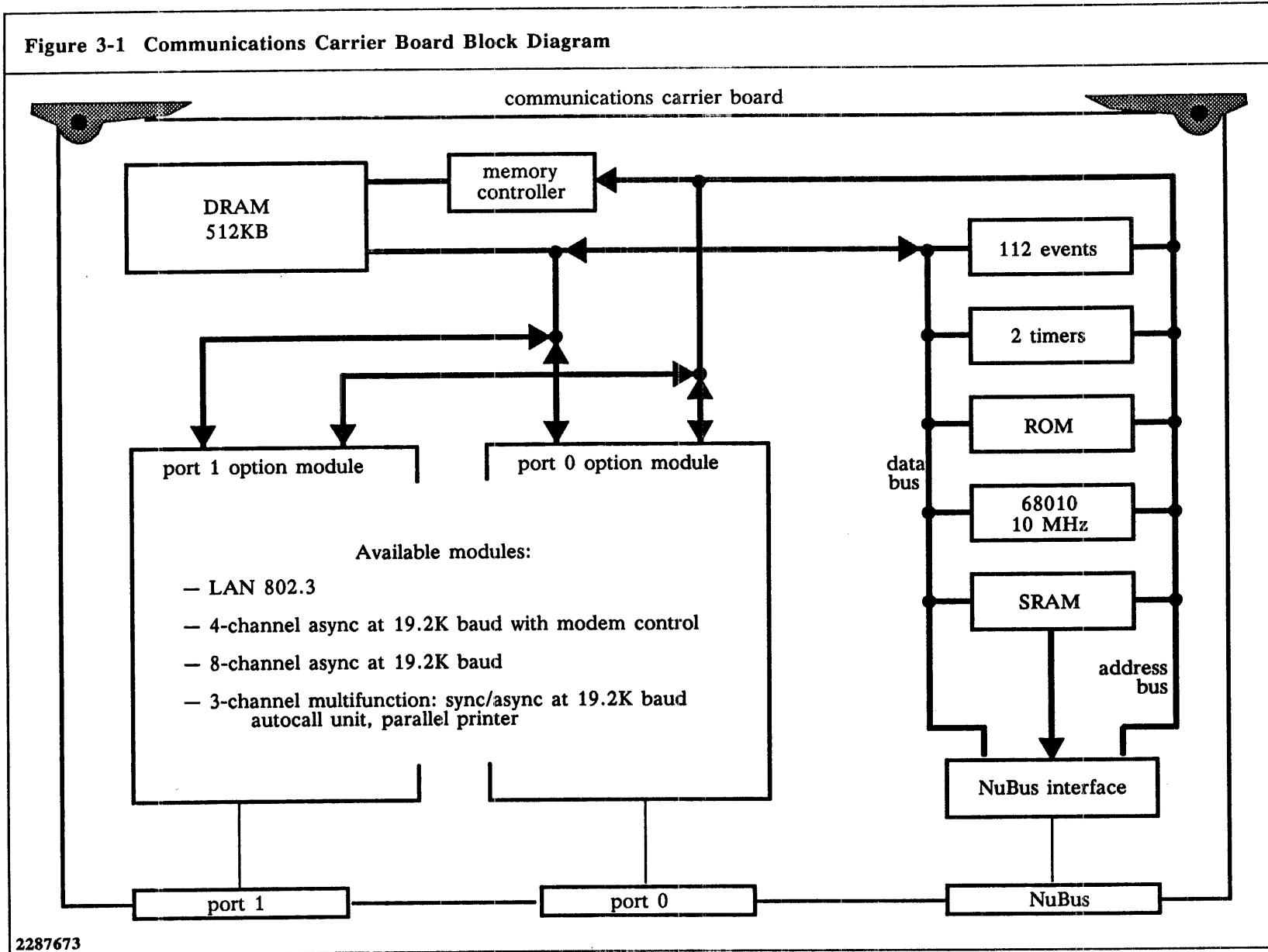
4-Channel Asynchronous Option

3.3 The 4-channel option board supplies four asynchronous data channels that support speeds up to 19.2 kilobits per second with full modem option capabilities. The 4-channel option board is built around the 68681 dual asynchronous receiver/transmitter (DUART) chip, as shown in Figure 3-2. Two DUART chips are used on each 4-channel option board, along with the line drivers for each channel. The line receivers are located in the cable adapter for the 4-channel option board.

Each channel supports the following signals:

- Status lines:
 - Clear to send (CTS-)
 - Data set ready (DSR-)
 - Data carrier detect (DCD-)
 - Ring indicator (RI-)
 - Speed indicator (SI-)
- Control lines:
 - Request to send (RTS)
 - Data terminal ready (DTR)
 - Analog loopback (ANLB)
 - Secondary request to send (SRTS)
- Data lines:
 - Transmit data (TD)
 - Receive data (RD)

Figure 3-1 Communications Carrier Board Block Diagram



Each channel has the following features and limitations:

- Quadruple-buffered receive data registers
- Double-buffered transmit data registers
- Independently programmable baud rate for each receiver and transmit channel
- Programmable data formats
- Programmable channel modes
- Multifunction 16-bit programmable counter/timer (one for each channel pair)
- Three fixed interrupt lines
- Change of state detection for DSR and RTS
- Parity, framing, and overrun error detection
- False-start bit detection
- Line-break detection and generation
- Break detection from within a character
- Start-end break interrupt/status
- Input lines support transistor/transistor level (TTL) signal levels only
- Output lines provide TTL, RS-232C, and RS-422 compatibility

Table 3-1 lists the standard baud rates of the 4-channel asynchronous option board.

Table 3-1

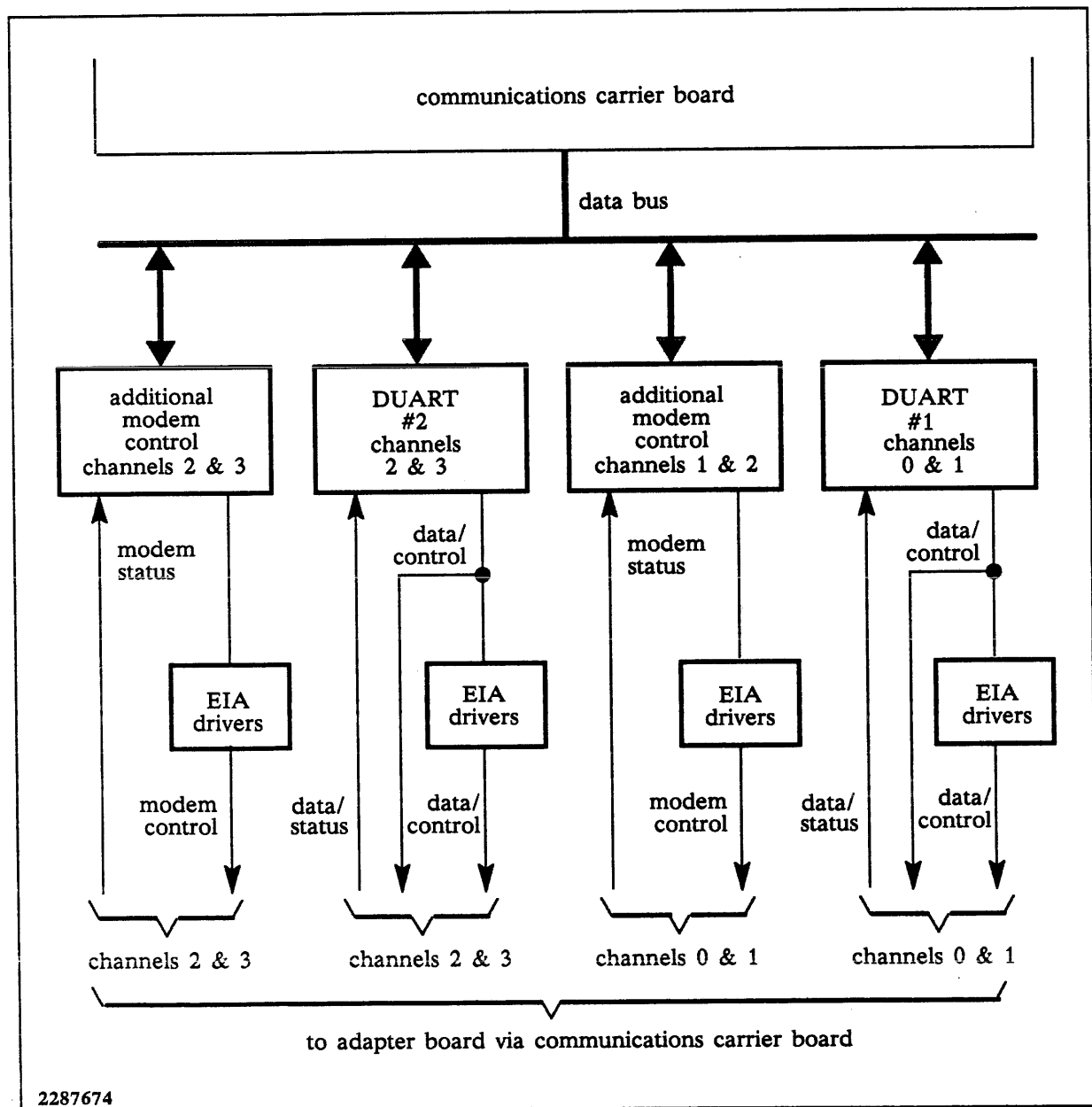
4-Channel Option Board Standard Baud Rates	
Nominal Rate (Baud)	Actual 16X Clock (Hz)
50.0	800
75.0	1200
100.0	1759
134.5	2153
150.0	2400
200.0	3200
300.0	4800
600.0	9600
1050.0	16756
1200.0	19200
1800.0	28800
2000.0	32056
2400.0	38400
4800.0	76800
7200.0	115600
9600.0	153600
19200.0	307200
38400.0	614400

The 4-channel option board supports one adapter. This adapter has four separate connectors, one for each data channel. Different data cables interface to the different peripherals (terminals, printers, and modems).

Refer to the system and software documentation for the application of this option in an Explorer system. The error codes for the 4-channel asynchronous option board are listed in Appendix A.

For additional information on the 4-channel option board, refer to the Specification for 4-Channel Asynchronous Option Board, TI part number 2535564-0001.

Figure 3-2 4-Channel Asynchronous Option Board Block Diagram



**8-Channel
Asynchronous
Option**

3.4 The 8-channel option board provides eight EIA asynchronous channels through the RS-232C 8-channel connector strip. The 8-channel option board is for use in systems where communication speeds of 19.2 kilobits per second (KBPS) or slower are required to drive local terminals and other EIA asynchronous devices. This option board does not support standard modems, but full duplex (FDX) modems can be used to communicate between the system enclosure location and remote locations or sites.

The 8-channel option board is built around the 68681 DUART chip, as shown in Figure 3-3. The major features of the 8-channel option board and the DUART are:

- Eight full-duplex asynchronous receive/transmit channels
- Quadruple-buffered receive data registers for each channel
- Double-buffered transmit data buffers for each channel
- Independently-programmable baud rate for each receive and transmit channel, selected from:
 - 18 fixed rates: 50 baud to 38.4 kilobaud
 - One user-defined baud rate per channel pair derived from a DUART programmable counter/timer
- Programmable data format for each channel of:
 - 5 to 8 data bits plus parity
 - Odd, even, no, and forced parity
 - 1 or 2 stop bits
- Programmable operating modes for each channel of:
 - Full-duplex (normal)
 - Automatic echo
 - Local loopback
 - Remote loopback
- Multifunction 16-bit programmable counter/timer (one per channel)
- Versatile interrupt system:
 - Single DUART interrupt output with eight maskable interrupting conditions
 - Individual receiver buffer interrupts
 - Individual transmit buffer interrupts
- Parity, framing, and overrun error detection for each channel
- False-start bit detection for each channel
- Change-of-state detection for DSR for each channel

- Line-break detection and generation for each channel
- Detection of mid-character break for each channel
- Start-break/end-break interrupt/status for each channel
- Communication input lines accept only TTL-level signals
- Output levels of both TTL, RS-232C, and RS-442

Figure 3-3 8-Channel Asynchronous Option Board Block Diagram

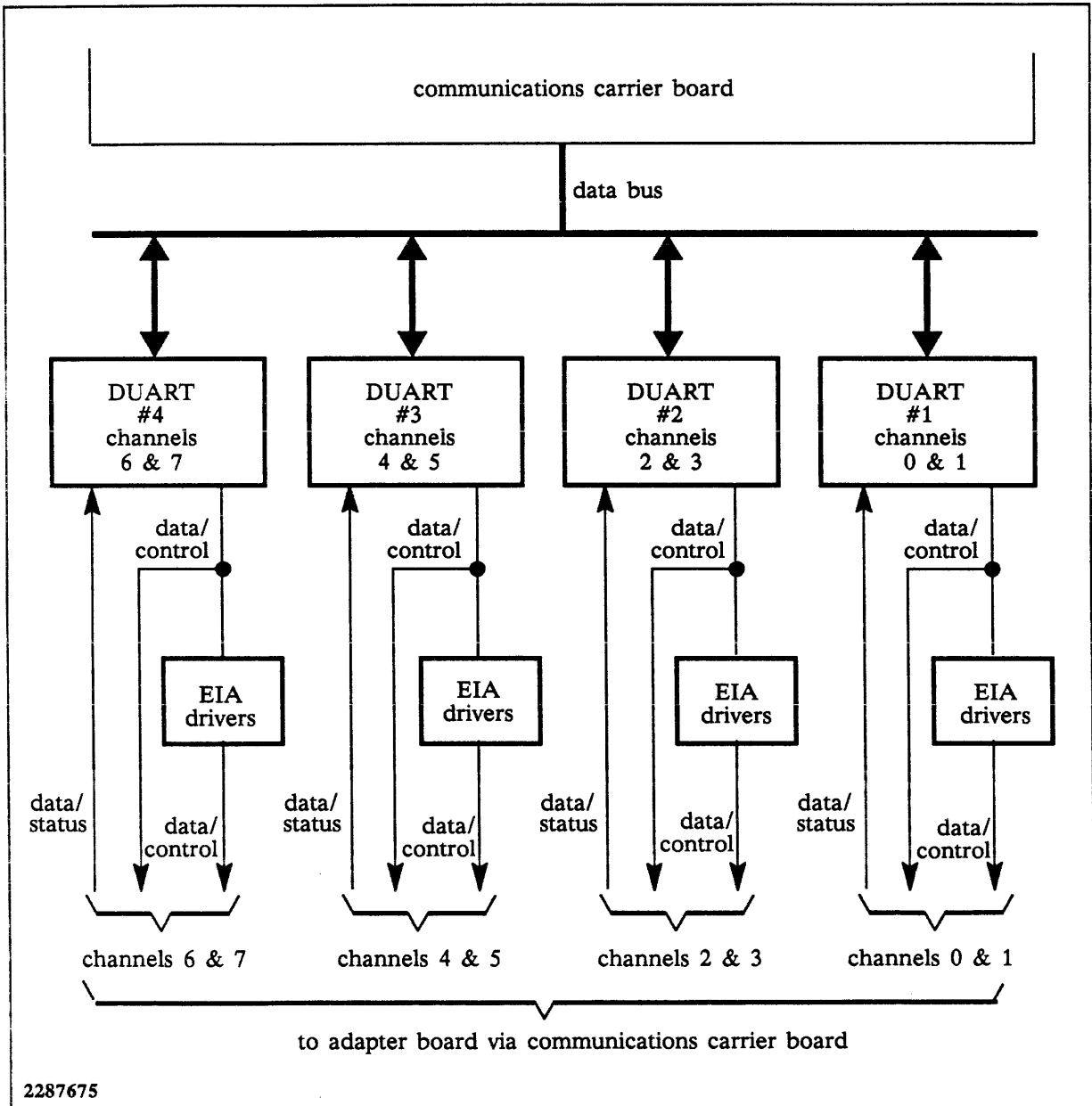


Table 3-2 lists the standard baud rates for the 8-channel asynchronous option board.

Table 3-2

8-Channel Option Board Standard Baud Rates	
Nominal Rate (Baud)	Actual 16X Clock (Hz)
50.0	800
75.0	1200
100.0	1759
134.5	2153
150.0	2400
200.0	3200
300.0	4800
600.0	9600
1050.0	16756
1200.0	19200
1800.0	28800
2000.0	32056
2400.0	38400
4800.0	76800
7200.0	115600
9600.0	153600
19200.0	307200
38400.0	614400

Refer to the system and software documentation for the application of this option in an Explorer system.

The error codes for the 8-channel asynchronous option board are listed in Appendix A.

For additional information on the 8-channel option board, refer to the Specification for 8-Channel Asynchronous Option Board, TI part number 2535574-0001.

Adapter and Cables

3.4.1 The 8-channel option board adapter is mounted on the backplane connector (P2 or P3) of the slot containing the CCB with the 8-channel option. The connector, P2 or P3, is determined by the position of the 8-channel option board on the CCB (that is, either port 0 or port 1, respectively).

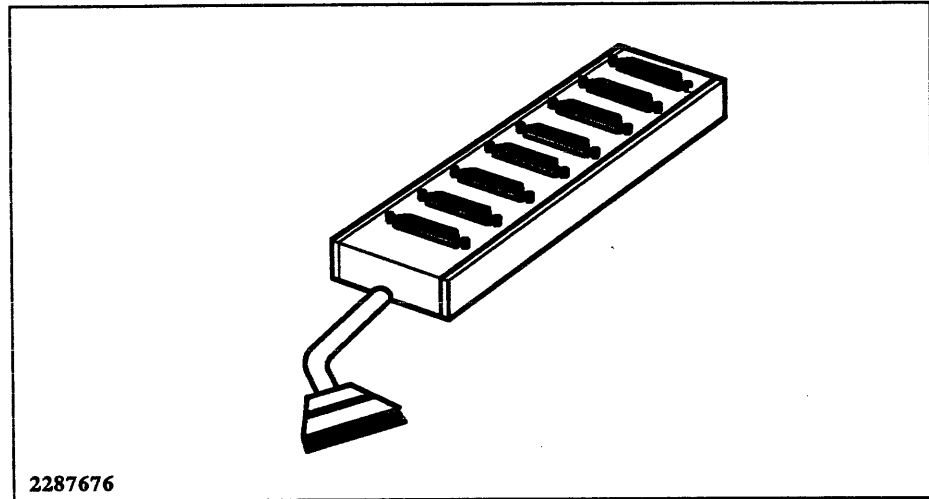
The 8-channel option board adapter interfaces between the system and the 8-channel RS-232C connector strip.

RS-232C Connector Strip

3.4.2 The 8-channel RS-232C connector strip (Figure 3-4) contains the pig-tail connector that attaches to the cable from the adapter and eight 25-pin EIA RS-232C connectors. The individual peripheral (EIA) cables attach from the connector strip to the peripherals.

Figure 3-4

RS-232C Connector Strip



LAN 802.3 Option Board

3.5 The LAN 802.3 option board interfaces between the CCB and the Ethernet (802.3) local area network data link. The LAN 802.3 uses the carrier sense multiple access with collision detection (CSMA/CD) Ethernet protocol.

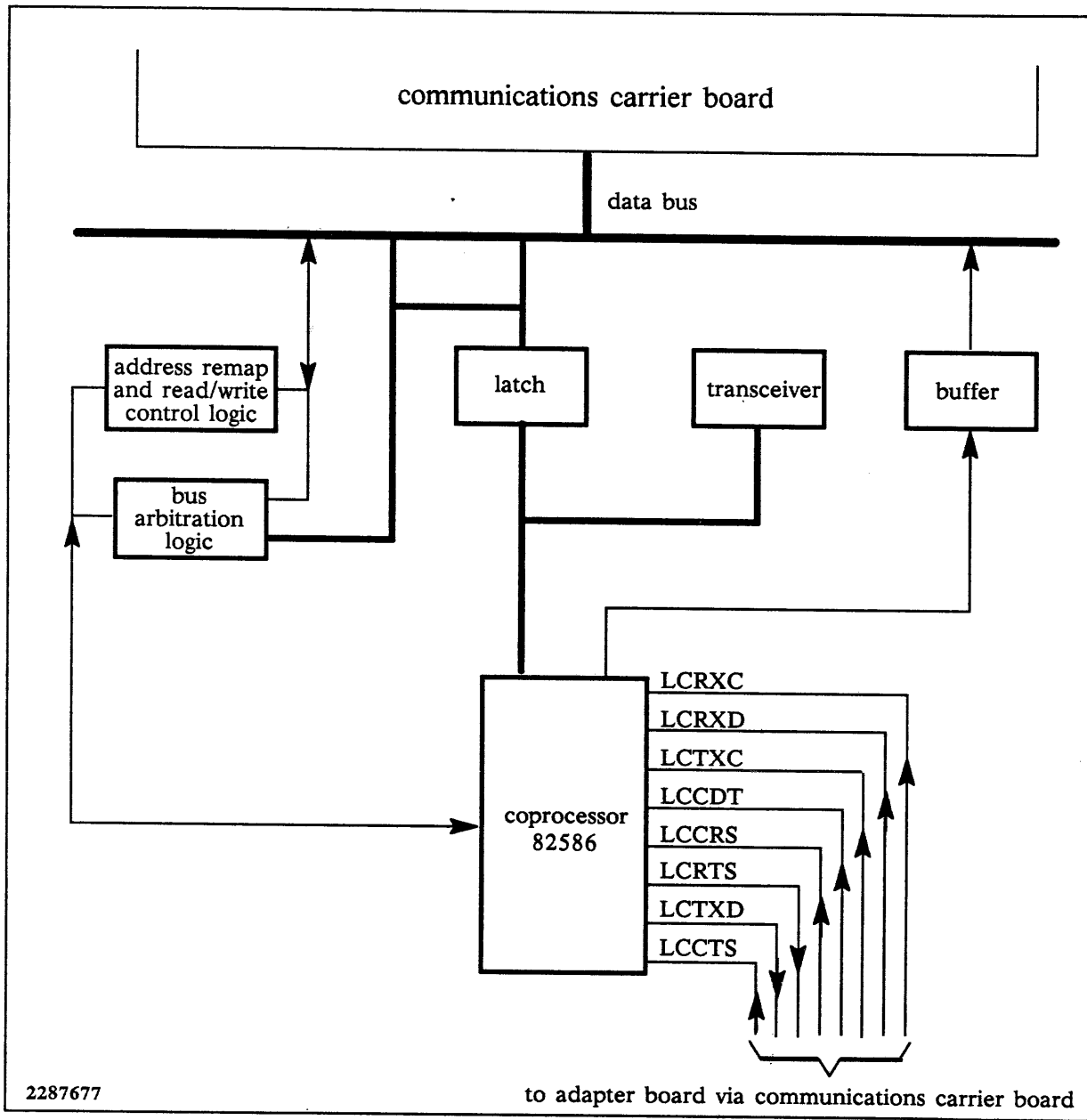
The adapter contains the Manchester encoder/decoder chip that encodes and decodes data received from and sent to the network through the transceiver.

The LAN option allows the use of the NTC in addition to individual LAN devices. The NTC provides an intelligent control and data multiplexer for remote clusters of up to 16 EIA devices. The NTC can interface to the host through either the 802.3 LAN option or the V.35 bit-oriented protocol data link.

The major components of the LAN 802.3 option board, shown in Figure 3-5, are:

- Local area network coprocessor (LCC)
- Status and command register

Figure 3-5 LAN 802.3 Option Board Block Diagram



The LCC (Intel 82586) provides the following functions:

- Media access control
- Serialization and deserialization of data
- Address recognition
- Collision detection
- Cyclic redundancy checking (CRC)
- Error detection and reporting
- Bit stuffing
- Data chaining

The status and command register controls the loopback and data terminal ready signals and reads six data bits that identify the installed adapter.

The nomenclature for the signals between the LAN 802.3 option board and the Ethernet adapter board is:

- LCRXC — Receive data clock
- LCRXD — Receive data
- LCTXC — Transmit data clock
- LCCDT — Collision detection
- LCCRS — Data channel receive line signal detector
- LCRTS — Request to send
- LCTXD — Transmit data
- LCCTS — Clear to send

Refer to the system and software documentation for the application of this option in an Explorer system.

The error codes for the LAN 802.3 option board are listed in Appendix A.

For additional information on the LAN 802.3 option board, refer to the Specification for LAN 802.3 Option Board, TI part number 2535594-0001.

Adapter and Cables

3.5.1 The LAN 802.3 option board supports the Ethernet 802.3 adapter board and the V.35 adapter board. The Ethernet adapter interfaces to a local area network, and the V.35 adapter interfaces to a leased-line telephone communications network. These adapters are described in the following paragraphs.

Ethernet Adapter and Cables

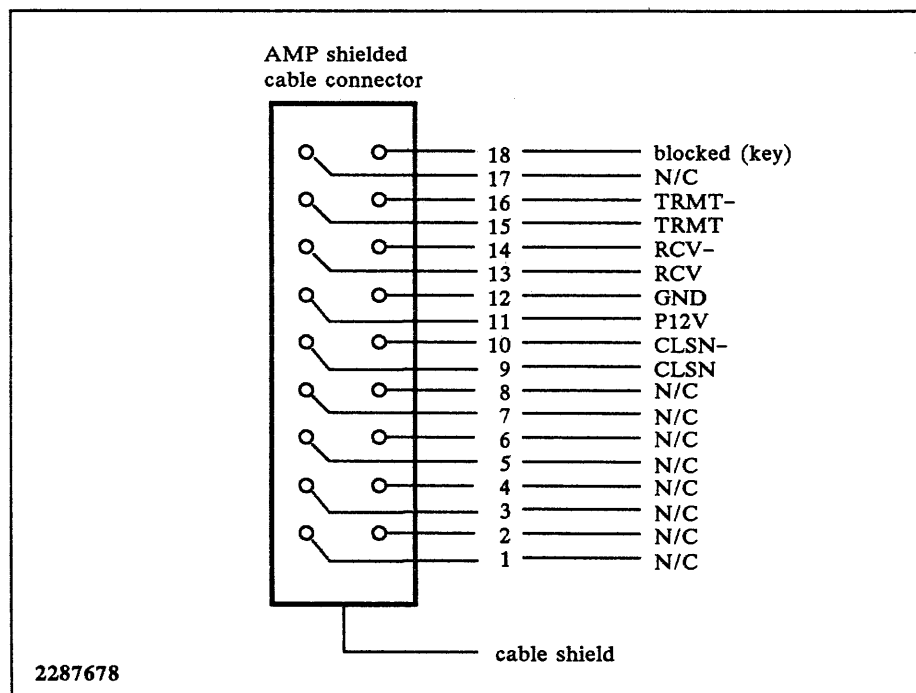
3.5.1.1 The Ethernet adapter contains the MCC™ Manchester Code Converter. The MCC provides:

- Fail-safe watchdog timer
- Direct interface with the LAN coprocessor
- Data encoding (transmitting) to Manchester format
- Manchester encoded (receive) data decoding
- Receive clock recovery with phase lock loop
- Clock rate of 20 MHz
- Differential transmit cable drivers

Figure 3-6 shows the interface (transceiver) cable pin assignments. The P12V line supplies the 12 volts needed by the transceiver electronics.

Figure 3-6

Ethernet Cable Pin Assignments



V.35 Adapter and Cables

3.5.1.2 The V.35 adapter contains a receive multiplexer, line drivers, and control logic for the V.35 protocol and modem.

MCC is a trademark of Seeq Technology, Incorporated.

3-Channel Multifunction Option Board

3.6 The 3-channel multifunction option board can be mounted at either or both option positions of the CCB. Depending on the downloaded software and the peripheral cable adapter that is installed, the 3-channel board supports:

- Multifunction adapter:
 - One external autocall unit
 - One parallel printer
 - One EIA RS-232C synchronous communications channel
- V.35 adapter and V.35 high-speed wide band modem

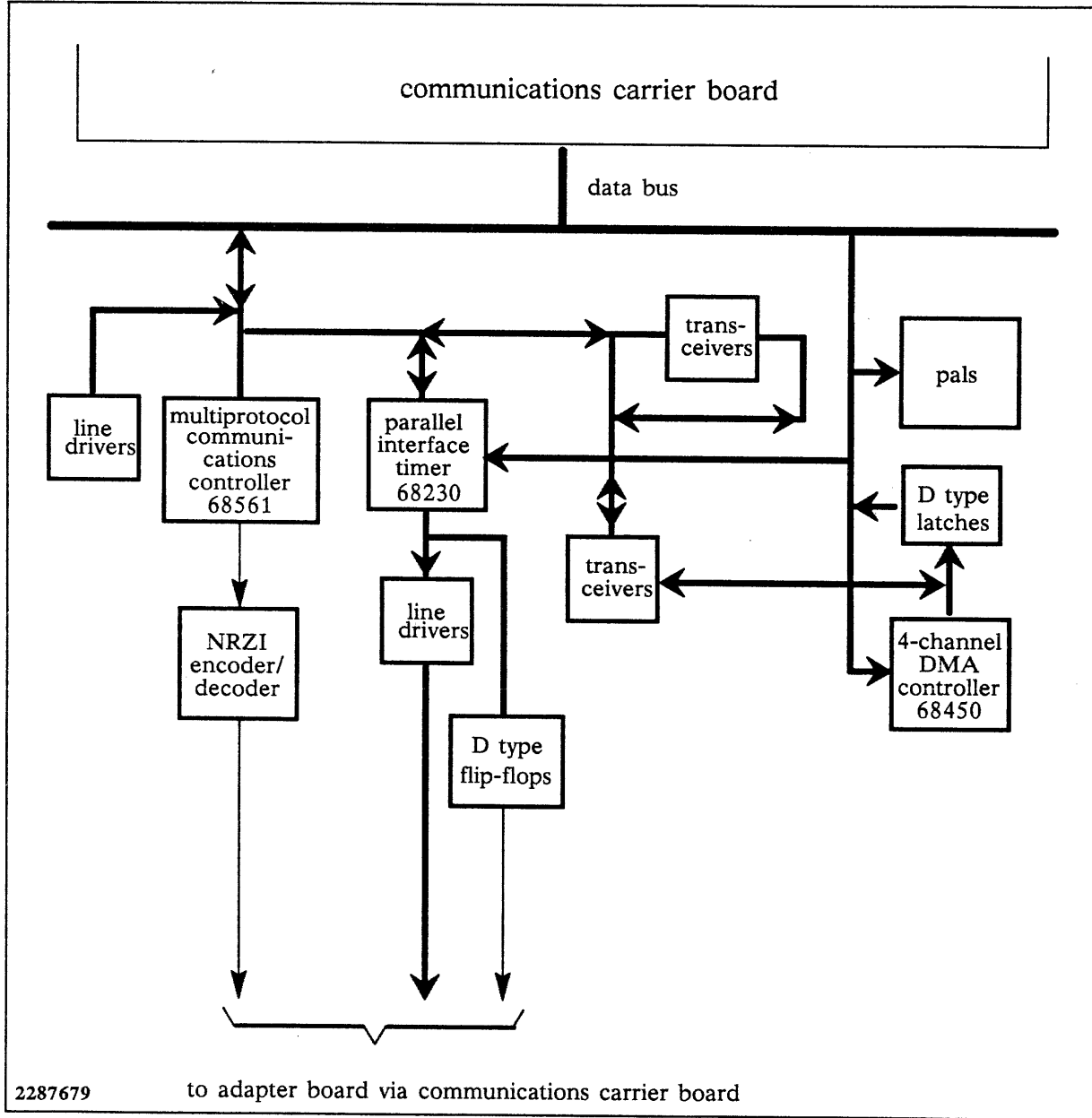
The key features of the 3-channel board are:

- Full-duplex synchronous and asynchronous transmit and receive
- Programmable serial data rates from dc to 56 000 Hertz (with V.35 adapter)
- Full modem and autocall unit interface for synchronous and asynchronous modems
- V.35 support for high-speed wide band modem communications on leased lines
- Support of synchronous bit-oriented protocol (BOP), including X.25, SDLC, and HDLC
- Support of synchronous character-oriented protocols (COP), including IBM® Binary Synchronous Communications (BSC)
- Selectable parity (odd, even, and none) and CRC (CRC-16, CCITT V.41, and VRC/LRC)
- Eight-character receive and transmit buffer registers to prevent data overrun and underrun
- Industry-standard (Centronics-compatible or Dataproducts) parallel printer interface
- Selectable modes (full/half duplex, autoecho, and loopback)

IBM is a registered trademark of International Business Machines Corporation.

Figure 3-7 shows a block diagram of the 3-channel multifunction option board.

Figure 3-7 3-Channel Multifunction Option Board Block Diagram



Major Components

3.6.1 The 3-channel multifunction option board employs several specialized integrated circuit chips to provide communications flexibility. The following list explains their functions.

- 68230 programmable interval timer (PI/T), which primarily handles the parallel interfaces (printer and autocall unit).
- R68516 multiprotocol communications controller, which handles synchronous and asynchronous communications.
- HD68450 DMA controller, which controls direct memory access to the CCB, thus relieving the CCB 68010 from the data transfer task.

All three devices are programmable and must be correctly programmed before any operations are initiated.

Refer to the system and software documentation (for example, the *Explorer LX User's Guide*) for the application of this option in an Explorer system.

The error codes for the 3-channel multifunction option board are listed in Appendix A.

For additional information on the 3-channel multifunction option board, refer to the 3-Channel Multifunction Option Board Specification, TI part number 2535584-0001.

Adapter and Cables

3.6.2 The 3-channel multifunction option supports either the multifunction adapter or the V.35 cable adapter. These adapters are described in the following paragraphs.

NOTE: The V.35 cable adapter is the same one as used in conjunction with the LAN 802.3 option board.

Multifunction Adapter and Cables

3.6.2.1 The multifunction adapter is mounted on the backplane connector (P2 or P3) of the slot containing the CCB with the 3-channel multifunction option board. The connector, P2 or P3, is determined by the position of the 3-channel multifunction option board on the CCB (that is, either port 0 or port 1).

The multifunction adapter contains line drivers and receivers for both the RS-232C interface and the autocall unit interface. The parallel printer is wired through the adapter to line drivers on the option board.

V.35 Adapter and Cables

3.6.2.2 The V.35 adapter contains a receive multiplexer, line drivers, and control logic for the V.35 protocol and modem.

Network Terminal Concentrator

3.7 The NTC is an intelligent, microprocessor-controlled interface that connects the system enclosure and 16 EIA devices. The intelligent controller executes downloaded 68010 native code or interprets primitive code based on ROM program sequences. Features of the NTC include the following (see also the following figure):

- 68010 16-bit virtual memory microprocessor with full 24-bit addressing capability and data transfer capabilities of byte and words.
- Two-ported 512K-byte dynamic random access memory (DRAM) with versatile access arbitration to optimize performance.
- 8K bytes of fast static random access memory (SRAM) dedicated to the 68010 for stacks, control words, and other time-critical code.
- 32K bytes of read-only memory (ROM) or erasable programmable read-only memory (EPROM) for storage of primitive code interpreter, fixed parameters, or special purpose code.
- 68230 programmable interval timer (PI/T). The PI/T does on-board status handling, flag register source, post reset, and port channel activities.
- Gate-array interrupt controller chip (ICC) designed to interface with the 68010 7-level interrupt assertion and vector and vector generation parameters. The ICC also provides address-based event handling based on the NuBus event handling scheme.
- 23-bit local address bus and a separate 16-bit local data bus that are shared by the main microprocessor, the LAN coprocessor, and the data paths to and from the DUARTs.

The NTC has the same form factor and size as the host system boards.

Power Supply

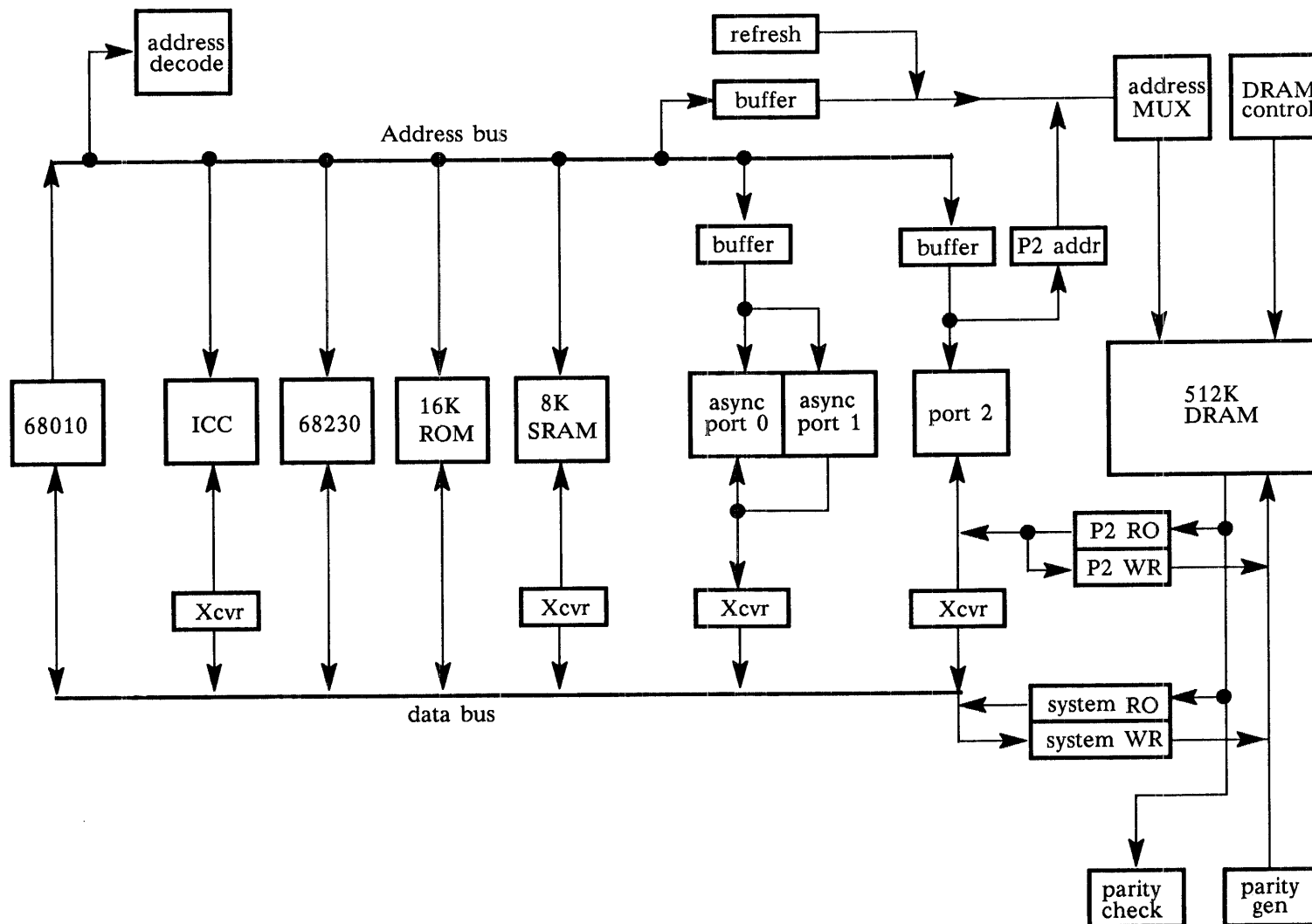
3.7.1 The NTC power supply provides the power required by the NTC controller board, the different adapter boards, and external devices such as the Ethernet transceiver. The power supply is completely separate from the NTC controller board and other NTC components. The NTC power supply produces three voltages and delivers the currents indicated in the following table.

Table 3-3 Network Terminal Concentrator Power Supply Loading

Interface Type	Power Supply Current Drain		
	+5 Vdc	+12 Vdc	-12 Vdc
NTC controller w/Ethernet adapter	6.10 amps	1.25 amps	0.40 amps
NTC controller w/V.35 adapter	6.10 amps	0.80 amps	0.40 amps

The NTC is cooled by convection; it has no cooling fan. All cable connections for the NTC are at the front of the unit, allowing the rear of the NTC to be placed against a wall. However, both sides of the NTC must have clearance so that the convection cooling will be effective.

Figure 3-8 Network Terminal Concentrator Block Diagram

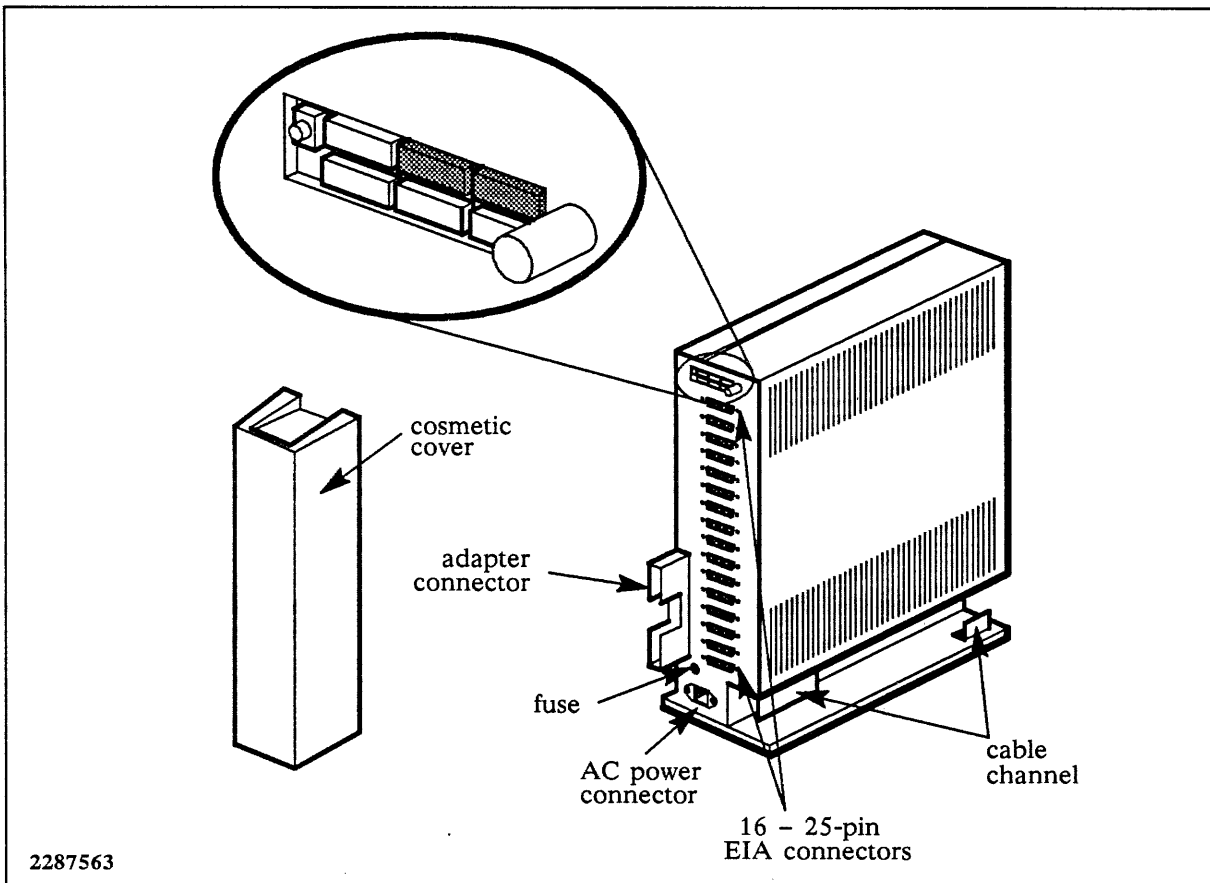


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Front Panel 3.7.2 The front of the NTC, except for the control panel, is covered by a protective cover. When the front NTC cover is removed, the following items can be accessed as shown in Figure 3-9. The exploded view of the control panel is explained in paragraph 3.7.6, Controls and Indicators.

- 16 EIA connectors
- Network adapter interface
- Ac power cord connector
- Ac line fuse

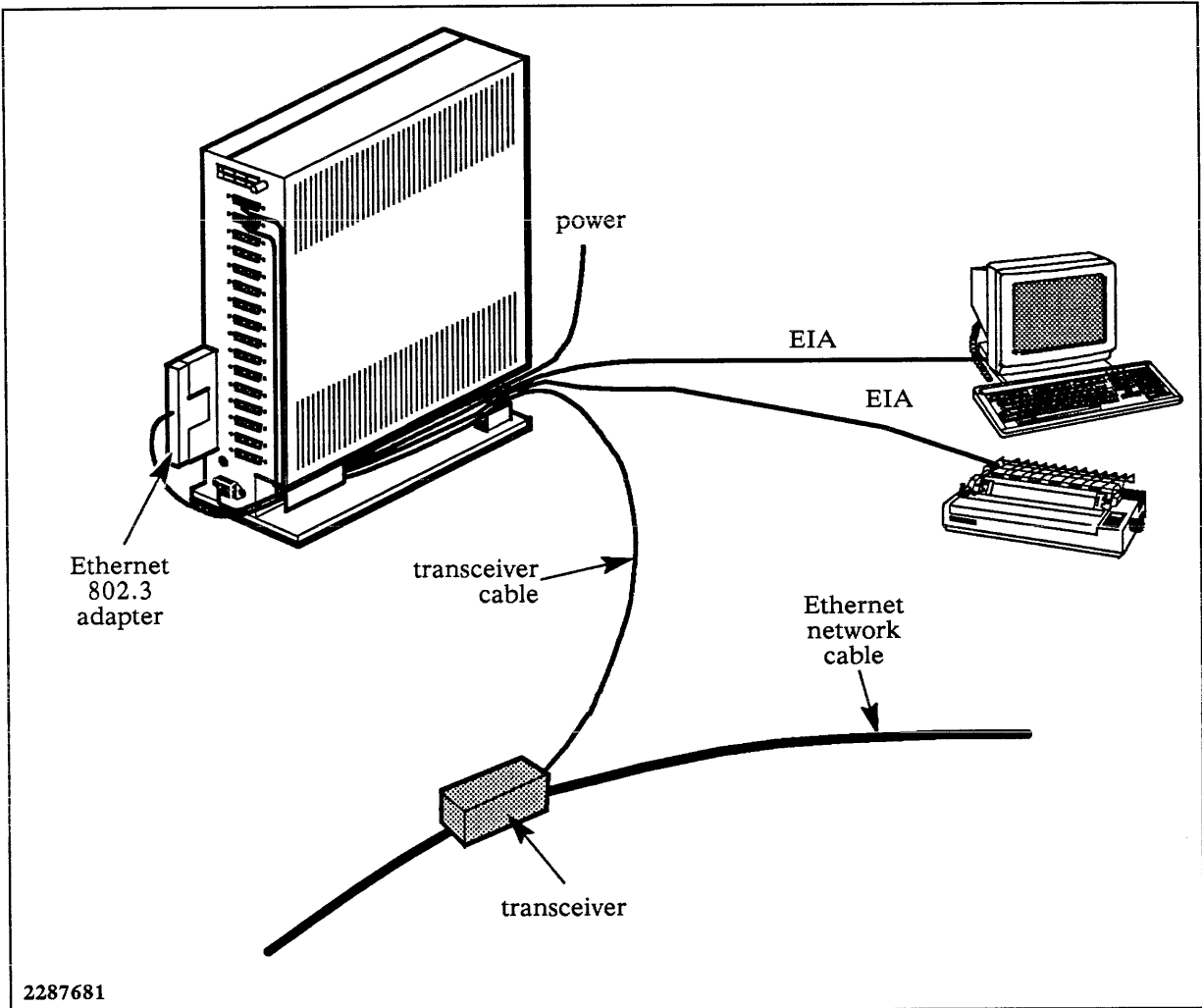
Figure 3-9 Network Terminal Concentrator With Front Cover Removed



Ethernet and V.35 Adapters and Cabling

3.7.3 The two adapters for the NTC are the Ethernet and the V.35 adapter. The Ethernet 802.3 adapter interfaces the NTC to an Ethernet LAN. The Ethernet 802.3 installation requires the Ethernet adapter, the transceiver cable, the transceiver, and network cable to the host system. The V.35 installation requires the V.35 adapter, the adapter to modem cable, the modem, and the telephone link to the host system, as shown in Figure 3-10.

Figure 3-10 Network Terminal Concentrator Ethernet 802.3 Cabling



Cable Routing 3.7.4 All NTC cables connect to the front of the unit; therefore, the cables are easy to install and the installed NTC fits flush against a wall. Two metal guides on the lower right side of the NTC provide a cable tray, routing the cables to the rear of the NTC and then to their respective locations. All cables, EIA data, ac power, and network interface use this same cable tray.

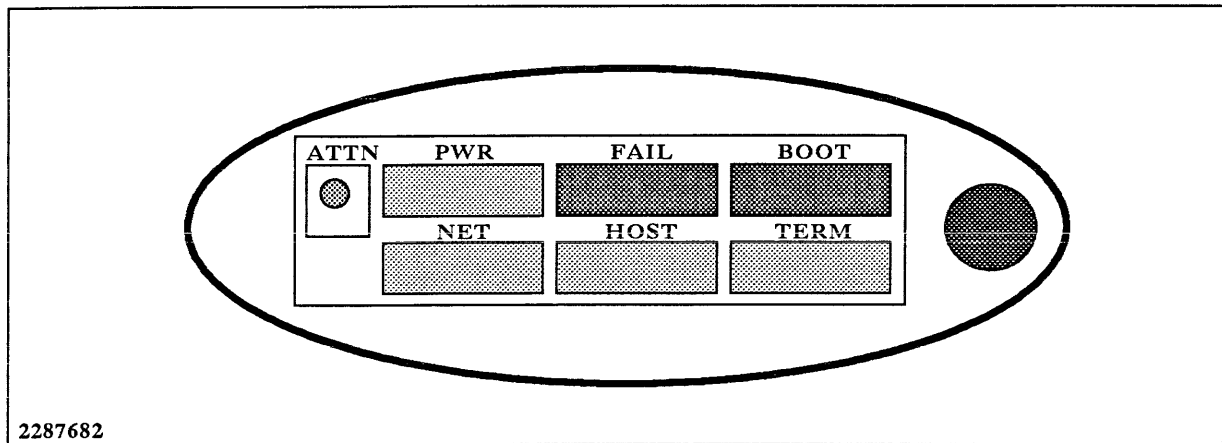
EIA Interface Panel 3.7.5 The EIA connectors mounted on the front panel of the NTC support RS-232C devices such as terminals, serial printers, and full-duplex (FDX) modems. Each of the 16 separate 25-pin connectors provides the following EIA signals to the peripherals:

- GND (1) — Ground
- XMT (pin 2) — Transmit data
- RCV (pin 3) — Receive data
- DTR- (pins 4 and 20) — Data terminal ready
- DSR- (pin 6) — Data set ready
- GND (pin 7) — Ground

Controls and Indicators 3.7.6 The controls and indicators, shown in Figure 3-11, consist of the power on/off button, the nonmaskable interrupt (NMI) switch, and the fault and status indicators (LEDs). The power on/off switch controls power to the NTC and to the Ethernet transceiver, when the transceiver is connected to the NTC. The status and fault LEDs signal the following:

- Power on (top left) — Illuminated when 5 volts is applied to the NTC controller board.
- Carrier sense (bottom left) — Illuminated whenever the carrier-sense signal from the adapter is active. This means that the network cable has an active signal (that is, a frame is being transmitted on the network).
- Self-test (top center) — Illuminated during self-test. This indicates a failure if it remains on after completion of self-test.
- Packet received (bottom center) — Illuminated whenever the NTC recognizes its own address on an incoming network packet.
- Boot in progress (top right) — Illuminated when the NTC controller board is getting its initial program download over the network or transmitting an upload of the NTC RAM software.
- RS-232C data (bottom right) — Illuminated whenever there is an input on any of the EIA channels of the NTC.

Figure 3-11 Network Terminal Concentrator Controls and Indicators



Network Terminal Concentrator Test Capabilities

3.7.7 The NTC features powerful on-board diagnostics that are activated at two levels. The NTC automatically executes a power-up self-test that uses the internal loopback capabilities to verify proper operation of the on-board logic. However, the operator also can invoke extended on-board diagnostics. The power-up self-test automatically executes when power is applied to the NTC, and the extended diagnostics are invoked when the ATTN switch is pressed. Figure 3-12 shows the state diagram of the ATTN switch.

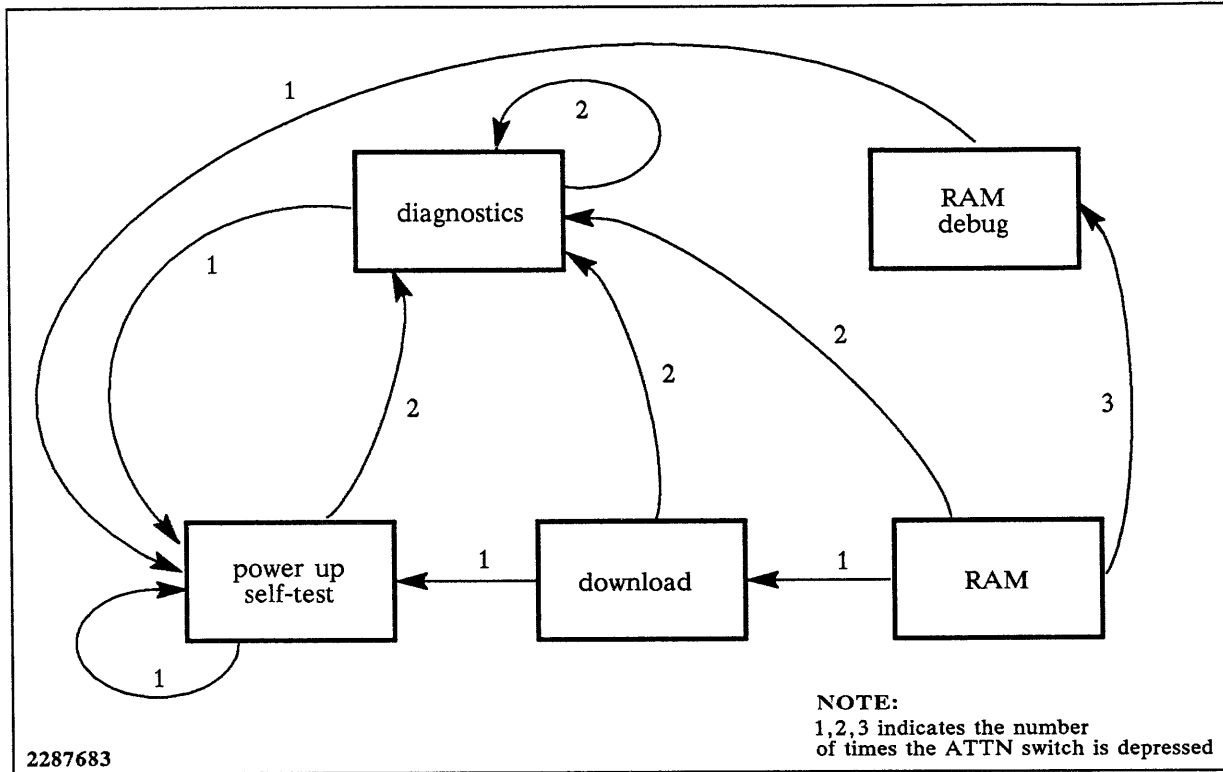
The following information is an overview of the operation of the NTC and its testing capability. For additional information on the test capabilities of the NTC, refer to the diagnostic software manual furnished with the system. Error codes for the NTC are listed in Appendix A.

The NTC can be in three states: power-up self-test, download, or RAM. In power-up self-test, the NTC checks itself and, after successful completion, downloads its operating software from the host Explorer system. When the operating software has been downloaded, the NTC is in the RAM state, running from the program loaded in NTC memory. If the ATTN switch is pressed once during the power-up self-test state, the NTC restarts the self-test. If the ATTN switch is pressed once when the NTC is in the download state, the NTC restarts the self-test and downloads again. If the ATTN switch is pressed once when the NTC is in the RAM state, the NTC again downloads from the host Explorer system.

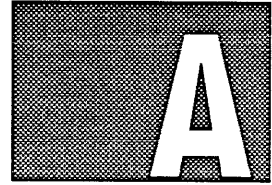
If the ATTN switch is pressed three times while the NTC is in the RAM state, the NTC goes into the RAM debug state, used for debugging machine-level code on the NTC controller board. If you should accidentally get into the RAM debug state, you can return to the RAM state by pressing the Z key on the video display terminal (VDT) connected to the lowest-numbered port (0 through 15) of the NTC, or simply press the ATTN switch once and the NTC will begin its initialization routine.

If the ATTN switch is pressed twice when the NTC is in any of the three operating states (power-up self-test, download, or RAM), the NTC enters the diagnostic state. To exit the diagnostic state of the NTC, press the ATTN switch one time, and the power-up self-test will be initiated. For information on the CCB diagnostic state, refer to the S1500 *Diagnostic User's Guide*, TI part number 2534850-0001.

Figure 3-12 State Diagram of ATTN Switch Test Functions



ERROR CODES



CCB/NTC Error Codes

A.1 The following error codes are displayed on VDTs attached to either the CCB or NTC. Error codes that indicate a NuBus error are for the CCB and have no meaning if displayed on a VDT attached to the NTC.

Table A-1

System Errors

Error Code	Definition
04	Standard command (05) failed
05	Address exception occurred
06	Illegal instruction exception occurred
07	Zero divide exception
08	Check error
09	Trap on overflow instruction
0A	Privilege violation
0B	Trace error
0C	Format error
0D	Spurious exception
0E	Unsupported exception
0F	NuBus bad status
10	Unable to generate an invalid exception
11	Unable to generate a NO_ENABLE bus exception
12	Bus error occurred with no source
13	Unexpected invalid bus error
14	Unexpected backoff bus error
15	Unexpected bad status bus error
16	Unexpected NO_ENABLE bus error
17	Unexpected bus error
18	Unable to generate a timeout exception
19	Nonmaskable interrupt occurred with no source
1A	NUBUS enabled at the wrong time
1B	Unexpected program error
1C	Unexpected parity error low byte
1D	Unexpected parity error high byte
1E	Unexpected timeout error
1F	Unable to generate an illegal instruction exception
20	Unable to generate a program error exception
21	NUBUS test failed
22	NUBUS not enabled
23	Invalid PSCB command in PSCB byte zero
24	Invalid command after EMIT bit set (STBM)
25	Invalid SUBTEST number in PSCB byte 1
26	Invalid option card installed
27	Cannot convert character to ASCII

Table A-1

System Errors (Continued)	
Error Code	Definition
28	Invalid port ID
29	Unable to initialize diagnostic monitor
2A	Diagnostic monitor transmitter not ready
2B	Diagnostic monitor lost DSR

Table A-2

Kernel Self-Test Errors	
Error Code	Definition
30	ROM CRC error on MSB
31	ROM CRC error on LSB
32	RAM pattern test failed
33	RAM bit test failed
34	RAM address test failed
35	RAM parity test failed
36	RAM parity error
37	Parity error low byte
38	Parity error high byte
39	Parity error low byte during address test
3A	Parity error high byte during address test
3B	Unable to generate parity error MSB
3C	Unable to generate parity error LSB
3D	Unexpected parity error MSB
3E	Unexpected parity error LSB
40	Unexpected PI/T exception
41	Unable to generate PI/T exception as expected
42	PI/T register failed the data test
43	PI/T register failed the address test
44	PI/T timer running too fast
45	PI/T timer running too slow
46	PI/T second exception never occurred
48	ICC timer error
49	First ICC timer exception never occurred
4A	Second ICC timer exception never occurred
4B	ICC counter too slow
4C	ICC counter too fast
4D	Unexpected ICC timer exception occurred
4E	ICC register failed the data test
4F	ICC spurious interrupt error
50	ICC RAM exception error
51	All ICC RAM exceptions did not occur
52	ICC exception with no source

Table A-3

Download Mode Errors	
Error Code	Definition
60	Received packet of unknown type
61	82586 command complete with error
62	Invalid adapter installed for download
63	Timeout error
64	XMIT error
65	XMIT retry 8 times error
66	Receive unit not able to start
67	Cannot receive
68	82586 did not clear the SCB command word
69	Receive error
6A	Receive timeout
6B	Bad data length
6C	No LAN card exists

Table A-4

Network Errors	
Error Code	Definition
A0	Adapter does not support internal loopback
A1	LAN ID checksum error
A2	LAN ID PROM all 0s
A3	LAN ID PROM all 1s
A4	LAN ID contains a multicast ID
A5	LCC timeout (no interrupt)
A6	No LAN interrupt after RESET and CHANNEL ATTENTION
A7	LCC not in idle state after clear interrupt
A8	LCC failed to clear an interrupt
A9	LCC completion status error
AA	Busy byte not cleared in the ISCP
AB	SCB status error in ISCP routine
AC	Executing the offboard test at the wrong time
AD	Compare blocks failed
AE	Maximum retry error
AF	Link error
B0	Returned status error during frame check
B1	Configuration command returned bad status
B2	Receive frame status error
B3	Invalid adapter installed for this test
B4	Unexpected LAN exception
B5	CRC error
B6	LAN board not installed
B7	Offboard test failed at power-up time
B8	Net port access generated timeout (no DTACK)

Table A-5

4-Channel and 8-Channel Option Board Errors	
Error Code	Definition
C0	Four-channel write and read control registers test failed
C1	Four-channel interrupts and counter test failed
C2	Four-channel baud rate test failed
C3	Four-channel async loopback test failed
C4	Four-channel adapter board test failed
C5	Four-channel write and read to all DUARTs test failed
C6	Four-channel no DTACK, local bus timeout occurred
C7	Four- or eight-channel invalid option board for this test
C8	Eight-channel write and read control registers test failed
C9	Eight-channel interrupts and counter test failed
CA	Eight-channel baud rate test failed
CB	Eight-channel async loopback test failed
CC	Eight-channel adapter board test failed
CD	Eight-channel write and read to all DUARTs test failed
CE	Eight-channel no DTACK, local bus timeout occurred
CF	Four- or eight-channel async control lines test failed (subtest error of read and write control register test on executed with loopback connector bit is set)

Table A-6

Option ROM Checksum Errors	
Error Code	Definition
D0	Any option board ROM checksum error
D1	Sync read and write control registers test failed

Table A-7

Sync PI/T 230 Timer and Interrupt Test	
Error Code	Definition
D2	PI/T 230 counter too slow or too fast
D3	No PI/T counter interrupt

Table A-8

Sync Adapter Test

Error Code	Definition
D4	Adapter board installed test failed
D5	ACU port check failed using external loopback connector
D6	RS-232C port check failed using external loopback connector
D7	Parallel port check failed using external loopback connector
D8	More than one port failed with external loopback connector
D9	V.35 port check failed using external loopback connector

Table A-9

No DTACK Errors for Sync Option Board

Error Code	Definition
DA	Miscellaneous output port - no DTACK
DB	Miscellaneous input port - no DTACK
DC	230 counter/timer chip - no DTACK
DD	DMAC chip - no DTACK
DE	MPCC chip - no DTACK
DF	Invalid option board installed

Table A-10

Async Loopback Test

Error Code	Definition
E0	Time-out expired error
E1	Receiving data errors
E2	Unexpected or missing MPCC interrupts
E3	MPCC chip detected an error

Table A-11

BOP Loopback Test	
Error Code	Definition
E4	Time-out expired error
E5	Receiving data errors
E6	Unexpected or missing MPCC interrupts
E7	MPCC chip detected an error

Table A-12

NRZI BOP Loopback Test	
Error Code	Definition
E8	Time-out expired error
E9	Receiving data errors
EA	Unexpected or missing MPCC interrupts
EB	MPCC chip detected an error

Table A-13

Async DMA Loopback Test	
Error Code	Definition
EC	Time-out expired error
ED	Receiving data errors
EE	Unexpected or missing DMA interrupts
EF	DMA chip detected an error

Table A-14

BOP DMA Loopback Test	
Error Code	Definition
F0	Time-out expired error
F1	Receiving data errors
F2	Unexpected or missing DMA interrupts
F3	DMA chip detected an error

Table A-15

DMA PAL State Machine

Error Code	Definition
F4	DMA state machine error

Table A-16

High-Speed BOP DMA Loopback Test

Error Code	Definition
F8	Time-out expired error
F9	Receiving data errors
FA	Unexpected or missing DMA interrupts
FB	DMA chip detected an error

Table A-17

Bisync DMA Loopback Test

Error Code	Definition
FC	Time-out expired error
FD	Receiving data errors
FE	Unexpected or missing DMA interrupts
FF	DMA chip detected an error

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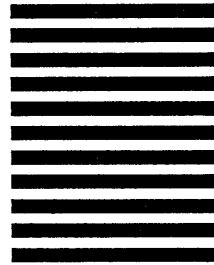
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