TEK SERVICE MANUAL

Part No. 070-7572-00

XD88
COMPUTE ENGINE MODULE
FIELD SERVICE

Please check for CHANGE INFORMATION at the rear of this manual

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COMMITTED TO EXCELLENCE

WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

MANUAL REVISION STATUS

PRODUCT: XD88 Series Products

This manual supports the following versions of this product: Serial Number B010100 and up.

REV DATE	DESCRIPTION
MAY 1989	Original Issue.

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Section 1

INTRODUCTION

PRODUCT DESCRIPTION

The XD88 Series Compute Engine Module (CEM) incorporates a modular design that allows its configuration to expand as processing complexity increases. Within each CEM is a Backplane board that implements a multiple parallel bus structure and accepts a variety of standard and optional modular logic boards. A complete listing of the various logic boards available for the CEM appears later in this section.

The CEM's primary configuration is as an integrated applications processor operating in combination with a Tektronix graphics subsystem to provide a stand-alone graphics workstation. In addition to graphics workstation configurations, the design of the CEM permits configuration for any application that requires a high-performance applications processor operating under an enhanced version of AT&T's System V UNIX.

A 32-bit M88100 microprocessor, operating at 20 MHz and located on the CEM's Compute Engine (CE) board, is the CEM's central processor. Operation of the M88100 is augmented by Cache Memory Management Units (CMMUs), which provide high-speed cache memory.

Other standard features include: eight megabytes of random-access memory (RAM) shared by the firmware and application programs, a 156-Mbyte fixed disk drive, a 125-Mbyte streaming tape unit, and a high-efficiency power supply. Optional features include: extended memory (16 or 32 Mbytes), magnetic peripherals, VME adapter, and I/O expansion boards.

NOTE

Detailed service information (schematics, parts lists, theory of operation) for some circuits and custom ICs is proprietary. Contact your Tektronix service center for more information.

ABOUT THIS MANUAL

This manual is part of a larger field service set and contains field service information necessary to isolate faulty field replaceable units (FRUs) in the CEM.

This field service manual discusses these topics:

Section 1, *Introduction*, provides the product description and identifies product features. The physical description includes an overview of FRU arrangement and diagrams that show the location of controls and connectors.

Section 2, *Specifications*, lists the characteristics and product specifications for the CEM.

Section 3, *Theory Overview*, includes functional block diagrams and block-level descriptions for each FRU in the CEM.

Section 4, *Diagnostics*, briefly describes the procedures and tools for field diagnosis of a malfunctioning CEM.

Section 5, *Maintenance Procedures*, contains preventive and corrective maintenance procedures for the CEM. The section includes procedures for disassembly and reassembly of the CEM required for troubleshooting, calibration, repair, or replacement of system FRUs.

Section 6, *Performance Checks*, contains the checks required to keep the CEM performing optimally. The section includes a list of test equipment needed, a summary of the performance checks, and a detailed test points diagram.

Section 7, *Replaceable Parts List*, gives a comprehensive listing of Tektronix part numbers as a reference for replaceable parts of the CEM.

Section 8, *Diagrams*, contains the logical block diagram that shows the structure of the CEM's primary circuitry and a system interconnect diagram which shows the connections between the CEM's FRUs.

Appendix A, *Connector Descriptions*, provides pinout configurations for each connector on the Backplane board as a reference for the service technician.

PHYSICAL DESCRIPTION

The CEM is housed in a six-piece plastic shell surrounding an aluminum chassis that provides EMI shielding. Access to the CEM's modular logic boards and power supply is through the rear panel. The CEM's Backplane board and magnetic peripheral subassembly are removed through the front panel. Section 5 provides complete details on removal and repacement of all the field replaceable units (FRUs) inside the CEM.

CEM FRONT PANEL

Located on the CEM's front panel (see Figure 1-1) is the main power switch providing a software controlled power-down of the CEM.

Other features of the CEM's front panel include:

- Streaming tape unit
- Optional magnetic peripheral slot

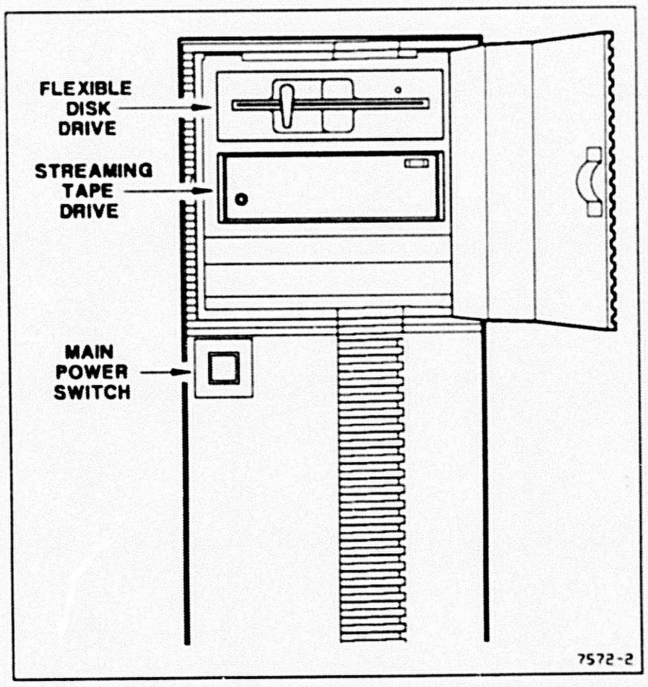

Figure 1-1. CEM Front Panel Features.

CEM REAR PANEL

On the CEM's back panel are the configuration and diagnostic switches that invoke the Self-Test diagnostic programs described in the *Field Service Overview* manual and a seven-segment LED that provides error and status indication. In addition, the CEM's rear panel provides these switches and connectors (see Figure 1-2):

- Input/Output board
  - Port 0 and Port 1 — RS-232-D ports (DMA)
  - Copier — Centronics-style copier port
  - SCSI port — Small Computer System Interface
  - LAN port — Local Area Network connector
- Compute Engine board
  - Configuration switches — controls operation
  - Seven-segment LED display — diagnostic indicator
  - Two additional RS-232-D ports — on auxiliary board
- Power Supply
  - Voltage selector switch
  - System Fuse
  - AC input connection

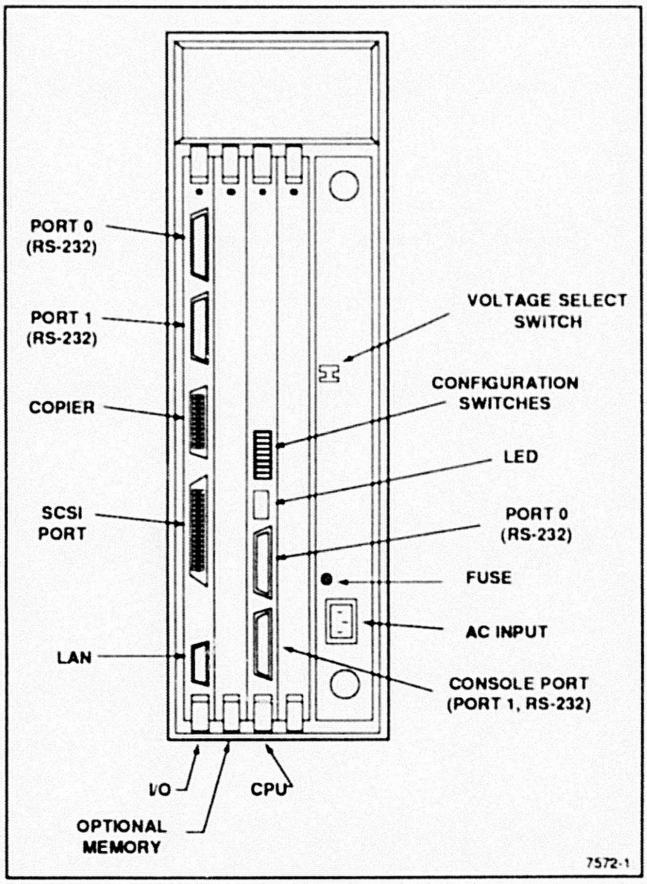

Figure 1-2. CEM Rear Panel Features.

CEM INTERNAL STRUCTURE

Internally, the CEM consists of these field replaceable units (see Figure 1-3):

- Compute Engine (CE) board
- Auxiliary RS-232-D board
- Input/Output board
- Backplane board (including Terminator boards)
- Optional Input/Output board*
- Power supply
- Cooling fan
- Optional 1.2-Mbyte and 360-Kbyte flexible disk drives
- Optional 125-Mbyte streaming tape drive
- 156-Mbyte and optional 300-Mbyte fixed disk drives
- Magnetic peripheral controller board (flexible drive)
- Extended Memory board and daughter boards
- Local Bus Converter board*

* Not shown in Figure 1-3

The CEM's modular logic boards and power supply are removed and replaced as single units. When the magnetic peripherals or the system cooling fan require service, remove the magnetic peripheral subassembly according to the instructions given in Section 5 of this manual.

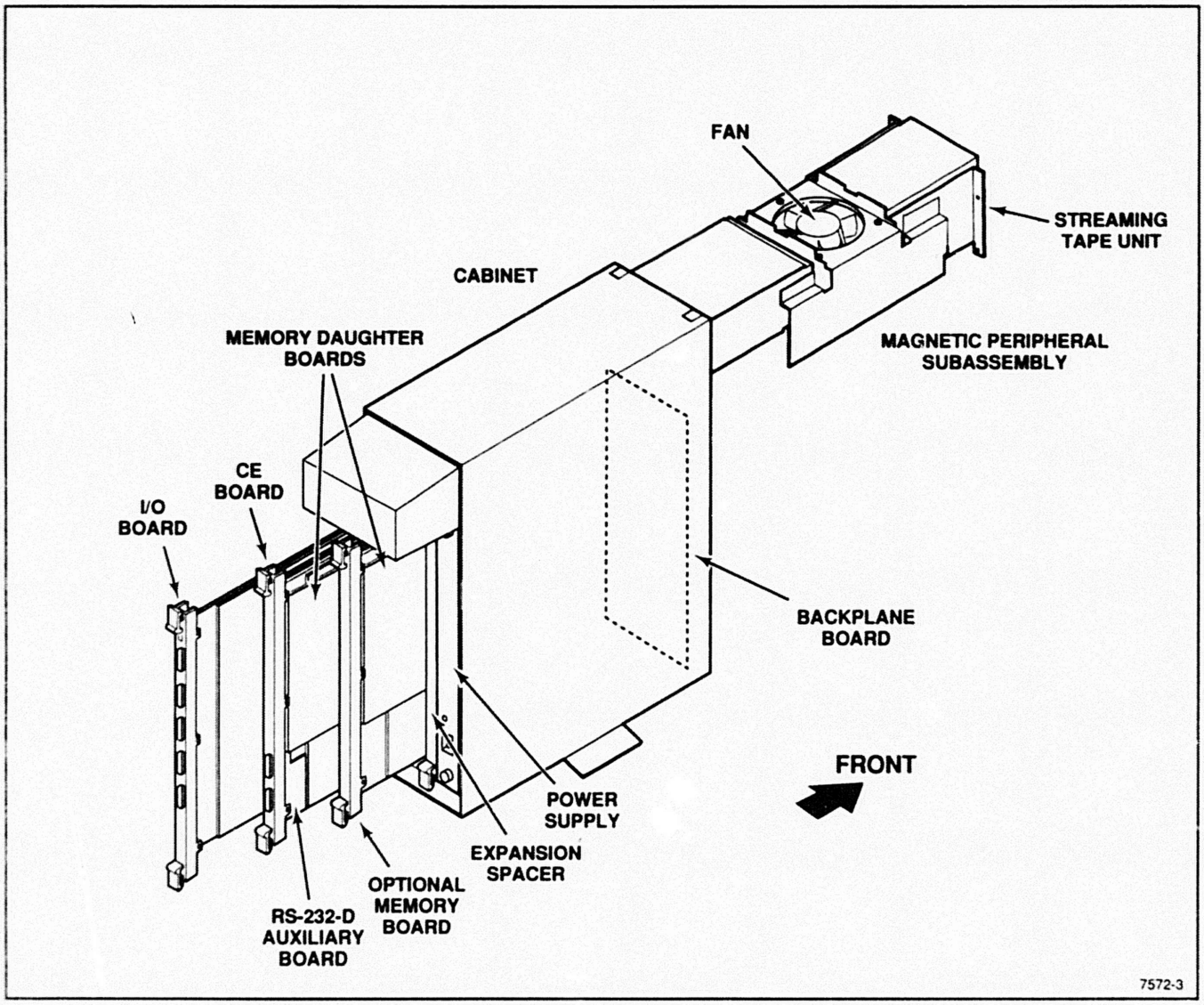

Figure 1-3. CEM Subassemblies.

Section 2

SPECIFICATIONS

INTRODUCTION

This section summarizes characteristics and performance specifications of the CEM. In order for these specifications to be achieved and to ensure proper performance the following conditions must be met:

1. The CEM must be installed properly and operating in an environment that does not violate its advertised specifications. See Table 2-4, Environmental Specifications.
2. The CEM's AC line source must meet specified power requirements. See Table 2-2 (CEM Electrical Specifications). The CEM operates from a power source with its neutral line at or near ground potential. It is not intended for operation from two phases of a multiphase system.

CEM SPECIFICATIONS

The following tables contain specifications and characteristics of the CEM. Use these specifications while selecting an installation site and performing the performance checks described in Section 6.

CAUTION

In workstation configurations, be sure to plug the male ends of each module's power cord into a different outlet. These outlets should be protected by separate breakers to avoid circuit overloading.

For detailed specifications of the individual field replaceable units contained within the CEM, see the technical data manual that describes the FRU.

PHYSICAL DIMENSIONS

Table 2-1 provides the physical dimensions of the CEM.

Table 2-1
CEM DIMENSIONS

Characteristic	Specification
Weight	68.0 lb. (30.9 kg)
Width	7.9 in (201 mm)
Height	24.2 inches (615 mm)
Depth	23.8 inches (605 mm)

ELECTRICAL SPECIFICATIONS

Table 2-2 lists the electrical specifications of the CEM.

Table 2-2
CEM ELECTRICAL SPECIFICATIONS

Characteristic	Performance
Nominal input voltages	
115V	90-128Vrms @@ 47-63 Hz
230V	180-256Vrms @@47-63 Hz
Max. power	
Single CEM chassis	472W
Fuse	
(115V or 230V)	15A/250V(type 3AB)
+5.2V	
Regulation	±1% of nominal
Current	
Peak	85A (1 minute)
Continuous	75A
+12V	
Regulation	±3%
Current	
Peak	14A (7 seconds)
Continuous	10A
-12V	
Regulation	±5%
Current	
Peak	1A
Continuous	1A
Fan Voltage	+12V to +26V
Current	
Peak	1.5A (2 seconds)
Continuous	1A

SITE CONSIDERATIONS

Tables 2-3 and 2-4 contain the installation requirements and environmental specifications of the CEM. When servicing or installing the CEM, maintain these requirements.

Table 2-3
INSTALLATION REQUIREMENTS

Characteristic	Supplemental Information
Heat dissipation	
Min configuration	1205 BTU/hr (typical)
Max configuration	1604 BTU/hr (typical)
Surge current	At turn on
110V	100A (typical)
220V	100A (typical)
Cooling clearance	
Sides	12 in
Back	8 in
Distance from EMI sources	The CEM should be as far removed from motors, fans, or other electromagnetic devices as possible

Table 2-4
ENVIRONMENTAL SPECIFICATIONS

Characteristic	Performance Requirement
Temperature	
Operating	+50° to +104° F (+10° to +40° C) Derate one degree for: Every 1000 ft over 5000 ft. Every 5% humidity over 40%
Nonoperating	-40° to +149° F (-40° to +65° C)
Altitude	
Operating	To 10,000 ft (3050 m)
Nonoperating	To 40,000 ft (12,200 m)
Humidity	
Operating	20% to 80% relative humidity (non-cond.)
Nonoperating	10% to 95% relative humidity (non-cond.)
Vibration	Withstands 0 to .010 in. displacement at 5 Hz to 200 Hz to 5 Hz (all 3 major axes)
Shock	Cabinet withstands a 20-g shock to all faces (non-op)
Electrostatic Immunity	
Operating	No interruption of operation, loss of data, or change of operating mode from 15kV discharge.
Nonoperating	No damage to the CEM from 20kV discharge.

COMMUNICATIONS PERFORMANCE

Table 2-5 provides a list of data transfer rates for each interface port provided by the CEM.

Table 2-5
COMMUNICATION PERFORMANCE

Characteristic	Supplemental Information
Alphanumeric (only) communications rate	38.4 kBaud maximum RS-232-D only
DMA Interface	1 Mbyte/sec
SCSI (ANSI X3.131-1986)	
Asynchronous	2 Mbyte/sec
Synchronous	3.3 Mbyte/sec
Four RS-232-D ports	communicate with peripheral devices at 38.4 kBaud maximum
Hard Copy Interface Centronics-style parallel interface	714 Kbytes/sec burst such as Tektronix 4692, 4696, 4693D or Epson FX80 compatible
LAN (IEEE 802.3)	10 Mbit/sec burst

NOTE

The CEM has been certified in accordance with Class A (FCC), and Class B (VDE) computing device/peripheral rules. Operation with a non-certified peripheral may result in interference to radio and TV reception. It also conforms to Canadian (EMC) standards for Class A devices.

Section 3

THEORY OVERVIEW

INTRODUCTION

This section presents an overview of the XD88 Series Compute Engine Module's (CEM) theory of operation. The general theory information contained here should aid you in field analysis of malfunctions or in diagnosing improper use of the CEM.

This theory discussion focuses on the CEM's hardware aspects and only describes the software/firmware features needed for troubleshooting.

FUNCTIONAL OVERVIEW

The CEM is a high-performance applications processor running under the UTek V operating system. UTek V is based on AT&T's System V UNIX with enhancements added by Tektronix. The CEM's Compute Engine (CE) board employs a M88100 microprocessor operating at 20 MHz and multiple M88200 Cache Memory Management Units (CMMUs). Also, the CE board accepts a memory daughter board that provides either 8 Mbytes or optional 16 Mbytes of RAM.

Figure 3-1 diagrams the function and process flow for a typical configuration of the CEM. Theory descriptions follow this overview under module or board headings.

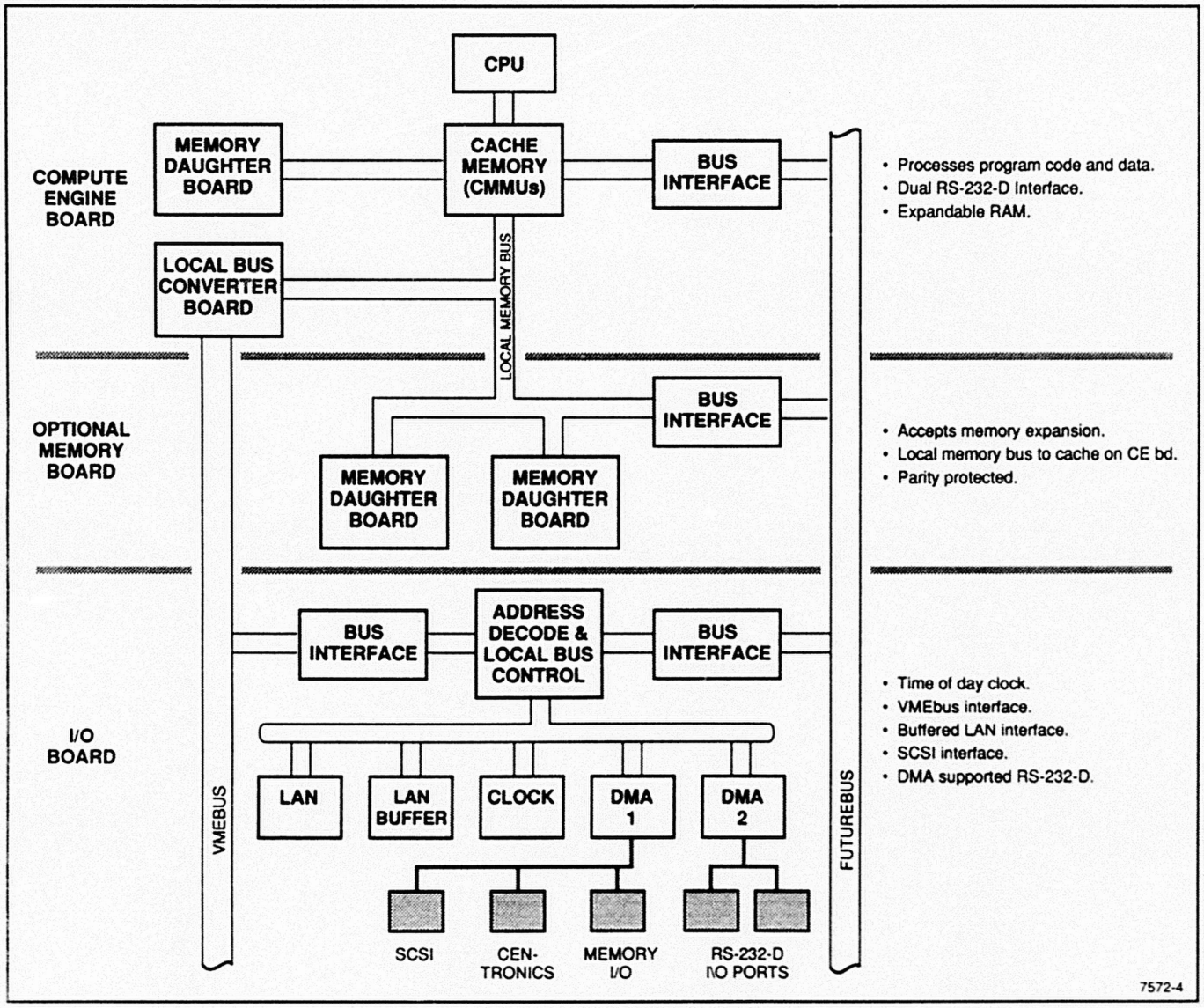

Figure 3-1. CEM Functional Diagram.

CEM THEORY

The CEM's Backplane board provides a multiple parallel bus architecture using the IEEE 896 Futurebus as the central system bus. The I/O board provides ports for communication with a number of peripheral devices via RS-232-D, LAN, SCSI, or a Centronics-type parallel data path.

To enhance the CEM's capabilities, optional Memory boards are available to increase system RAM up to 176 Mbytes. Each Memory board accepts one or two memory modules and holds a maximum of 32 Mbytes of RAM each.

The remainder of this section presents discussions of each CEM FRU. Included with these discussions are diagrams that show the major features of each subassembly. The discussions start with the CEM's Compute Engine (CE) board.

CE BOARD

The CE board provides the M88100 compute resources, M88200 cache memory, and standard system memory for the CEM. The major components include (see Figure 3-2):

- CPU and CMMUs
- Dual RS-232-D ports (on auxiliary board)
- Diagnostic input and output devices (on auxiliary board)
- Standard system RAM (on daughter board)
- Futurebus interface

NOTE

The RS-232-D ports located on the I/O board provide DMA capabilities. The two located on the Compute Engine board do not.

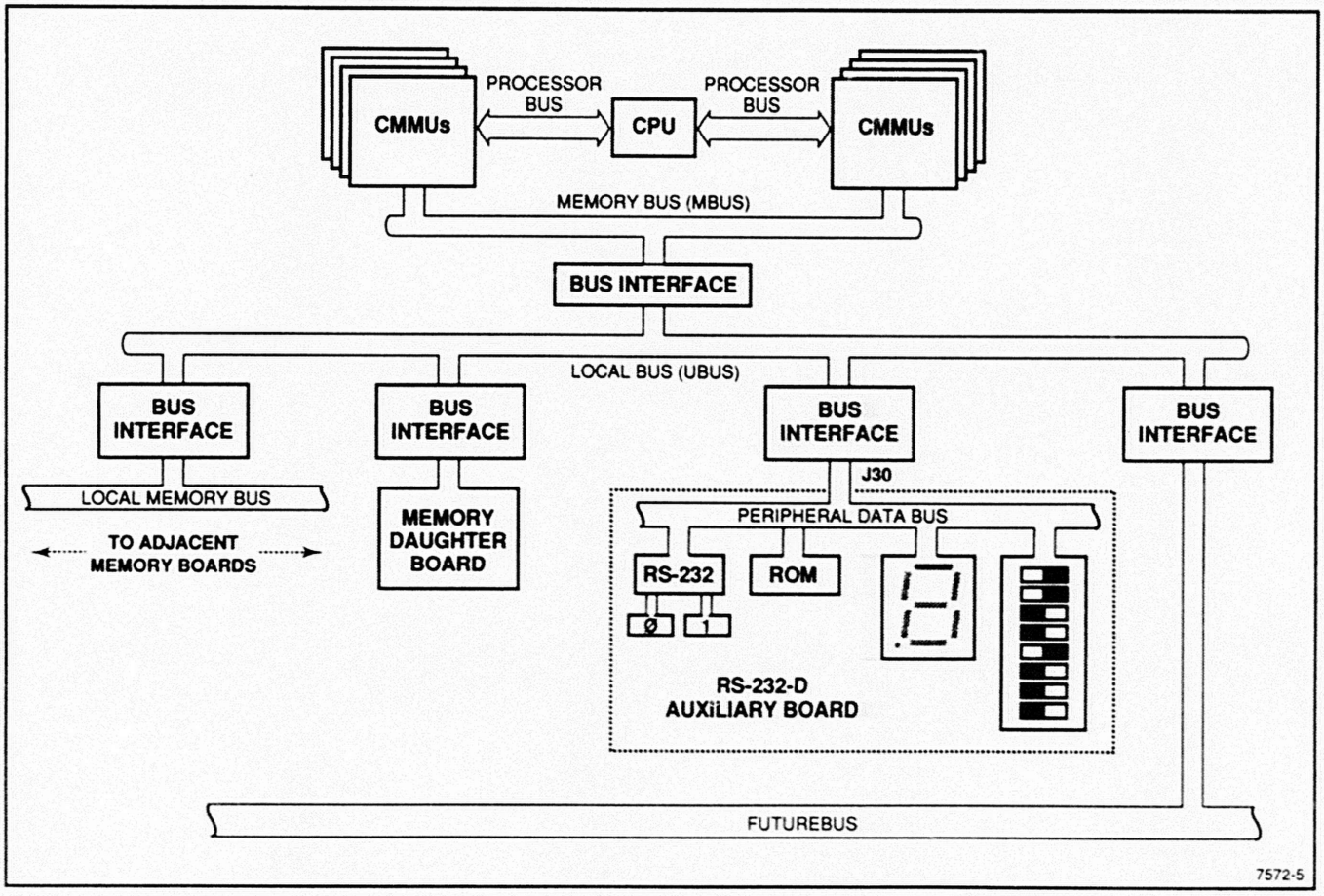

Figure 3-2. CE Board Block Diagram.

CPU and CMMUs

The M88100 (CPU) operates at a clock speed of 20 MHz and utilizes a dedicated processor bus to support a maximum of eight (four per bus) M88200 Cache Memory Management Units (CMMUs). The CMMUs interface directly with the memory bus and provide the CEM with cache memory (16 Kbytes each) for storage of frequently used program code and data, enabling the CPU to rapidly access information.

RS-232-D Ports

The RS-232-D ports provided on an auxiliary board attached to the CE board allow programmable baud rates of up to 38.4 Kbaud with less than 0.3% error and programmable configurations (parity, number of bits, etc.). Based on the Z85C30 serial communications controller, the interface is full-duplex, asynchronous, and compatible with existing RS-232-C interfaces.

Diagnostic I/O Devices

Also located on the RS-232-D auxiliary board, the diagnostic I/O devices include the seven-segment (with decimal point) LED display and a bank of eight DIP switches. The LED display provides a visual indication of board status and the DIP switches activate the various diagnostic features included in ROM and on a subdirectory of the fixed disk. See the *XD88 Series Field Service Overview Manual* for detailed information on CEM diagnostics.

Standard RAM

The standard RAM provides the main system memory for the CEM. Included in this block are the access timing, refresh generation, and actual memory devices. The standard CEM configuration includes 8 Mbytes of RAM mounted on a daughter board, which is secured to the CE board by five posts and a single Torx screw. The CEM's options allow system RAM to increase to a maximum of 176 Mbytes in 16-Mbyte increments.

The memory system's design allows 32-bit burst mode transfers to support the CMMUs and the DMA I/O system. Also, the CE board can access memory located on adjacent memory boards (up to 64 Mbytes) via the local memory bus (LMB). Memory access by the CE board across the LMB avoids the added time required for bus arbitration necessary for Futurebus transfers. The CE board's ability to access up to 64 Mbytes of optional memory via the LMB results in enhanced system performance.

Futurebus Interface

This block provides the interface between the CE board and the system bus (Futurebus). It contains the state machines, registers, and transceivers required to implement the IEEE 896 protocols. The signals present on the 96-pin connector that conveys the Futurebus interface appear in Appendix A.

I/O BOARD

The CEM's I/O board provides a number of interfaces for communication with standard and optional system peripherals. Interfaces available on the I/O board include (see Figure 3-3):

- DMA interface
- RS-232-D Interface
- SCSI interface
- LAN interface
- VMEbus interface
- Centronics-style copier interface
- Futurebus interface
- Time of day clock (battery-backed)

NOTE

On systems configured with internal mass storage, the magnetic peripherals connect to the SCSI interface on the I/O board. This connection occurs on the VMEbus Terminator board installed in slot 1 on the front side of the Backplane board. (Slot 1 is the left-most slot when viewing the CEM from the back.)

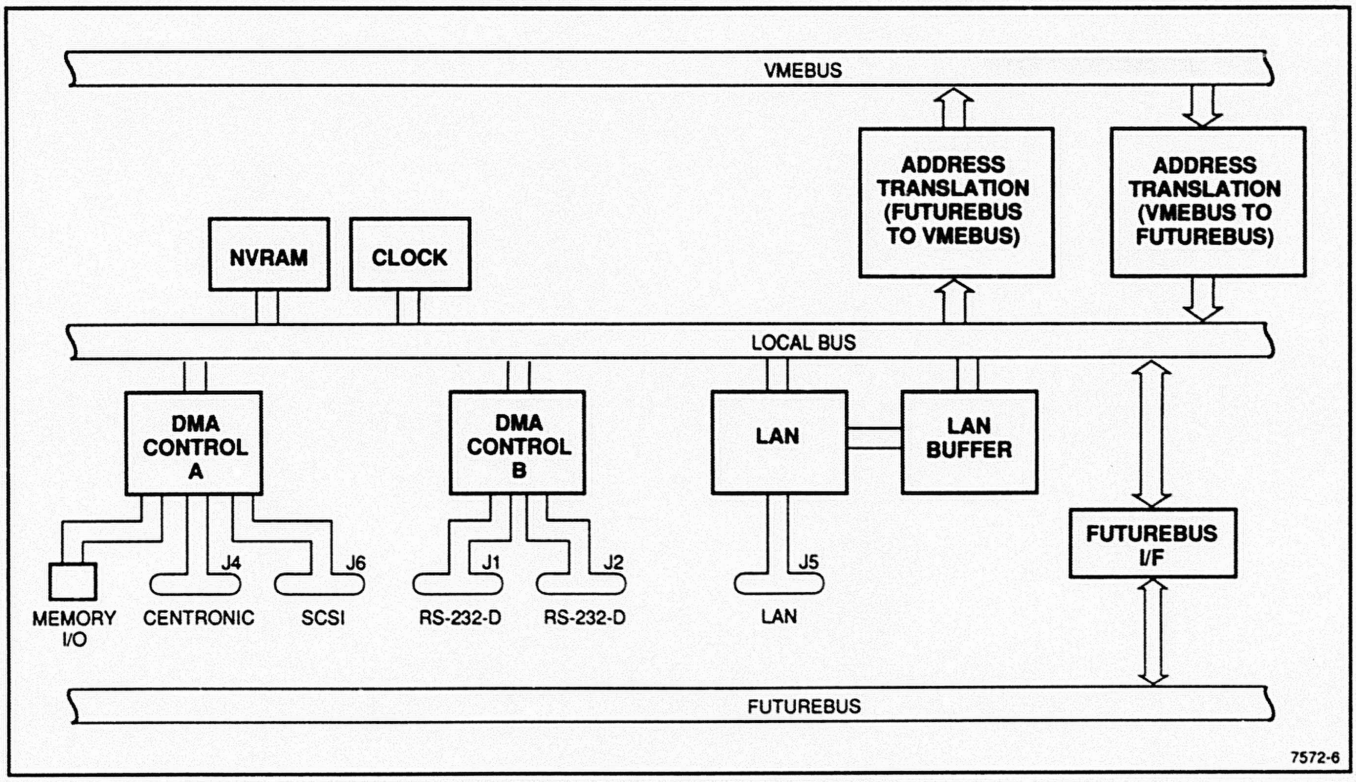

Figure 3-3. I/O Board Block Diagram.

DMA Interface

The I/O board implements DMA using two WE32104 devices. Each device provides four DMA channels, an eight-bit peripheral bus, 32-bit address and data buses, and memory-to-memory or memory-fill operations. In addition, each DMA channel has a 32-byte internal FIFO and transfers data to and from memory in 32-bit words to reduce bus bandwidth requirements.

One four-channel WE32104 controller provides DMA support for the RS-232-D interface (two channels each). The other controller provides support for the SCSI, Centronics parallel interface, and memory-to-memory operations.

RS-232-D Interface

The RS-232-D ports provided on the I/O board allow programmable baud rates of up to 38.4 Kbaud with less than 0.3% error and programmable configurations (parity, number of bits, etc.). Based on the Z85C30 serial communications controller and supported by the DMA controller, the interface is full-duplex, asynchronous, and compatible with existing RS-232-C interfaces.

SCSI Interface

The SCSI interface provides access to internal and external mass storage devices. Compatible with ANSI X3.131-1986 specifications, this single-ended synchronous interface operates at a maximum transfer rate of 3.3 Mbytes per second.

LAN Interface

The LAN interface supports an IEEE 802.3 (Ethernet) network and provides a 256 Kbyte buffer consisting of dual-ported RAM. This dual-ported feature allows access by the LAN controller and I/O board's internal bus.

VMEbus Interface

The VMEbus interface gives the CEM the capability of direct connection to existing Tektronix modular graphics systems. This interface implements a VMEbus master and slave that provides a window for memory reads and writes between the CEM and graphics system modules. This memory window between the VMEbus and Futurebus is 512 Mbytes. The VMEbus interface supports all standard VMEbus interrupts.

Centronics-Style Copier Interface

This interface provides compatibility with the industry standard hard copy interface described by Centronics for parallel data and Tektronix's parallel interface.

Futurebus Interface

This block provides the interface between the CE board and the system bus (Futurebus). It contains the state machines, registers, and transceivers required to implement the IEEE 896 protocols.

Time of Day Clock

The battery-backed, time of day clock maintains a continuous day/date/time clock, two general purpose 16-bit timers, and 44 bytes of RAM.

OPTIONAL MEMORY BOARD

The optional Memory board provides additional system RAM for the CEM. The board includes the circuitry for access timing, refresh generation, and the actual memory devices. These devices reside on memory expansion daughter boards that attach to the Memory board. The primary use for increased memory capacity is storage of program code and data.

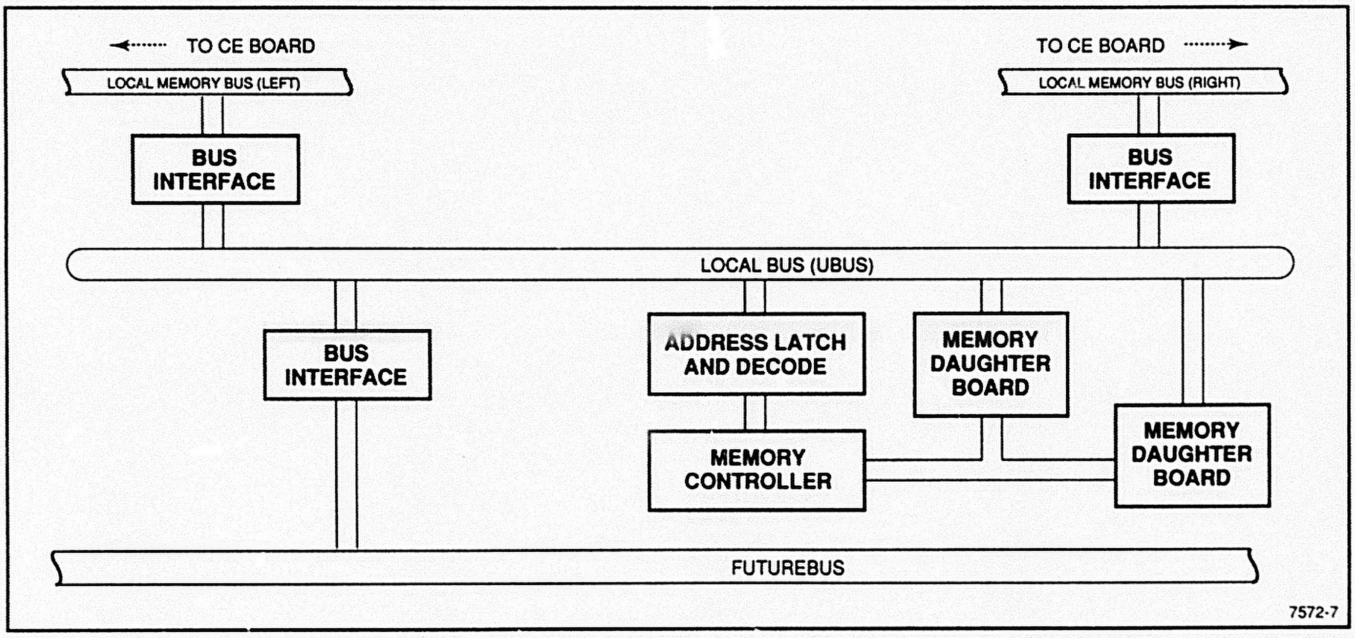

Figure 3-4. Memory Board Block Diagram.

CEM POWER SUPPLY

The CEM is powered by a high-efficiency switching power supply (see Figure 3-5). The power supply provides fused protection for the CEM's circuitry and a voltage selector switch that enables the CEM to operate on nominal line voltages of 115V or 230V.

See Section 2, Table 2-2, for detailed specifications of the Compute Engine Module's power supply.

The power supply provides these outputs:

- +5V
- +12V
- -12V
- Variable 0V to -17V

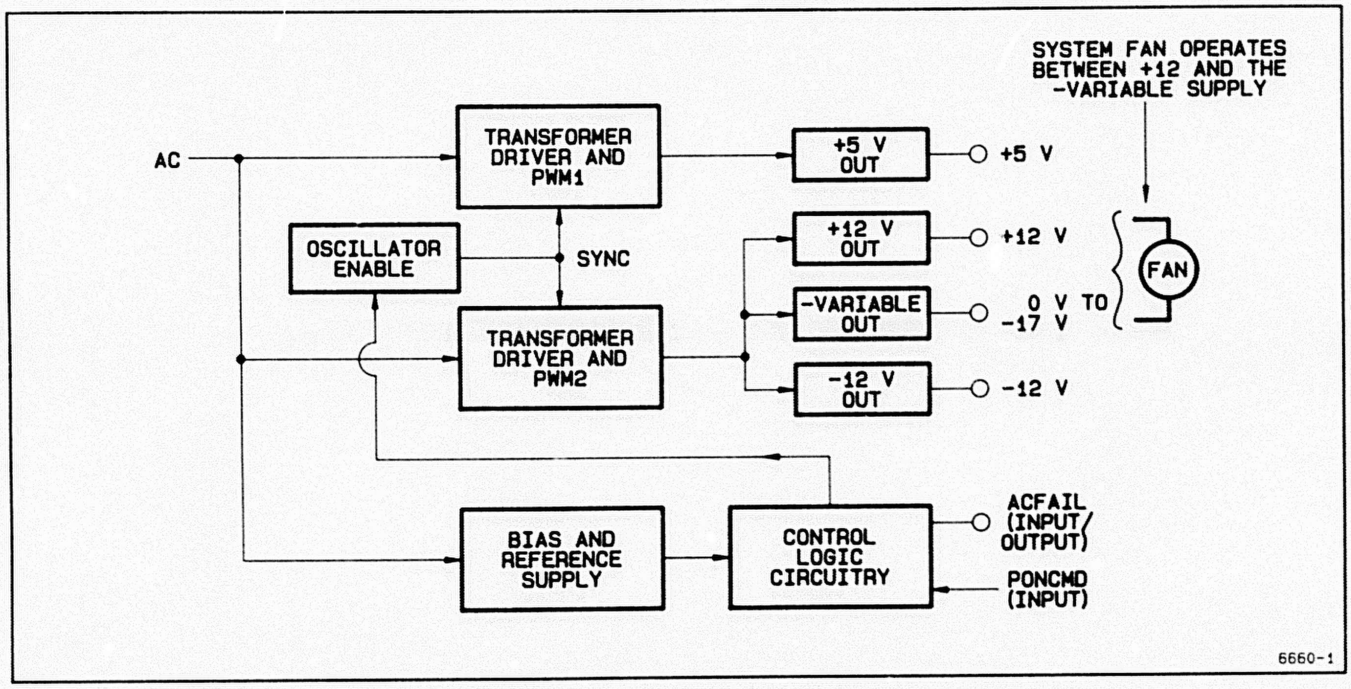

Figure 3-5. Power Supply Block Diagram.

MAGNETIC PERIPHERAL SUBASSEMBLY

The magnetic peripheral subassembly (see Figure 3-6) contains the CEM's mass storage devices. The subassembly consists of a removable frame attached to the CEM's chassis by eight screws. The disk drives interface with the CEM via the SCSI interface. Included within this subassembly are the standard 156-Mbyte fixed-disk drive, optional flexible drives (including the required controller board), standard streaming tape drive, and the cooling fan.

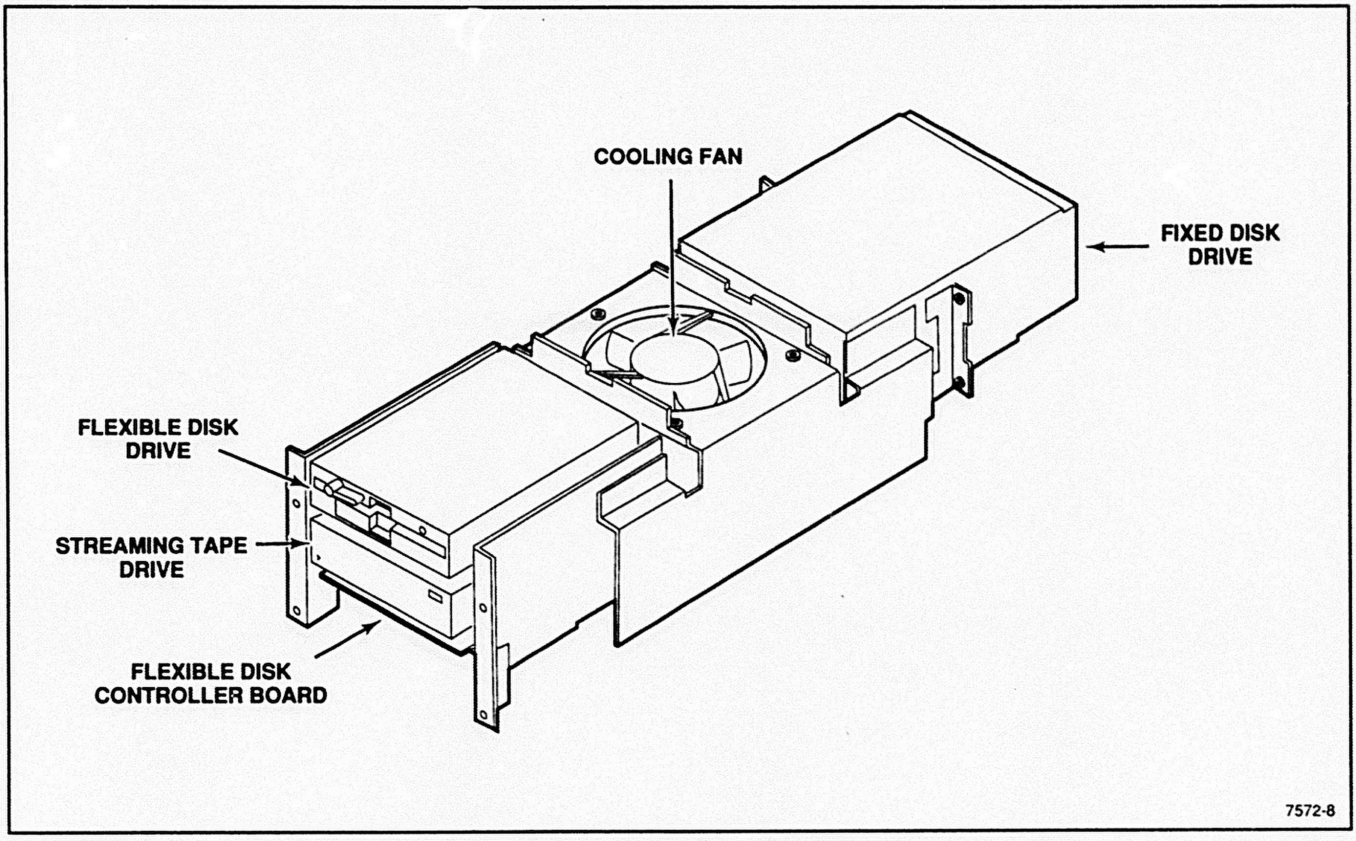

Figure 3-6. Magnetic Peripheral Subassembly.

TERMINATOR BOARDS

The CEM's Terminator boards serve as a termination for the CEM's expandable bus structure. These boards reside in the connectors provided on the front side of the Backplane board and terminate the VMEbus and Futurebus. The proper termination of this bus structure requires four Terminator boards. Two of these terminators occupy the 96-pin Futurebus connectors, while the other two reside in the 256-pin VMEbus connectors (see Figure 3-7).

The VMEbus Terminator board located in slot one (right-most connector when viewed from the front of the CEM) provides a connection to the SCSI interface. This connector accepts the attachment of the fixed- disk drive and other magnetic peripherals using the SCSI interface located on the I/O board.

Expansion of the CEM into a graphics workstation with the addition of a graphics module requires the installation of a flex link connector between each module's Backplane board and movement of the slot four, 256-pin Terminator board to the physical end of the VMEbus structure on the graphics module. See the Removing the Board Assemblies discussion in Section 5 for more information on the Backplane and Terminator boards.

LOCAL BUS CONVERTER BOARD

The Local Bus Converter board provides a high-speed path for data transfers between the CE board and graphics subsystems (GEMs). The Local Bus Converter adapts the CE board's local memory bus to the VMEbus. The Local Bus Converter board resides in the 256-pin connector directly across the Backplane board from the CE board. For example, if the CE board occupies slot 3, the Local Bus Converter board would reside in J12 (see Figure 3-7).

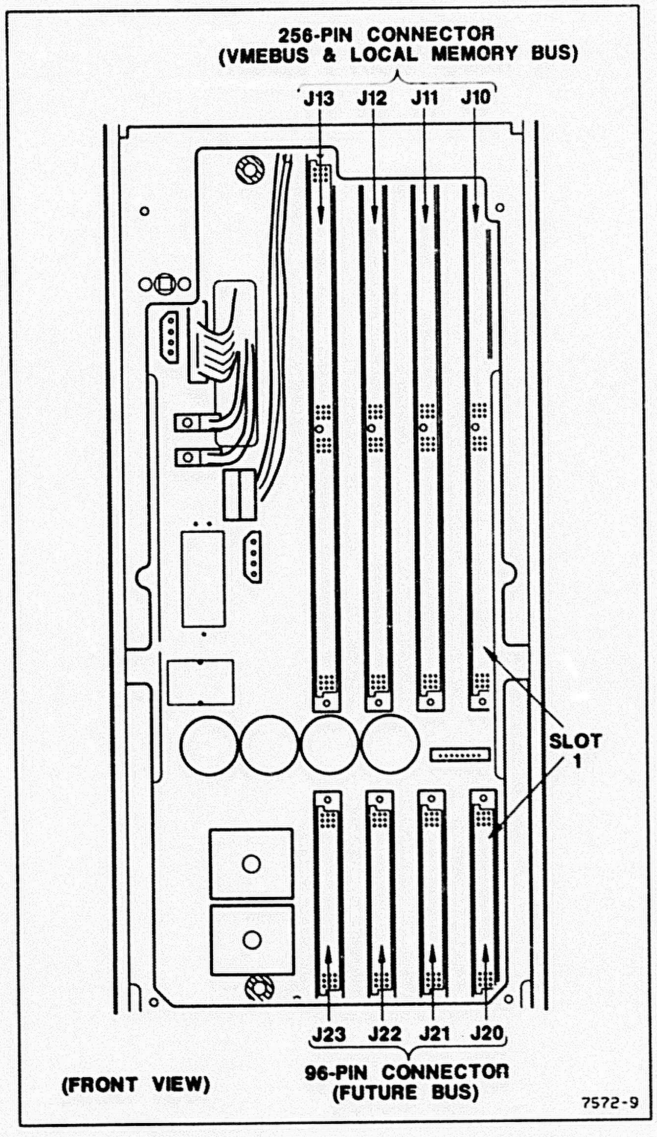

Figure 3-7. Backplane Board Connector Locations.

Section 4

DIAGNOSTICS

INTRODUCTION

This section provides a brief description of the tools and procedures that will help you to diagnose a malfunctioning CEM in the field. Your main diagnostic tool is the system's diagnostic programs. The diagnostics determine the current condition of the CEM's subsystems and FRUs.

SELECTING DIAGNOSTICS

The configuration switches located on the CEM's rear panel control which set of field service diagnostic routines execute at power-up. For example, with the switches set in their normal power-up position, the power-up diagnostic tests execute automatically. Other switch settings invoke the ROM service mode routines at power-up. Figure 4-1 illustrates the configuration switches on the CE board.

NOTE

Set the configuration switches before turning the system on. The switch positions are read only at power-up and changes to their positions afterwards have no effect.

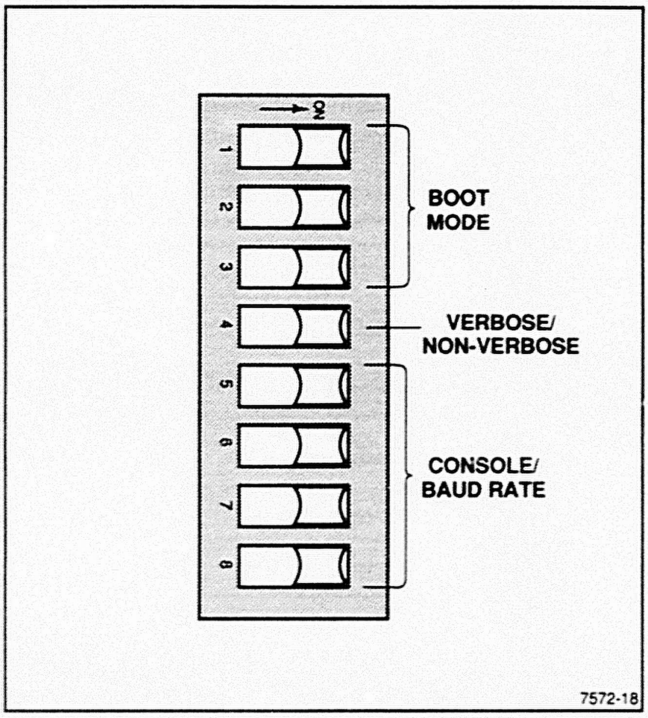

Figure 4-1. Configuration Switches.

The diagnostics provide three modes of operation:

- **Service mode.** Select service mode for detailed hardware debugging. Routines available in low-level mode are: low-level and extended tests, ROM hardware debug monitor, and DBX debug monitor. These tests are designed to be used with appropriate test equipment for diagnosis of systems that will not boot normally.
- **Power-up mode.** Select power-up mode for preliminary diagnostic testing and to boot the system. Failures that occur during power-up mode appear on the seven-segment LED on the CEM's rear panel or on the console device via 'printf'. Console devices include:
  - 2-D or 3-D GEM
  - CE board's serial port 0
  - I/O board's serial port 0
  - NULL_CONS (null console, no output)

NOTE

Selecting NULL_CONS will suppress all diagnostic messages. Also, selection of the 2-D or 3-D GEM requires display code downloading from some media (SCSI disk, tape, or LAN).

Selection between diagnostic routines, the console for fault message output, and the baud rate of transfer is determined by the settings of the configuration switches on the rear panel.

Before you begin diagnostic tests on the CEM, see Section 4 of the *Field Service Overview* manual included in this field service manual set for a complete description of how to use all three modes of diagnostic tests in the diagnosis of CEM malfunctions.

Section 5

MAINTENANCE PROCEDURES

INTRODUCTION

This section contains preventive and corrective maintenance procedures for the Compute Engine Module (CEM). These procedures detail the disassembly and reassembly of the CEM and allow you to access the field replaceable units (FRUs) for troubleshooting, calibration, repair, or replacement.

Before performing any of the maintenance procedures listed in this section, carefully read the Safety Summary at the front of this manual set. In addition, read ALL warnings and cautions before attempting any of the cleaning or maintenance procedures listed here.

PREVENTIVE MAINTENANCE

The design of the CEM is such that it requires very little routine or preventive maintenance. The CEM requires no routine lubrication or cleaning. If cleaning or maintenance is necessary (due to an adverse operating environment), perform these procedures on a yearly preventive maintenance schedule.

WARNING

Disconnect the line power cord before cleaning or performing maintenance on any parts in the module. Dangerous voltages exist inside the module covers and may cause injury if contacted.

WARNING

After cleaning, be sure to dry all moisture inside the module covers. Moisture could conduct a potentially lethal shock to the user when the power is reapplied to the module.

CAUTION

To avoid damage to the CEM's plastic housing, do NOT use cleaning agents that contain benzene, acetone, toluene, xylene, or similar chemicals.

CAUTION

Static charges can be generated by a brush with synthetic bristles. Such static charges may damage solid state components, so use a brush with natural soft bristles. Read the Electrostatic Precautions in the Disassembly / Assembly procedures discussed later in this section.

CAUTION

This cleaning procedure uses water, so avoid getting water on any parts susceptible to water damage; then dry thoroughly.

CLEANING THE MODULE

Clean the CEM's external cover using a soft cloth dampened with a solution of mild detergent and water.

Occasionally, remove any accumulated dust from inside the CEM. Dust conducts electricity under high humidity conditions. The CEM's interior is best cleaned with a vacuum cleaner. Remove any remaining dust with a soft bristle brush (paint brush) or a cloth dampened with a mild detergent and water solution. To clean narrow spaces, use a cotton-tipped applicator.

ROUTINE VISUAL INSPECTION

Inspect the CEM occasionally for defects, such as broken connections, damaged circuit boards, loose connectors, heat-damaged parts, and general mechanical fitness. If the CEM is used in a high vibration environment, pay particular attention to connectors, cable strain reliefs, and sheet metal enclosure fasteners.

The corrective procedure for most visible defects is repair or replacement; however, particular care must be taken if heat damaged components are found. Overheating usually indicates other trouble in the unit. It is important to correct the cause of the overheating to prevent a recurrence of the damage.

The CEM contains these FRUs (see Figure 5-1):

- Compute Engine (CE) board
- Auxiliary RS-232-D board
- Memory daughter board(s)
- Input/Output board
- Option Input/Output board*
- Optional 1.2-Mbyte and 360-Kbyte flexible disk drives
- 125-Mbyte streaming tape drive
- Magnetic peripheral subassembly
- Cooling fan
- Flexible disk drive controller board (if installed)
- Optional Memory board
- Backplane board
- Terminator boards*
- Local Bus Converter board*
- Power Supply

* Not shown in Figure 5-1.

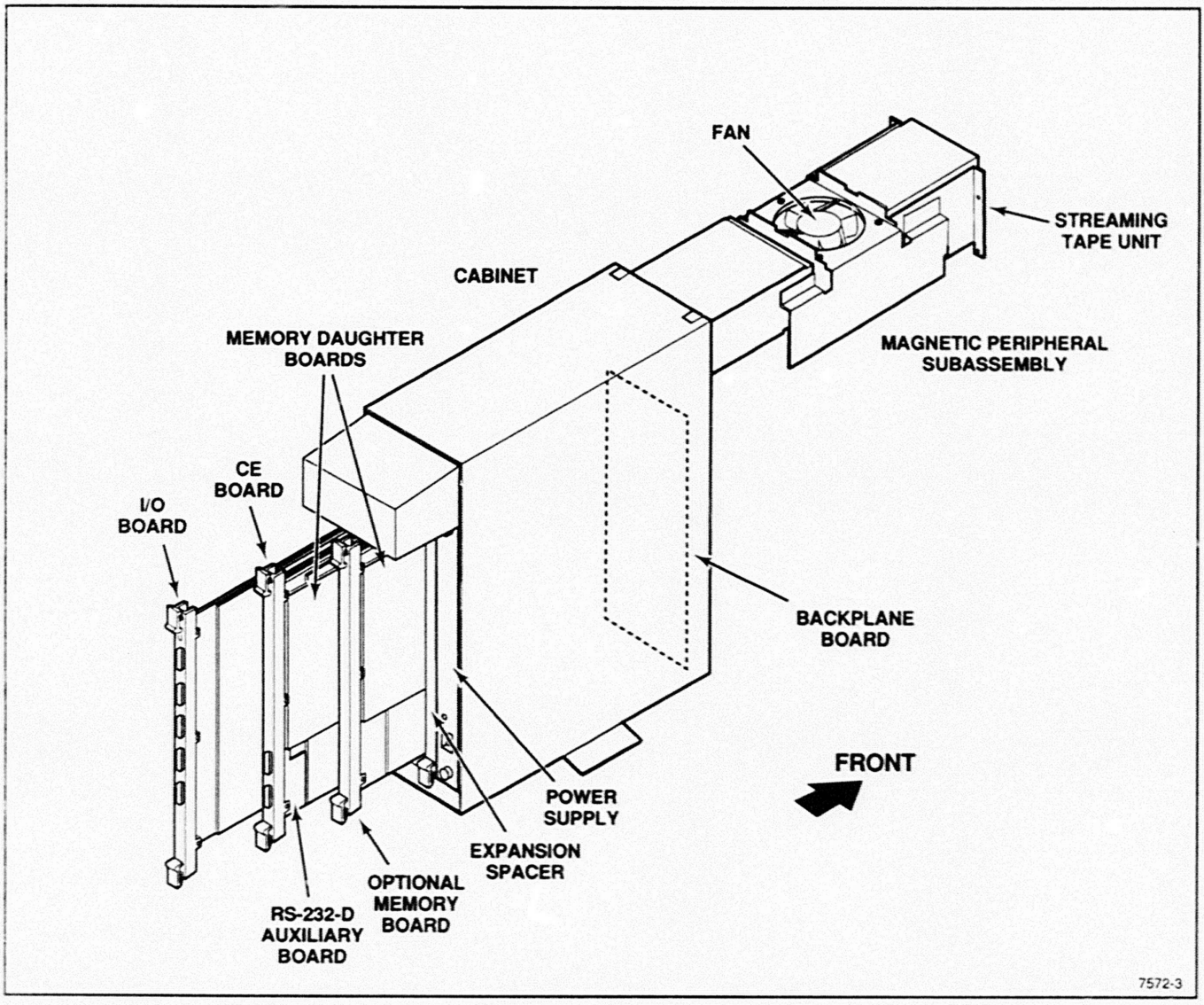

Figure 5-1. CEM FRUs.

DISASSEMBLY / ASSEMBLY

Unless a specific assembly procedure is given, perform assembly by following the disassembly procedure in reverse order. Use this procedure to inspect, adjust, troubleshoot, or remove and replace any of the CEM's FRUs.

In following these procedures refer to the guidelines below:

1. Disconnect the power cord.
2. Exchange circuit boards, subassemblies, or other FRUs, if necessary.
3. If replacement of an FRU is made, make the required field tests.

RECOMMENDED TOOL LIST

Disassembly and assembly of the CEM requires the use of the following tools:

- 3/16-inch nut driver
- 5/8-inch open-end wrench
- 7/16-inch open-end wrench
- 7/16-inch socket, 1/4-inch drive
- 3-inch extension, 1/4-inch drive
- Ratchet, 1/4-inch drive
- Bit, screwdriver, Phillips, P2
- Bit, screwdriver, Phillips, X1
- Bit, screwdriver, slotted, Magna 000-8
- Bit, screwdriver, Torx, T7
- Bit, screwdriver, Torx, T10
- Bit, screwdriver, Torx, T15
- Screwdriver, 8.5-inch, magnetic tip

ELECTROSTATIC PRECAUTIONS

This product contains components that are highly sensitive to electrostatic discharge. To prevent damage to such components and to maintain product reliability, **DO NOT** touch or remove the circuit boards or components from the CEM until you provide the proper electrostatic protection.

Handling Static-Sensitive Components

Handle all static-sensitive components and boards containing static-sensitive components (such as RAMs, ROMs, EEPROMs, and custom gate arrays) in a static safeguarded area capable of controlling static charge on people and conductive and non-conductive materials. Static protected areas include non-static table tops, non-static floor mats, and grounding wrist straps for persons working with static sensitive parts, boards, or equipment.

Transport of Static-Sensitive Components

Transport all static-sensitive components and boards in static shielded containers or packages. A "static shield" container will protect its contents from static discharge and electromagnetic fields.

REMOVING THE PLASTIC COVERS

There are six plastic covers surrounding the CEM. On CEMs connected to a Graphics Engine Module (GEM), plastic covers are not installed on the adjoining sides.

The CEM's design allows the performance of nearly all service procedures without requiring the removal of the top and side covers. If the plastic covers require removal, use these steps (see Figure 5-2):

1. Perform these steps to remove the bottom side covers:
   a. Pry the covers outward at the bottom near each end to release the bottom guides.
   b. Slide the cover upwards to release the latching hangers, then remove the covers.
2. Perform these steps to remove the front cover:
   a. Open the front panel door, then push upward on the tabs, as shown.
   b. Rotate the cover outward, and lift it out of the bottom guides.
3. Perform these steps to remove the top cover:
   a. While holding the top cover from each side, lift the center and slide the cover backward to release it from the chassis.
   b. Lift the cover upward at the rear, then pull it up out of the slots at the front of the module.
4. Perform these steps to remove the side covers:
   a. Slide the cover slightly forward to release the front guides.
   b. Lift the cover upward to disengage the six hangers, and remove the cover.

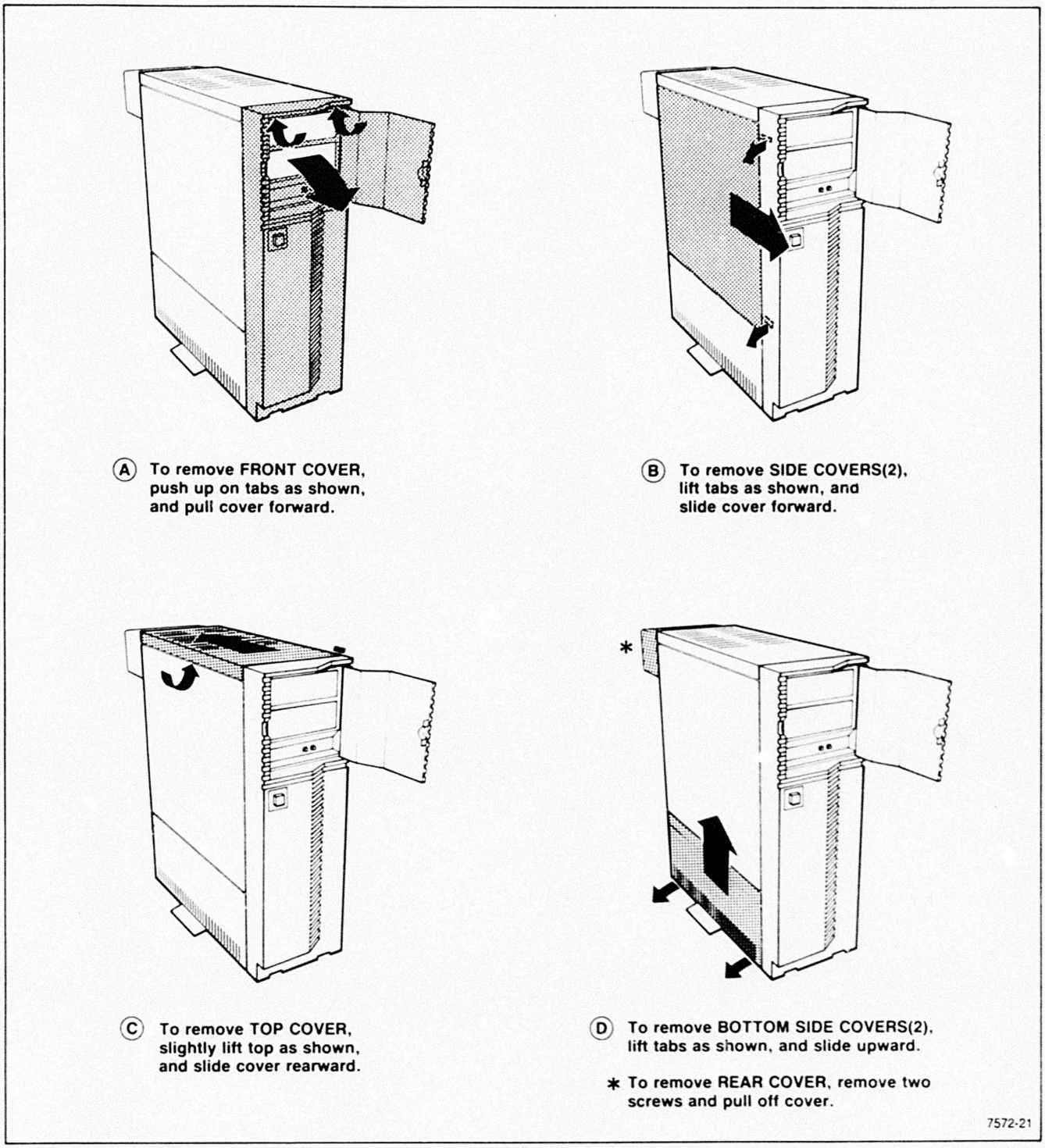

Figure 5-2. Removing the CEM's Covers.

REMOVING THE BOARD ASSEMBLIES

Before removing any board assembly, read the brief overview that follows describing the multiple-bus architecture of the CEM and how this architecture affects the placement and configuration of the modular logic boards.

Backplane, Terminators, and Flex Link

Each CEM has a Backplane board that provides multiple connectors on both the front and rear sides. Connectors located on the rear side accept the CEM's modular logic boards. The connectors located on the front provide power for system peripherals, interconnection to graphics subsystems (workstation configurations), and termination of the CEM's major bus structures.

Connectors J10 and J13, located on the Backplane board's front side, accept either a 256-pin VMEbus Terminator board or a flex link connector to a GEM or additional CEM chassis. One of these VMEbus terminator boards provides a connection to the SCSI interface located on the I/O board. Since the I/O board must reside in slot one, make certain the VMEbus Terminator board with the 50-pin SCSI connector occupies J10. The two 96-pin connectors (J20 and J23) located directly below J10 and J13 accept the Futurebus Terminator boards. For information on connector locations and the signals present on each of the Backplane board's connectors, see Appendix A.

The Backplane board interconnects these three bus structures between the CEM's modular logic boards:

- Futurebus — the central system bus between modular boards installed in the CEM.
- VMEbus — the interface to graphic subsystems (GEMs) and additional CEMs.
- LMB — local memory bus used for both on-board and off-board communication and memory access.

Up to three Backplane boards can be connected together with flex links to form a continuous VMEbus structure holding a maximum of twelve modular boards.

NOTE

Unlike the VMEbus, the Futurebus extends only to additional CEM Backplane boards.

If a Backplane slot is open (no board installed) between the Terminator boards, install jumpers on the five connectors provided to the immediate left of the open slot (as viewed from the front of the CEM) to bridge the bus grant (BG) and interrupt acknowledge (IACK) signals across the open connector.

This requirement exists because each modular logic board physically interrupts the VMEbus. If a connector is left open between Terminator boards without the jumpers installed, the BG and IACK signals are interrupted. Remember to remove these jumpers before installing a board into a previously open connector. An exception to this requirement is the CE board. The CE board relies on the Local Bus Converter board to bridge the BG and IACK signals. Installation of the CE board without the Local Bus Converter board requires installation of the jumpers on the appropriate slot.

Table 5-1 lists the bridged signals and jumper designations for the four slots on the Backplane board. The table lists each slot's jumpers from top to bottom. These jumper designations have also been printed directly on the Backplane board to assist in their identification.

Table 5-1
JUMPER DESIGNATIONS

Signal	Slot 1	Slot 2	Slot 3	Slot 4
BG0	J34	J35	J36	J37
BG1	J38	J39	J40	J41
BG2	J42	J43	J44	J45
BG3	J46	J47	J48	J49
IACK	J30	J31	J32	J33

Order of Board Installation

When installing board assemblies in the CEM, always take care to insert them in the order shown in Table 5-2. The table assumes that you are viewing the CEM from the rear.

NOTE

The installed magnetic peripherals connect to the SCSI interface on the I/O board. This connection occurs on the VMEbus Terminator board installed in slot 1 (J10) on the front side of the Backplane board. (Slot 1 is the left-most slot when viewing the CEM from the back.)

Table 5-2
CEM BOARD ASSEMBLY ORDER

	Slot (from left)			
Board	**1**	**2**	**3**	**4**
CE		x	x	x
I/O	x			
MEM		x	x	x

Use these steps to remove the CE, I/O, and optional Memory board assemblies (Figure 5-3):

1. Remove the Torx screw holding the plate at the bottom of the CEM that holds the board extractors in their upright position.
2. To release the board from its Backplane board socket, grasp both upper and lower extractors, place thumbs on surrounding assemblies, and pull firmly upwards.
3. Hold the extractors and pull the assembly out.

To install any of these assemblies:

1. Place the top and bottom of the board in the rail slot.
2. Push the center of the assembly inwards as far as possible while holding the extractors in the upward position.
3. Grasp the front of the CEM frame, and push the assembly inwards until the board seats into the Backplane board.
4. Push the extractors inward to finish seating the board.

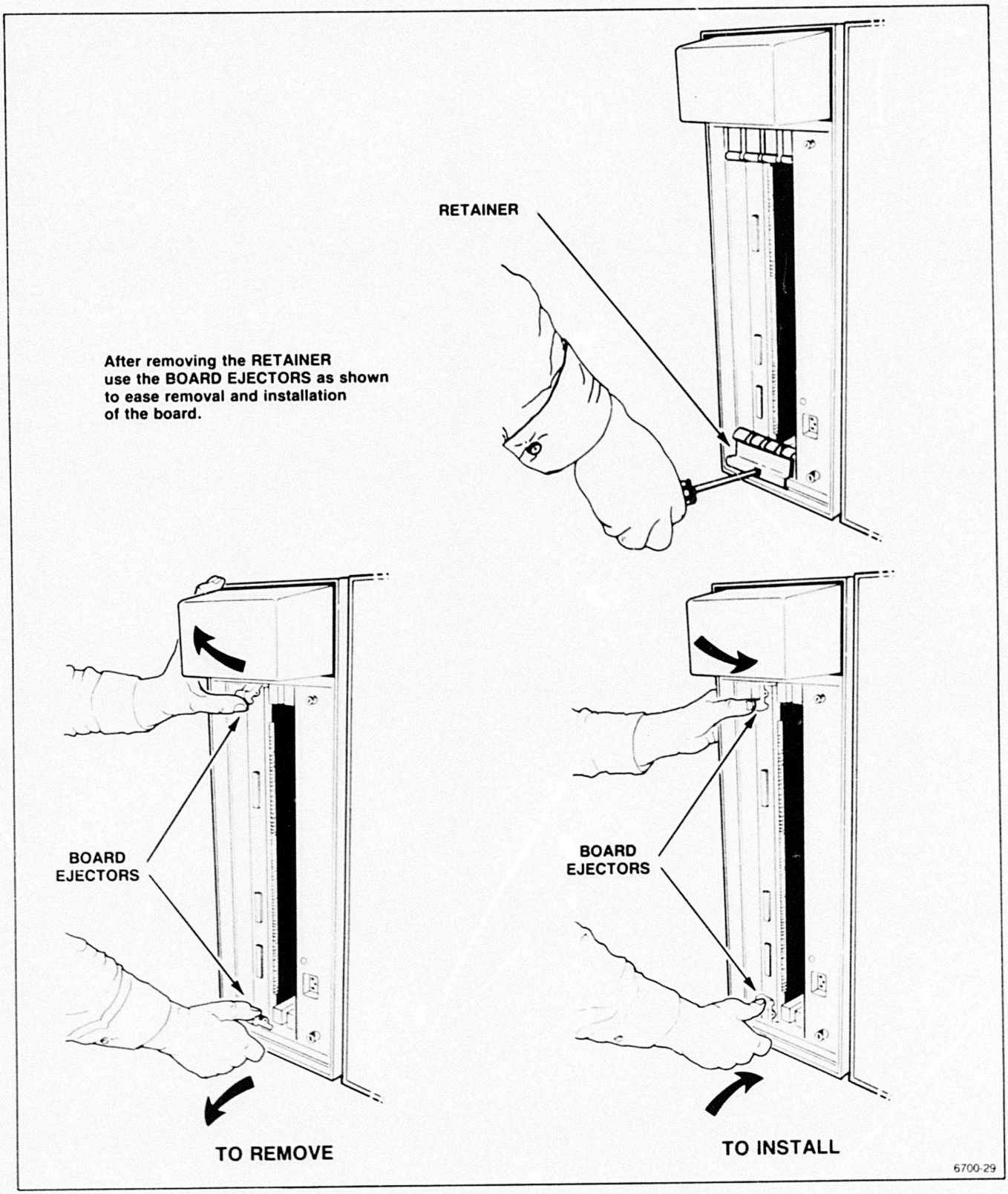

Figure 5-3. Removing CEM Modular Boards.

REMOVING THE FRONT EMI SHIELD

Access to the CEM's Backplane board and magnetic peripheral subassembly requires the removal of the front EMI shield. To remove this shield, use this procedure:

1. Remove the front plastic cover as previously described.
2. Remove the eight screws that secure the EMI shield to the CEM's chassis (see Figure 5-4).
3. Grasp the handle located at the bottom of the shield and gently pull the shield away from the CEM, being careful not to damage the power switch.

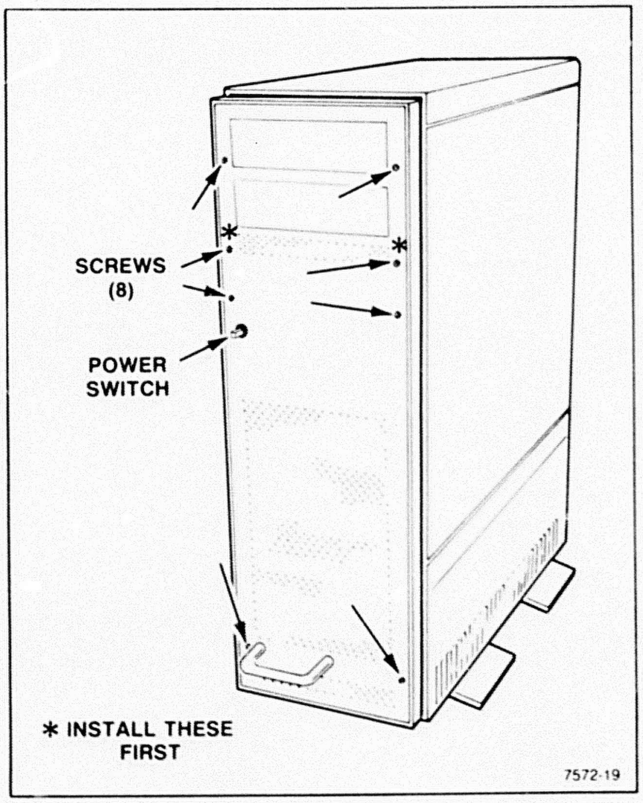

Figure 5-4. Removing the Front EMI Shield.

REMOVING THE MAGNETIC PERIPHERAL SUBASSEMBLY

To service a tape drive, fixed disk, optional flexible disk and its associated controller board, or the cooling fan, remove the magnetic peripheral subassemby. Use these steps to remove the magnetic peripheral subassembly from the chassis of the CEM. Replace the subassembly by reversing this procedure.

CAUTION

If the subassembly contains a flexible disk drive, use caution during handling to avoid damage to the controller board mounted directly beneath the flexible drive.

1. Remove the front cover and EMI shield as previously described.
2. Remove the two screws that secure the fixed disk cover at the rear of the CEM and then, remove the cover.
3. Remove the eight screws holding both the front and back of the magnetic peripheral subassembly to the chassis.
4. Pull the subassembly part way out of the chassis.
5. Unplug the fan's power cable from the Backplane board (J5).
6. Unplug all cabling connecting the peripherals to the Backplane board
7. Pull the subassembly out of the chassis.
8. To remove a magnetic peripheral from the subassembly, turn the subassembly over and remove the four holding screws, two on each side of the housing (see Figure 5-5).
9. Remove the flexible disk controller board by removing the three cable connections, the two screws that secure it to the subassembly, and sliding it to the rear.
10. To remove the fan from the subassembly, remove the four mounting screws that secure the fan to the housing.

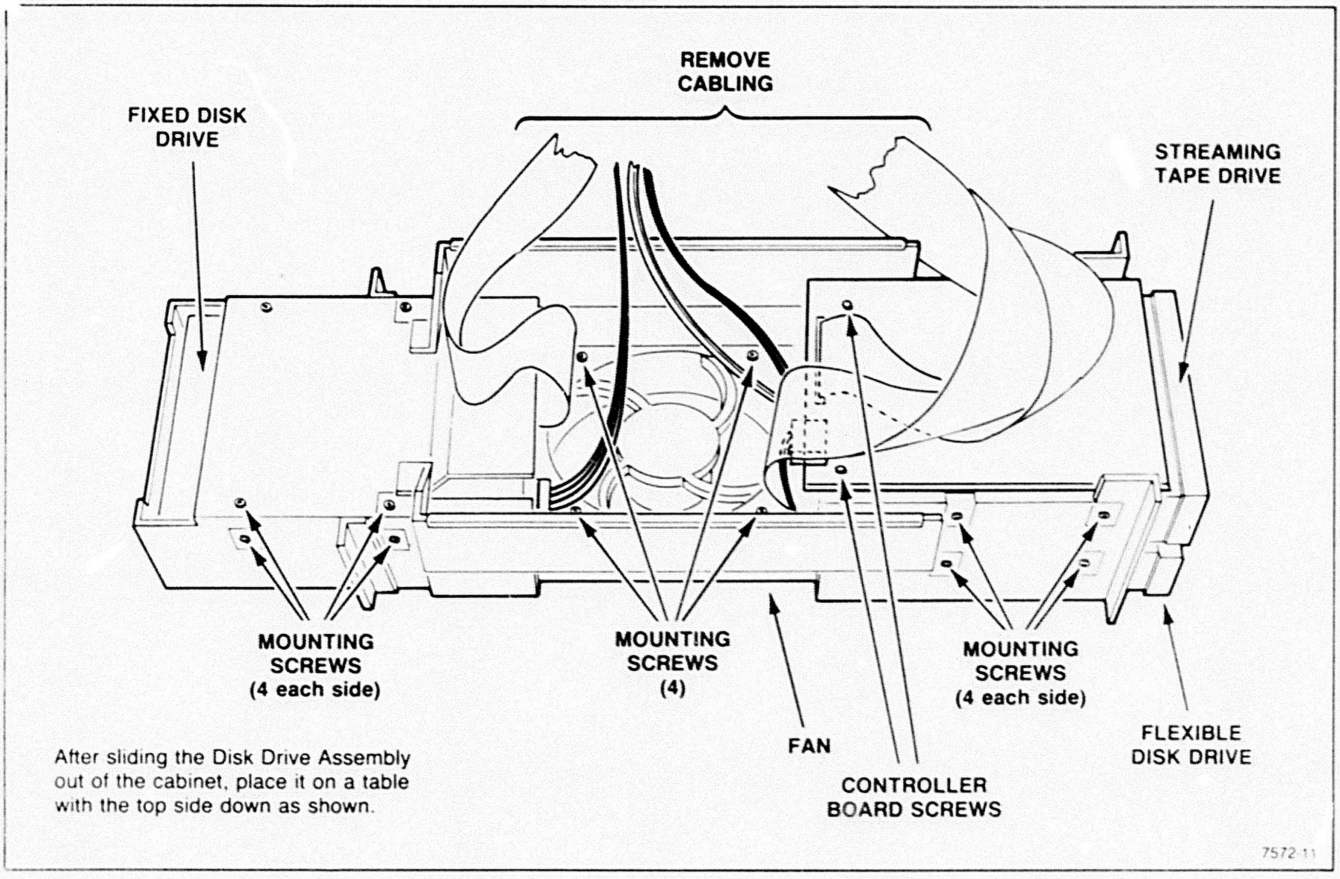

Figure 5-5. Removing Magnetic Peripherals.

REMOVING THE BACKPLANE BOARD

Use these steps to remove the Backplane board from the CEM housing (see Figure 5-7):

1. Remove the board assemblies (procedure in this section).
2. Remove the power supply (procedure in this section).
3. Remove the holding screws from the bracket on each side of the Backplane (use a Torx driver).
4. From the front, release the top two plastic board holders, then remove the Backplane assembly by rotating it toward the rear and lifting it up out of the bottom holders.

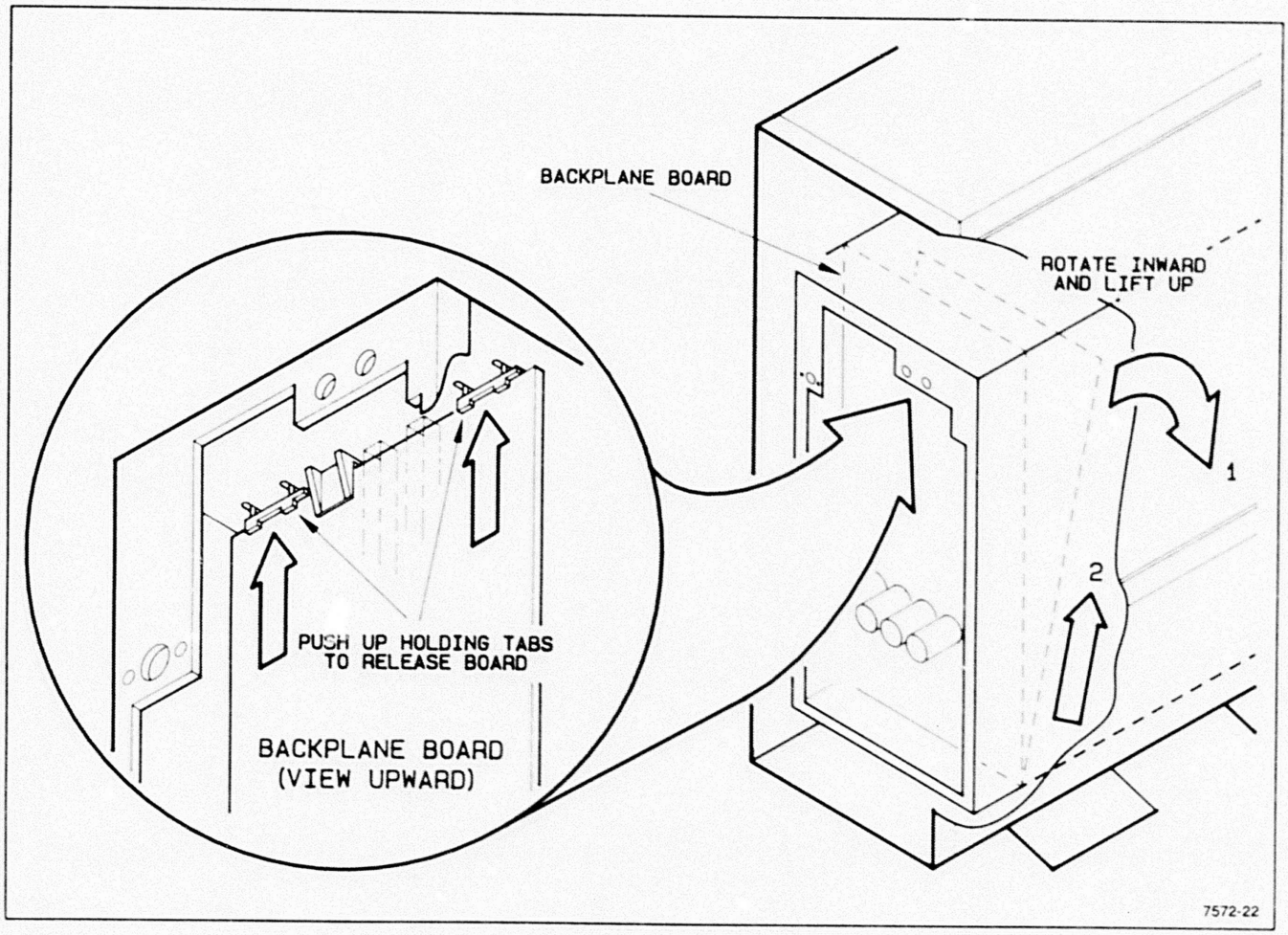

Figure 5-6. Removing the Backplane Board.

REMOVING THE RS-232 INTERFACE

Use these steps to remove the RS-232 interface from the CE board (see Figure 5-8):

1. Remove the CE board assembly from the CEM.
2. Remove the seven Torx screws that hold the CE board to the frame.
3. Remove the CE board and memory daughter board from the frame being, careful not to damage the connection between the CE board and RS-232 auxiliary board.
4. Remove the screw that secures the auxiliary board to the CE board's frame.
5. Remove the four hex-head screws holding the RS-232 connectors to the edge of the assembly frame.

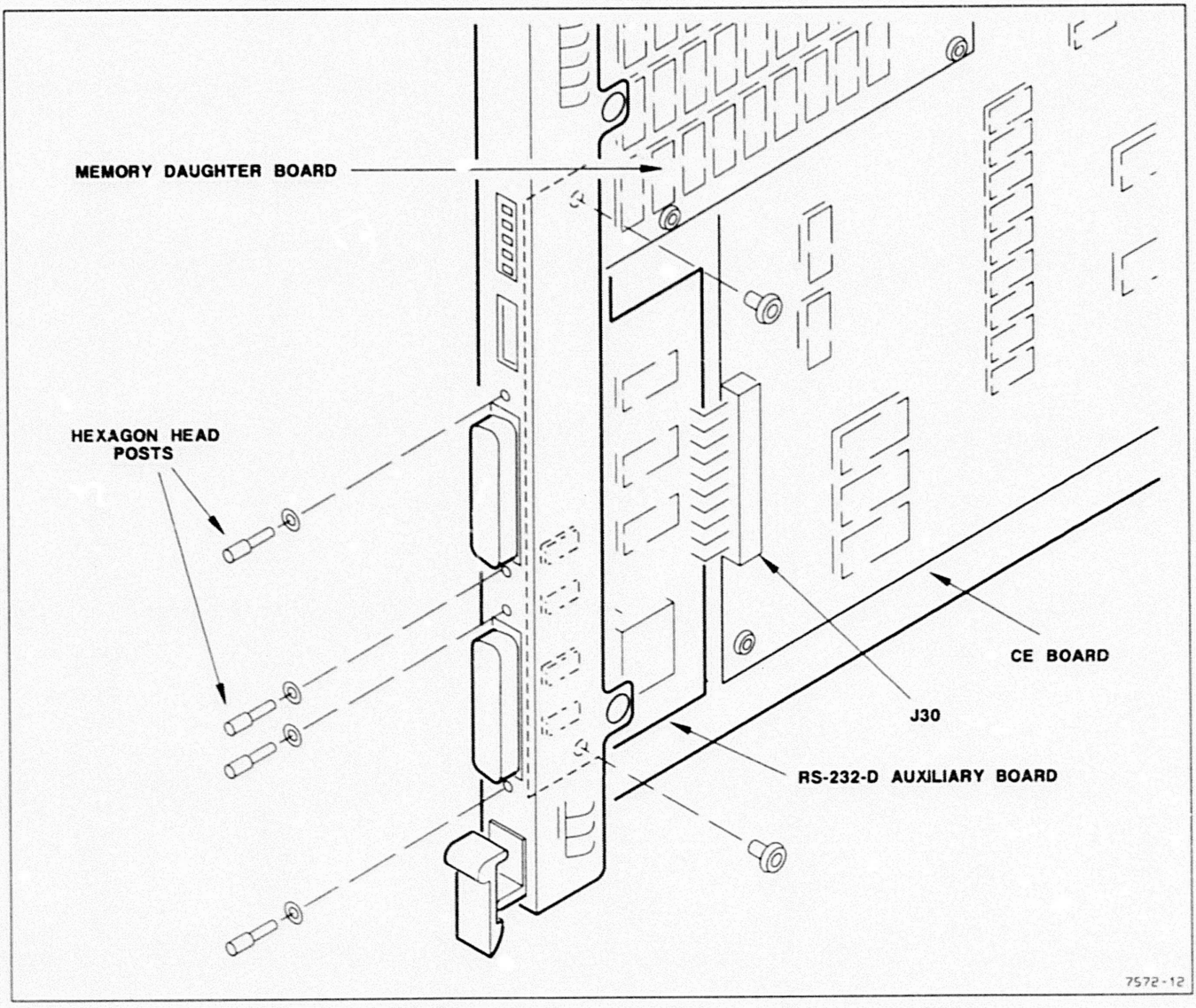

Figure 5-7. Removing the RS-232 Interface Board.

REMOVING MEMORY DAUGHTER BOARDS

Use these steps to remove memory daughter boards from the CE board or optional Memory boards (see Figure 5-9):

1. Remove the CE or optional Memory board assembly from the CEM according to the procedures described earlier.
2. Remove the Memory daughter board from either assembly by removing a single Torx screw; then lift the memory board off the main assembly, being careful not to bend the pins that connect the two boards together.

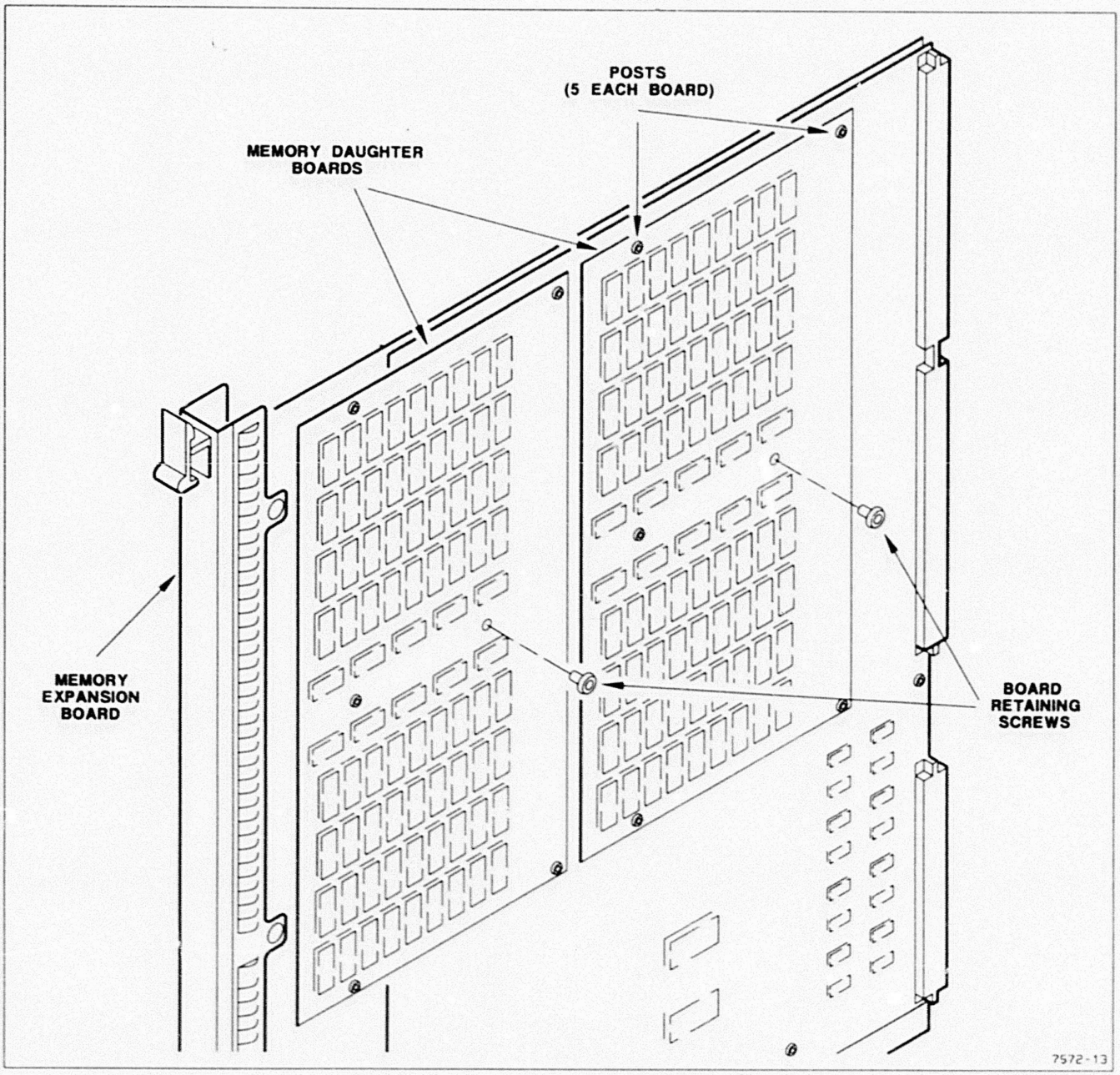

Figure 5-8. Removing Memory Daughter Boards.

REMOVING THE POWER SUPPLY

Use these steps to remove the CEM's power supply (see Figure 5-10):

1. Access the Backplane board according to the procedures described earlier.
2. Unplug connectors J1, J7, and J8 on the Backplane board.
3. Unbolt the +5V and GND connectors, then remove bolts, lockwashers, and washers.
4. Remove the #10 screws holding the power supply to the Backplane board.
5. Return to the rear of the CEM and loosen the two knurled fasteners holding the power supply to the CEM's chassis, then remove the power supply.

Use these steps to reinstall the power supply:

1. Push the supply into the CEM. Don't tighten the knurled fasteners yet.
2. Install the +5V and GND connectors with the flat washers closest to the circuit board pad. Tighten the connectors finger tight.
3. Install the two #10 screws to hold the supply to the Backplane board, then tighten them.
4. Torque the +5V and GND connector bolts to 40 inch-pounds.
5. Connect J1, J7, and J8 connectors.
6. Tighten the knurled fasteners.

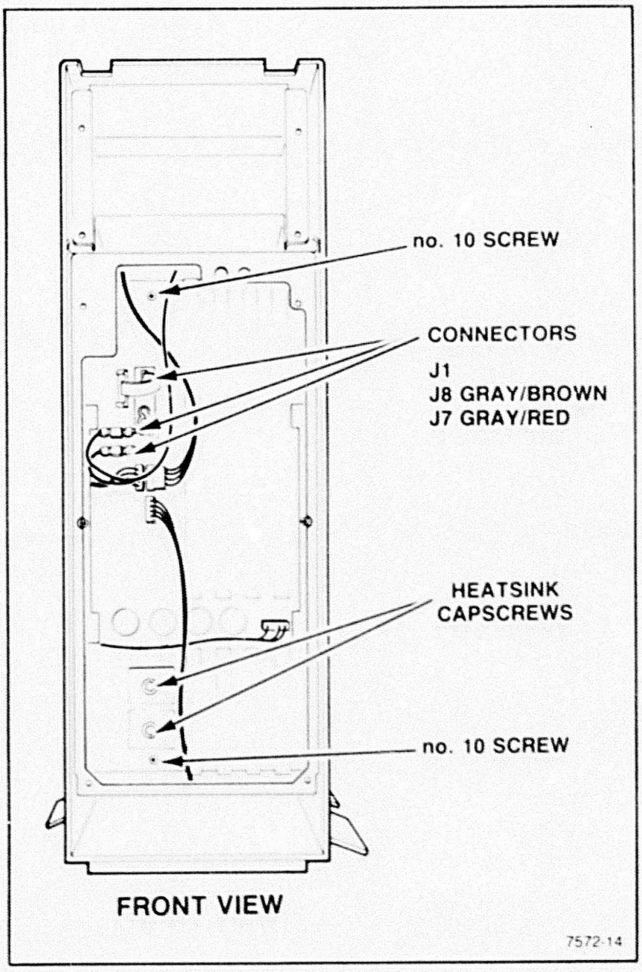

Figure 5-9. Removing the CEM's Power Supply.

Setting the Line Voltage Switch

Use this procedure to make the field adjustment (if required) to the power supply's line voltage selector switch.

CAUTION

To avoid damage to the CEM be sure to use the proper line cord for the voltage chosen. The part number for the 240V cord is 161-0066-12.

1. Find the input voltage switch, located directly above the AC power cord connector.
2. Using a screwdriver, push the switch up for 115V or down for 230V.

Fuse Replacement

The fuse for the CEM is for fire protection. If the fuse has failed, there is a high probability that a major failure has occurred in the power supply. In most cases, the power supply will require replacement. Replace the fuse with one having a value of 15A at 250V.

SEPARATING THE MODULES

Depending on the CEM's configuration, the system could consist of a combination of both Compute Engine and Graphics Engine modules. If separation of these modules is necessary, use these procedures (see Figure 5-11):

1. Remove the front covers and front EMI shielding from the CEM according to procedures previously described in this section. For procedures describing the removal of the GEM's EMI shield, see the appropriate modular field service manual.
2. Remove the flex link interconnecting the Backplane boards.
3. Remove the eight nuts on the four spacer posts that hold the two modules together.
4. Separate the two modules.

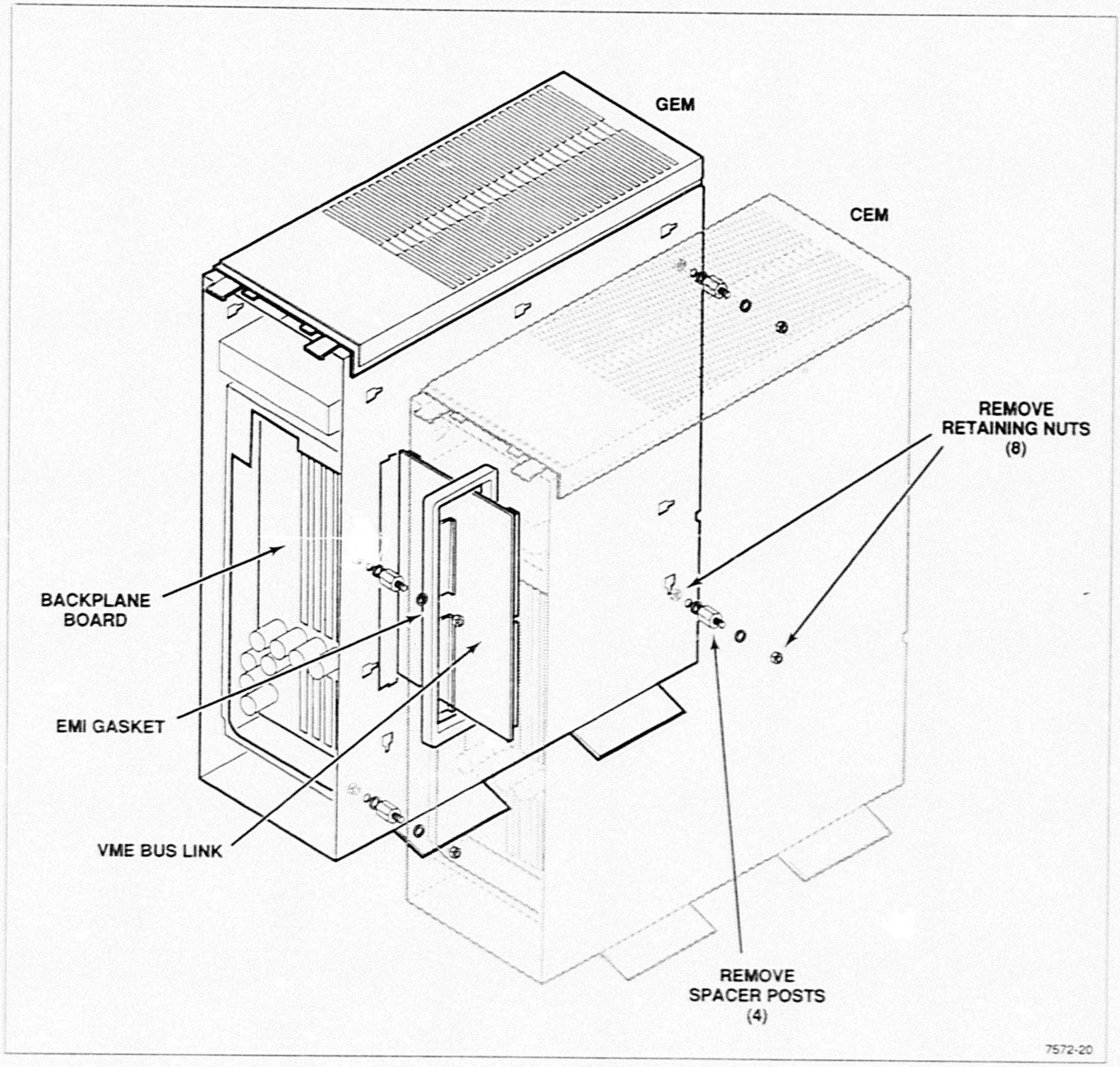

Figure 5-10. Separating the Modules.

Section 6

PERFORMANCE CHECKS

INTRODUCTION

This section contains the performance checks required to keep the Compute Engine Module (CEM) at optimum performance. The procedures in this section are intended for use on-site.

Performance checks for the CEM consist of the power supply's output voltages. The magnetic peripherals require no maintenance or adjustments. If Self-Test reports a failure in a magnetic peripheral, check the cable and power connections before replacing the entire unit.

Refer to Figure 6-1 to check the voltages listed in Table 6-1. There are no adjustments to make. If the voltage values fail to meet specifications, replace the power supply.

SAFETY CONSIDERATIONS

Before beginning the performance checks listed in this section, carefully read the Service Safety Summary at the front of this manual set. In addition, read ALL warnings and cautions before attempting any checks or adjustments.

WARNING

Lethal voltages are present in the CEM power supply. Be careful when performing power supply performance check procedures. Avoid contact with exposed components and conductors. Use an isolation transformer when checking voltages, especially when checking voltages within the power supply.

CAUTION

Before applying power, see that the voltage selector switch on the rear panel of the CEM matches the nominal voltage level of the AC power outlet that will supply the system. See Section 5 of this manual for the procedure.

RECOMMENDED TEST EQUIPMENT

Verification of the output voltage delivered by the power supply requires a digital voltmeter (DVM) able to read voltages that range from 0 to 100 VDC to within 0.1% accuracy. An example of a DVM that meets these specifications is the Tektronix DM501. If you use different equipment, it must meet or exceed this specification.

Table 6-1
CEM POWER SUPPLY CHECKS

Nominal Voltage	Test Point	Tolerance
+5.2V	+5.2V on Backplane board	±1%
+12.0V	J7	±5%
-12.0V	J1, pin 6	±5%

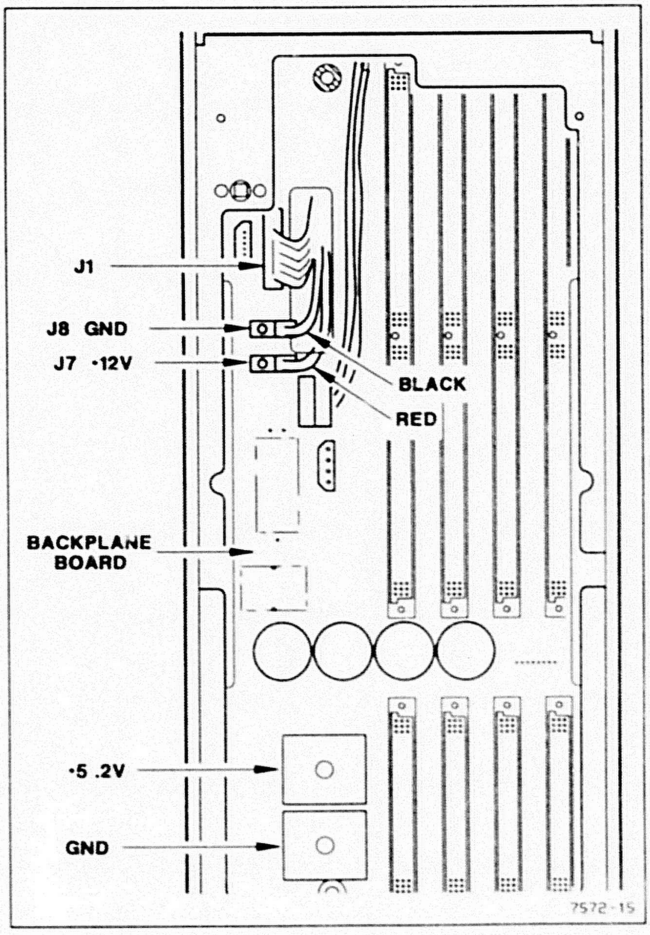

Figure 6-1. CEM Power Supply Test Points.

Section 7

REPLACEABLE PARTS LIST

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5	*Name & Description*
	Assembly and/or Component
	Attaching parts for Assembly and/or Component
	····END ATTACHING PARTS····
	Detail Part of Assembly and/or Component
	Attaching parts for Detail Part
	····END ATTACHING PARTS····
	Parts of Detail Part
	Attaching parts for Parts of Detail Part
	····END ATTACHING PARTS····

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation.

Attaching parts must be purchased separately, unless otherwise specified.

ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
16428	COOPER BELDEN ELECTRONIC WIRE AND CA SUB OF COOPER INDUSTRIES INC	NW N ST	RICHMOND IN 47374
30817	INSTRUMENT SPECIALTIES CO INC	EXIT 53 RT 80 BOX A	DELAWARE WATER GAP PA 18327
61058	MATSUSHITA ELECTRIC CORP OF AMERICA PANASONIC INDUSTRIAL CO DIV	ONE PANASONIC WAY PO BOX 1502	SECAUCUS NJ 07094-2917
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
79136	WALDES KOHINOOR INC	47-16 AUSTEL PLACE	LONG ISLAND CITY NY 11101-4402
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201-2431
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108-5181
S3109	FELLER	ASA ADOLF AG STOTZWEID CH8810	HORGEN SWITZERLAND
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK0858	STAUFFER SUPPLY CO (DIST)	810 SE SHERMAN	PORTLAND OR 97214
TK1319	MORELLIS Q & D PLASTICS	1812 16-TH AVE	FOREST GROVE OR 97116
TK1373	PATELEC-CEM (ITALY)	10156 TORINO	VAICENTALLO 62/45S ITALY
TK1543	CAMCAR/TEXTRON	600 18TH AVE	ROCKFORD IL 61108-5181
TK6020	DAINICHI-NIPPON CABLES	NEW KOKUSAI BLDG 4-1 MARUNOUCHI 3-CHOME CHIYODA-KU	TOKYO 100 JAPAN

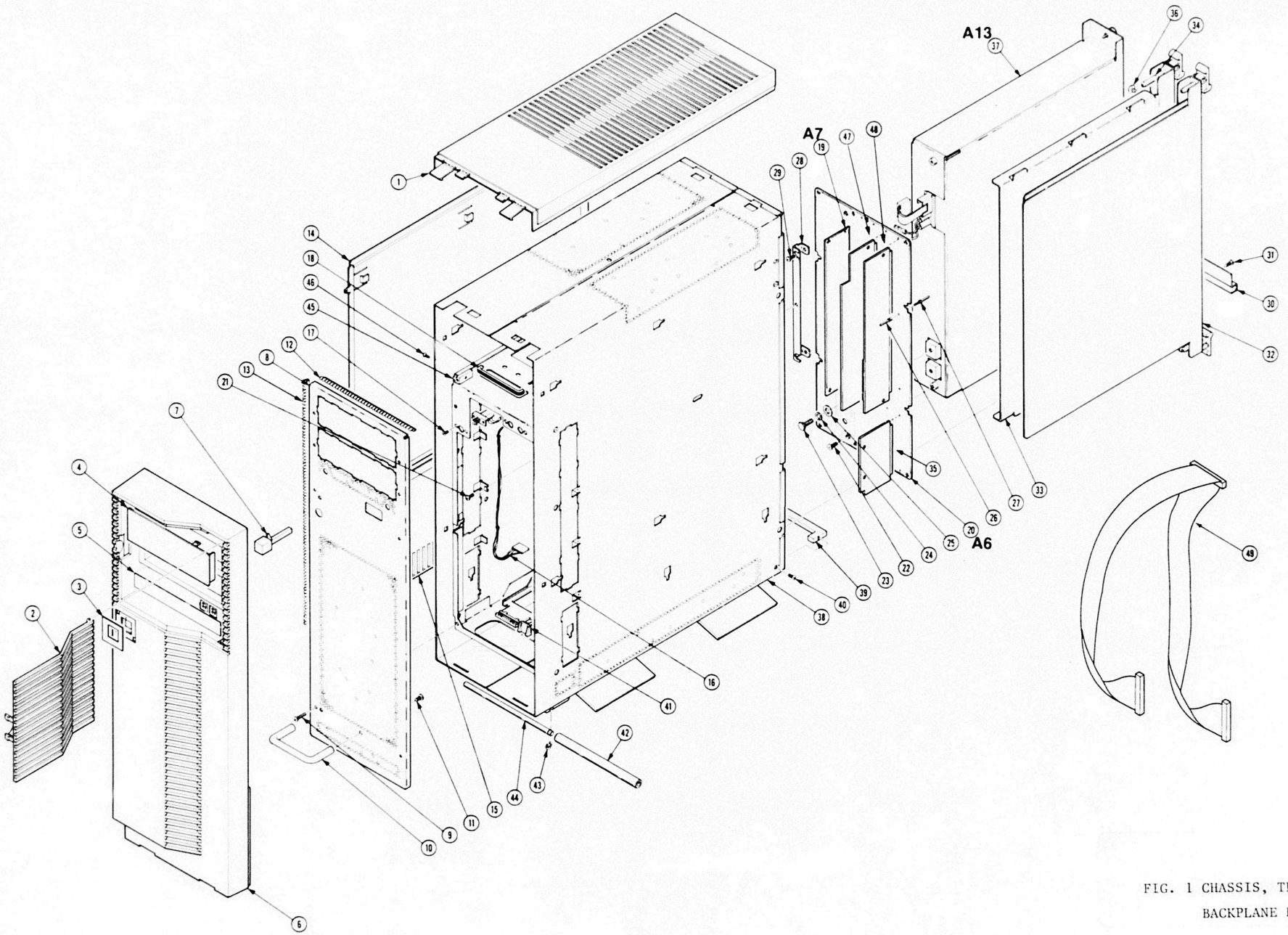

FIG. 1 CHASSIS, TERMINATOR, AND BACKPLANE BOARDS

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	200-3359-00			1	COVER,TOP:PLASTIC	80009	200-3359-00
-2	200-3462-02			1	DOOR,FRONT:FLOPPY	80009	200-3462-02
-3	334-7691-00			1	MARKER,IDENT:MKD LOGO,XD8801	80009	334-7691-00
-4	134-0192-00			1	PLUG,FRONT PNL:PLASTIC,4235	80009	134-0192-00
-5	387-0107-00			1	PLATE,FRONT:PC W/ADHESIVE BACK	80009	387-0107-00
-6	200-3370-01			1	COVER,FRONT:PLASTIC,4225	80009	200-3370-01
-7	366-2096-00			1	PUSH BUTTON:GRAY,0.58 SQ,2.4 H	80009	366-2096-00
-8	200-3373-00			1	COVER,FR ACCESS: (ATTACHING PARTS)	80009	200-3373-00
-9	211-0691-00			8	SCREW,MACHINE:6-32 X 0.625,PNH,STL (END ATTACHING PARTS)	TK0858	ORDER BY DESCR
					COVER ASSY INCLUDES:		
-10	367-0385-00			1	.HANDLE,BOW:3.0 L,ALUMINUM (ATTACHING PARTS)	80009	367-0385-00
-11	212-0681-00			2	.SCREW,MACHINE:10-32 X 0.25,PNH,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR
-12	348-1029-00			4	.GSKT,SHLD ELEK:7.1 L,COPPER	30817	9761017MODIFIED
-13	348-1028-00			2	.GSKT,SHLD ELEK:16.0 L,COPPER	30817	97-610-17
-14	200-3447-01			2	COVER,CABINET:ABS,TOP	80009	200-3447-01
-15	200-3357-00			2	COVER,SIDE:PLASTIC	80009	200-3357-00
-16	174-0874-00			1	CA ASSY,SP,ELEC:2,22 AWG,18.0 L,RIBBON (ATTACHING PARTS)	80009	174-0874-00
-17	211-0303-00			2	SCREW,MACHINE:4-40 X 0.25,FLH 100 DEG,STL (END ATTACHING PARTS)	TK1543	ORDER BY DESCR
-18	348-0158-00			2	GROMMET,PLASTIC:BLACK,U-SHAPE,2.91 ID	TK1319	ORDER BY DESCR
-19	670-9604-00			1	CIRCUIT BD ASSY:TERMINATOR (ATTACHING PARTS)	80009	670-9604-00
-20	671-0537-00			1	CIRCUIT BD ASSY:BACKPLANE (ATTACHING PARTS)	80009	671-0537-00
-21	211-0721-00			2	SCREW,MACHINE:6-32 X 0.375,PNH,STL	83486	ORDER BY DESCR
-22	212-0507-00			2	SCREW,MACHINE:10-32 X 0.375,PNH,STL	TK0435	ORDER BY DESCR
-23	213-1007-00			2	SCREW,MACHINE:0.25-28 X 0.625,HEX	80009	213-1007-00
-24	210-0016-00			2	WASHER,LOCK:0.25 ID,SPLIT,0.062 THK,STL	86928	ORDER BY DESCR
-25	210-1446-00			2	WASHER,FLAT:0.312 ID X 0.75 OD X 0.06 (END ATTACHING PARTS)	80009	210-1446-00
					BACKPLANE BD ASSY INCLUDES:		
-26	214-4049-00			4	.PIN,GUIDE:W/2-56 INT THD	80009	214-4049-00
-27	214-4259-00			4	.PIN,GUIDE:2056 X 0.430 L,SSTUMINUM	80009	214-4259-00
-28	407-3550-00			2	.BRACKET,MTG:BACKPLANE (ATTACHING PARTS)	80009	407-3550-00
-29	211-0721-00			4	.SCREW,MACHINE:6-32 X 0.375,PNH,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR
-30	407-3683-00			2	BRKT,CKT BD LOC:ALUMINUM (ATTACHING PARTS)	80009	407-3683-00
-31	211-0721-00			2	SCREW,MACHINE:6-32 X 0.375,PNH,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR
-32	386-5831-00			1	STIFFENER:CIRCUIT BOARD (PART OF CPU CIRCUIT BD ASSY)	80009	386-5831-00
-33	386-5513-00			AR	STIF,CIRCUIT BD:4235 FAKE,ALUMINUM	80009	386-5513-00
-34	214-4067-00			2	.PIN,GUIDE:0.25,SST	80009	214-4067-00
-35	671-0540-00			2	CIRCUIT BD ASSY:TERMINATOR (ATTACHING PARTS)	80009	671-0540-00
-36	344-0425-00			3	.CLIP,GUIDE:0.330 L,NYLON	80009	344-0425-00
-37	119-2438-00			1	PWR SPLY,MODULE: (SEE A13 REPL)	80009	119-2438-00
-38	441-1897-00			1	CHASSIS,FRAME:ALUMINUM	80009	441-1897-00
-39	381-0454-00			2	.BAR,EJECTOR:7.394 L,6-32 THD,ALUMINUM (ATTACHING PARTS)	80009	381-0454-00
-40	211-0718-00			4	.SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR
-41	351-0816-00			2	.GUIDE,CKT BD:PLSTC,LOWER/UPPPER	80009	351-0816-00
-42	384-1739-00			2	.ROD,ROLLER SPRT:0.5 OD W/0.258 THRU,6.18 L, .PLASTIC	80009	384-1739-00
-43	354-0331-00			2	.RING,RTNG:EXT BOWED E,U/O 0.219 DIA SFT	79136	5131-X-21MD
-44	384-1738-00			2	.SHAFT,SUPPORT:6.604 L,SST	80009	384-1738-00
-45	220-0080-01			2	.NUT BLOCK:6-32 X 0.42 DIA,ALUMINUM (ATTACHING PARTS)	80009	220-0080-01

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-46	211-0718-00			2	.SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR
-47	671-1407-00			1	CIRCUIT BD ASSY:LBC (ATTACHING PARTS)	80009	671-1407-00
-48	671-0596-00			1	CIRCUIT BD ASSY:VME TERMINATOR (ATTACHING PARTS)	80009	671-0596-00
-49	174-1915-00			1	CA ASSY,SP,ELEC:50,50.1 L (OPTION 19 ONLY)	80009	174-1915-00

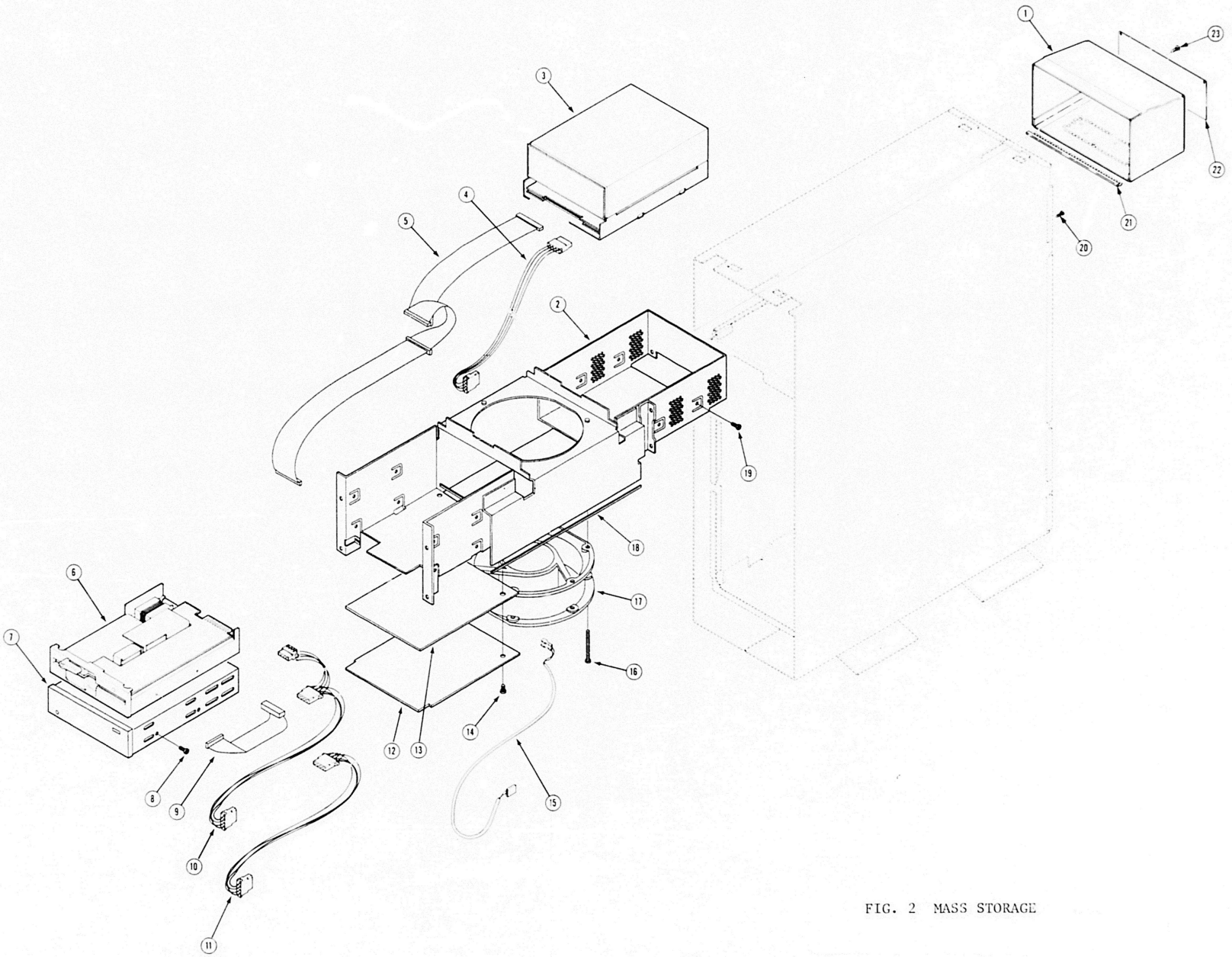

FIG. 2 MASS STORAGE

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-1	386-5912-00			1	COVER,REAR: (ATTACHING PARTS)	80009	386-5912-00
-2	441-1924-00			1	CHASSIS,FAN:ALUMINUM (ATTACHING PARTS)	80009	441-1924-00
-3	119-2437-01			1	DISK DRIVE:5.25 WINCHESTER,182MBYTES (STANDARD ONLY)	80009	119-2437-01
	119-3123-01			1	DISK DRIVE:WINCHESTER 5 1/4 IN,300MB (OPTION 17 ONLY)	80009	119-3123-01
	119-3607-00			1	DISK DRIVE:5.25,WINCHESTER,601 MEGABYTE,16.5MS SEEKTIME (OPTION 18 ONLY) (ATTACHING PARTS)	80009	119-3607-00
-4	174-1762-00			1	CA ASSY,SP,ELEC:4,18 AWG,26.0 L (STANDARD AND OPTION 17,18)	80009	174-1762-00
-5	174-1291-00			1	CA ASSY,SP,ELEC:50,28 AWG (STANDARD ONLY)	80009	174-1291-00
-6	119-2400-02			1	FLOPPY DISK DR:5.25 MINI FLOPPY,1.6MB,1/2H VER AGG (OPTION 14 ONLY) (ATTACHING PARTS)	61058	JV-475-3AEG
-7	119-3650-00			1	TAPE,DRIVE: (STANDARD) (ATTACHING PARTS)	80009	119-3650-00
-8	211-0294-00			8	SCREW,MACHINE:M3 X 0.5 X 10MM,PNH,STL (STANDARD STREAMER AND OPTION 14) (END ATTACHING PARTS)	83486	ORDER BY DESCR
-9	174-1340-00			1	CA ASSY,SP,ELEC:34,28 AWG (OPTIONS 14 ONLY) (ATTACHING PARTS)	80009	174-1340-00
-10	174-1029-01			1	CABLE ASSY,PWR,:3,20 AWG (OPTION 14 ONLY) (ATTACHING PARTS)	80009	174-1029-01
-11	174-0873-00			1	CA ASSY,SP,ELEC:4,22 AWG,26.0 L,RIBBON (STANDARD ONLY)	80009	174-0873-00
-12	670-9804-03			1	CIRCUIT BD ASSY:SOFTPC FLOPPY CONT MOD (OPTION 14 ONLY)	80009	670-9804-03
-13	342-0877-00			1	INSULATOR:CIRCUIT BOARD/FLOPPY CONTROLLER (OPTION 14 ONLY) (ATTACHING PARTS)	80009	342-0877-00
-14	211-0722-00			2	SCREW,MACHINE:6-32 X 0.25,PNH,STL (OPTION 14 ONLY) (END ATTACHING PARTS)	80009	211-0722-00
-15	174-0454-00			1	CA ASSY,SP,ELEC:2,22 AWG,28.0 L	80009	174-0454-00
-16	211-0623-00			3	SCREW,MACHINE:6-32 X 2.25,PNH,STL (END ATTACHING PARTS)	TK0435	ORDER BY DESCR
-17	119-3709-00			1	FAN:18 W,12-28VDC (ATTACHING PARTS)	80009	119-3709-00
-18	255-0581-00			AR	PLASTIC CHANNEL:0.156 X 0.156,POLYETHYLENE	80009	255-0581-00
-19	211-0722-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,STL (END ATTACHING PARTS)	80009	211-0722-00
-20	211-0721-00			4	SCREW,MACHINE:6-32 X 0.375,PNH,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR
-21	348-1029-00			1	GSKT,SHLD ELEK:7.1 L,COPPER (END ATTACHING PARTS)	30817	9761017MODIFIED
-22	334-7548-00			1	MARKER,IDENT: (ATTACHING PARTS)	80009	334-7548-00
-23	211-0721-00			2	SCREW,MACHINE:6-32 X 0.375,PNH,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR

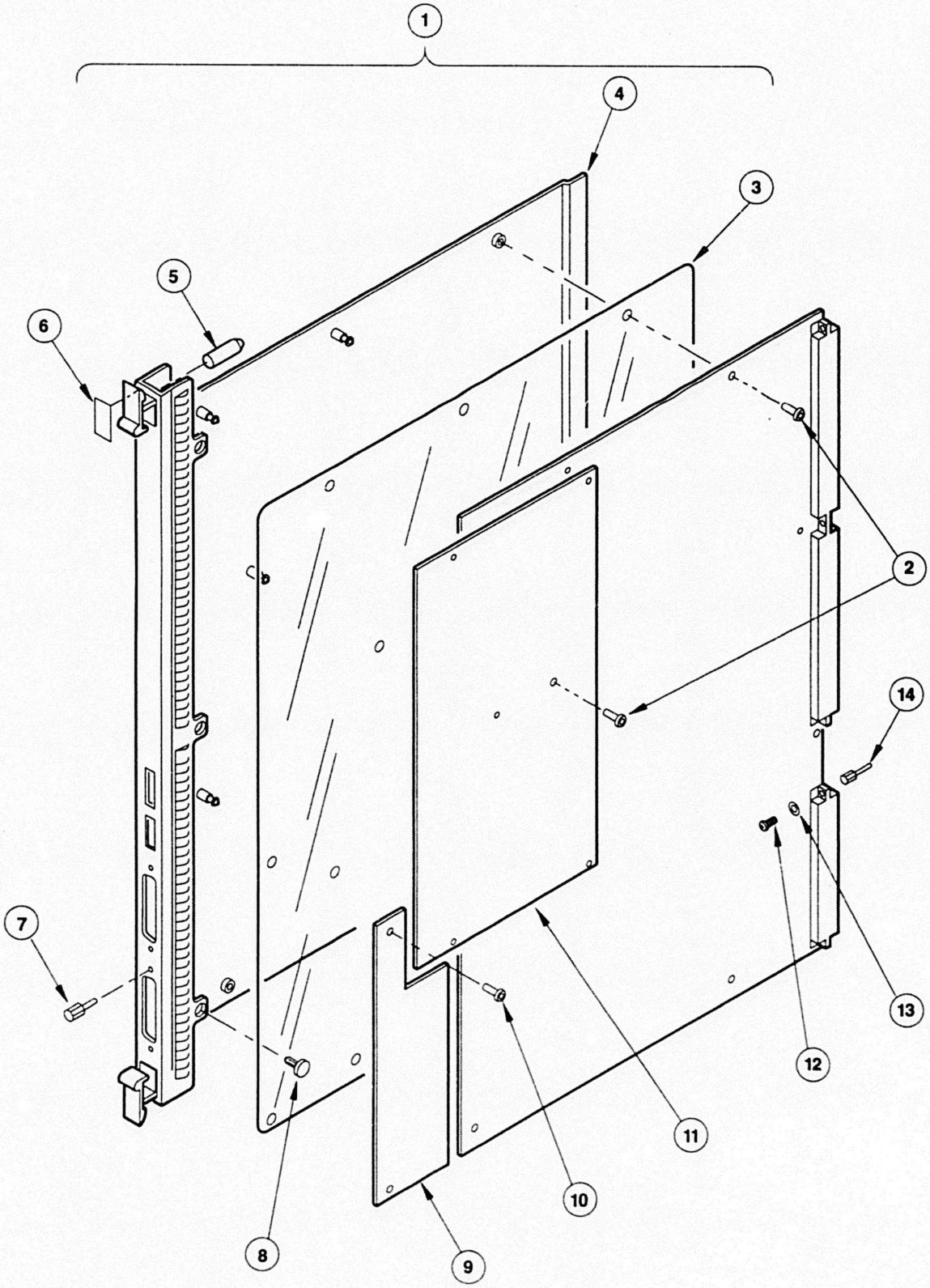

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-1	671-0541-00			1	CIRCUIT BD ASSY:CPU	80009	671-0541-00
					(ATTACHING PARTS)		
-2	211-0722-00			9	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-3	342-0875-00			1	INSULATOR:CIRCUIT BOARD/CE & I/O	80009	342-0875-00
					(ATTACHING PARTS)		
-4	386-5831-00			1	STIFFENER:CIRCUIT BOARD	80009	386-5831-00
-5	214-4067-00			2	PIN,GUIDE:0.25,SST	80009	214-4067-00
-6	334-7738-00			1	MARKER,IDENT:MARKED CE BOARD	80009	334-7738-00
-7	214-3903-00			4	SCREW,JACK:4-40 X 0.312 LONG,HEX HEAD	80009	214-3903-00
					(ATTACHING PARTS)		
-8	344-0425-00			3	CLIP,GUIDE:0.330 L,NYLON	80009	344-0425-00
-9	671-0805-00			1	CIRCUIT BD ASSY:AUXULIARY	80009	671-0805-00
-10	211-0722-00			2	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-11	671-0553-00			1	CIRCUIT BD ASSY:8MB MEMORY MODULE (STANDARD ONLY)	80009	671-0553-00
					(ATTACHING PARTS)		
	671-0926-00			1	CIRCUIT BD ASSY:MEMORY MODULE II (OPTION 1A ONLY)	80009	671-0926-00
					(ATTACHING PARTS)		
-12	211-0485-00			3	SCREW,MACHINE:2-56 X 0.250 L,PAN HEAD(T7)TO RX DRIVE	80009	211-0485-00
					(ATTACHING PARTS)		
-13	210-0053-00			3	WASHER,LOCK:#2 SPLIT,0.02 THK STL	78189	ORDER BY DESCR
					(ATTACHING PARTS)		
-14	214-4119-00			3	PIN,GUIDE:RCPT,W/2-56 THD	80009	214-4119-00
					(ATTACHING PARTS)		

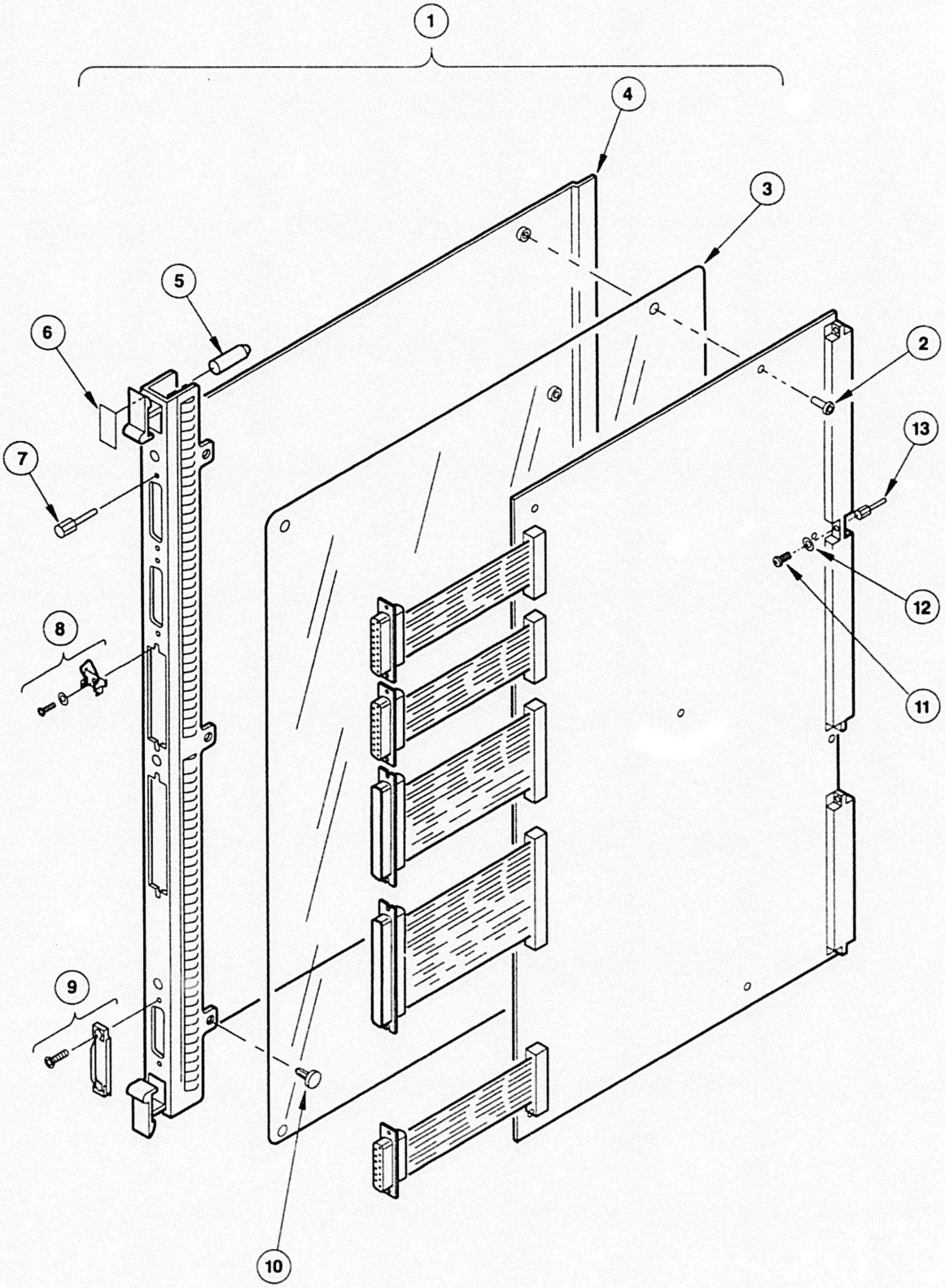

FIG. 4 I/O BOARD

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
4-1	671-0538-00			1	CIRCUIT BD ASSY:I/O	80009	671-0538-00
					(ATTACHING PARTS)		
-2	211-0722-00			7	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-3	342-0875-00			1	INSULATOR:CIRCUIT BOARD/CE & I/O	80009	342-0875-00
-4	386-5830-00			1	STIFFENER:CIRCUIT BOARD	80009	386-5830-00
-5	214-4067-00			2	PIN,GUIDE:0.25,SST	80009	214-4067-00
-6	334-7737-00			1	MARKER,IDENT:MARKED I/O BOARD	80009	334-7737-00
-7	214-3903-00			1	SCREW,JACK:4-40 X 0.312 LONG,HEX HEAD	80009	214-3903-00
-8	343-1433-00			2	CLIP,BAIL:RIBBON,CONN,HDW ASSY KIT	80009	343-1433-00
-9	343-1171-00			1	RTNR,ELEC CONN:U/W 15 CONT D-SUBMINIATURE	00779	745405-1
-10	344-0425-00			3	CLIP,GUIDE:0.330 L,NYLON	80009	344-0425-00
					(ATTACHING PARTS)		
-11	211-0485-00			3	SCREW,MACHINE:2-56 X 0.250 L,PAN HEAD(T7)TO RX DRIVE	80009	211-0485-00
					(ATTACHING PARTS)		
-12	210-0053-00			3	WASHER,LOCK:#2 SPLIT,0.02 THK STL	78189	ORDER BY DESCR
					(ATTACHING PARTS)		
-13	214-4119-00			3	PIN,GUIDE:RCPT,W/2-56 THD	80009	214-4119-00
					(ATTACHING PARTS)		

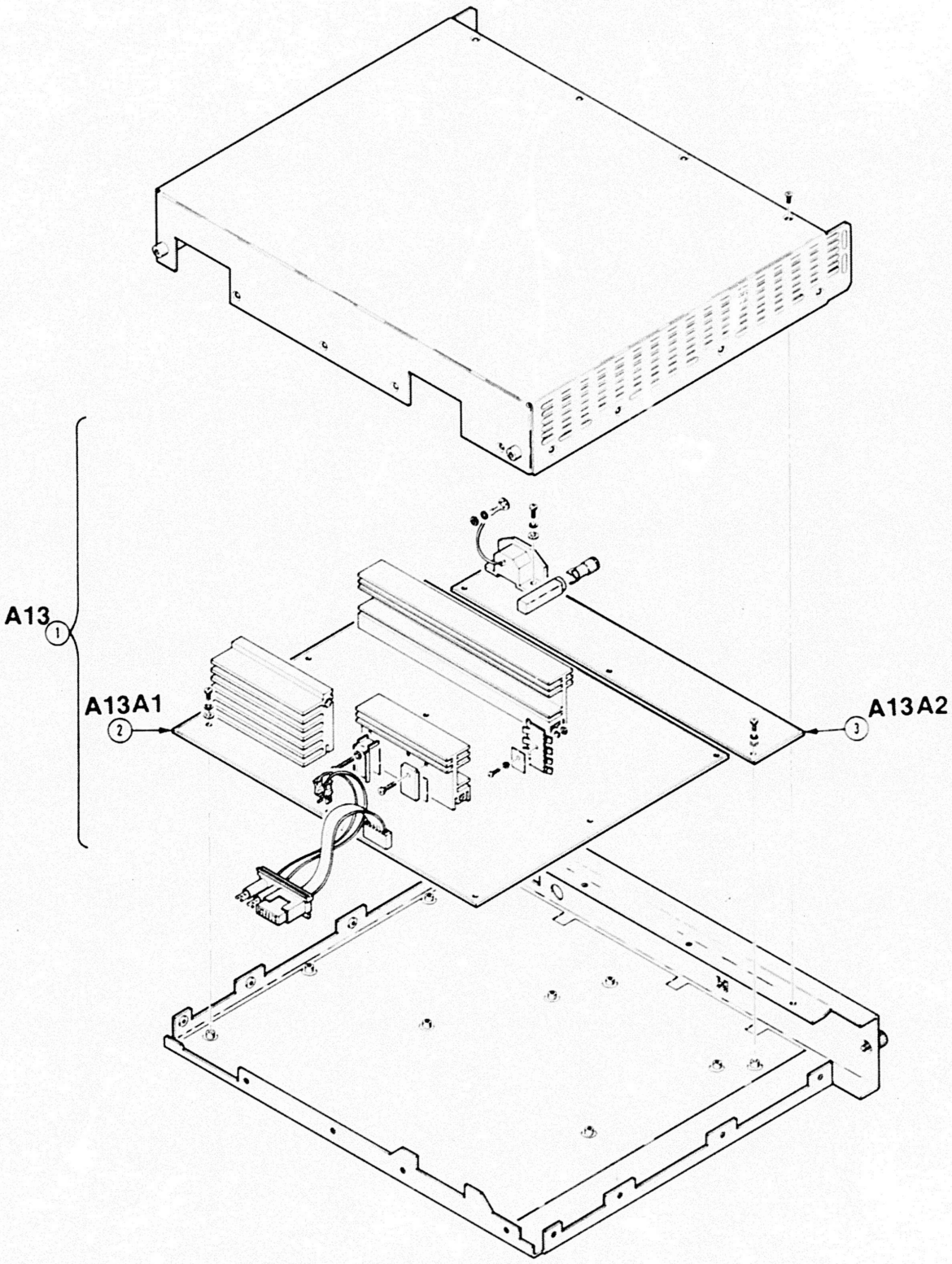

FIG. 5. POWER SUPPLY

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
5-1	119-2438-00			1	PWR SPLY,MODULE:	80009	119-2438-00
-2	118-7669-00			1	CIRCUIT BD ASSY:MAIN	80009	118-7669-00
-3	118-7670-00			1	CIRCUIT BD ASSY:POWER	80009	118-7670-00

FIG. 6 OPTIONS IB-IM MEMORY

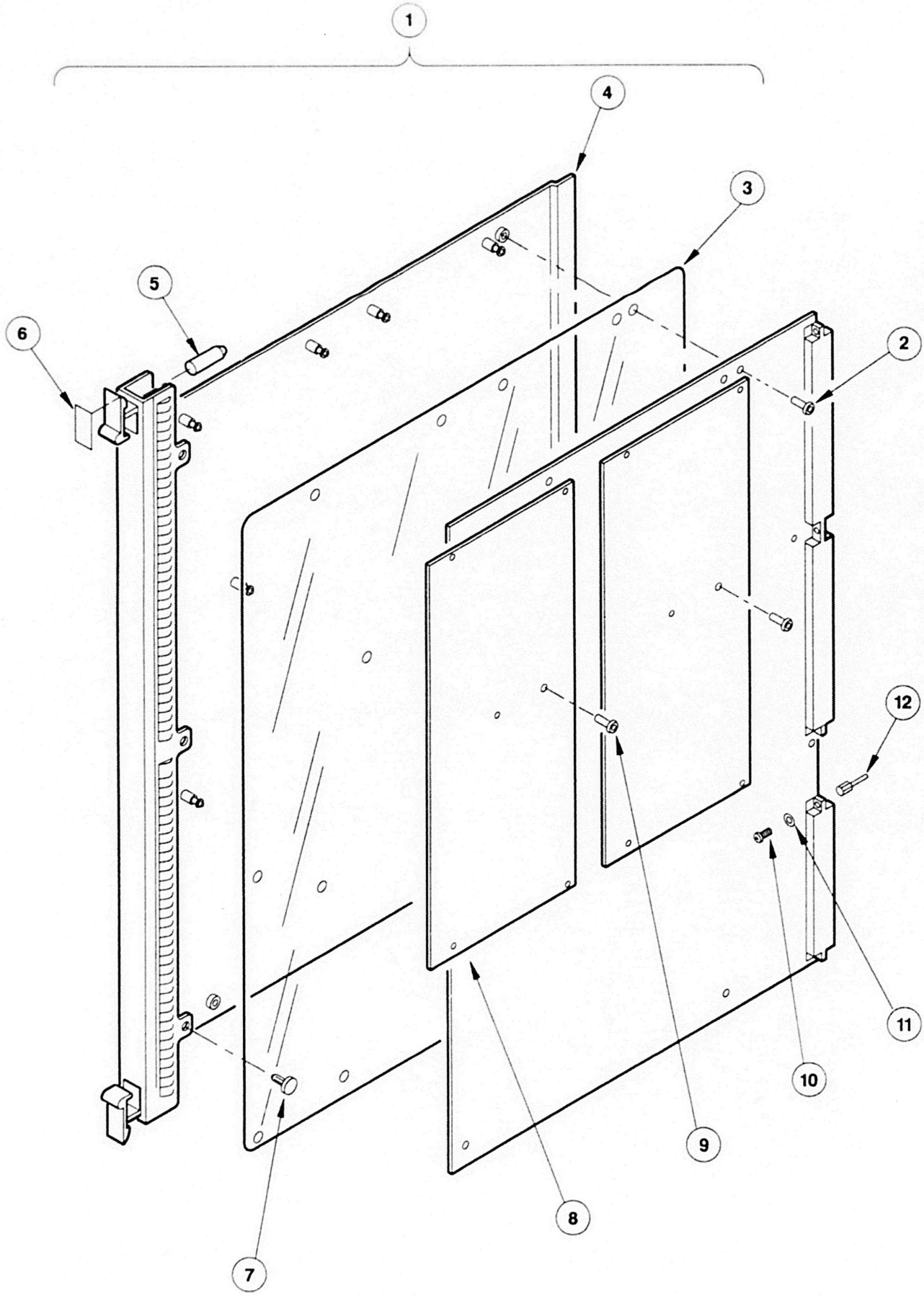

FIG. 6 OPTIONS IB-IM MEMORY

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
6-1	671-0539-00			1	CIRCUIT BD ASSY:MEMORY	80009	671-0539-00
					(ATTACHING PARTS)		
-2	211-0722-00			7	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-3	342-0876-00			1	INSULATOR:CIRCUIT BOARD/MEMORY	80009	342-0876-00
-4	386-5832-00			1	STIFFENER:CIRCUIT BOARD	80009	386-5832-00
-5	214-4067-00			2	PIN,GUIDE:0.25,SST	80009	214-4067-00
					(ATTACHING PARTS)		
-6	334-7736-00			1	MARKER,IDENT:MARKED MEMORY CONTROLLER	80009	334-7736-00
-7	344-0425-00			3	CLIP,GUIDE:0.330 L,NYLON	80009	344-0425-00
					(ATTACHING PARTS)		
-8	671-0926-00			1	CIRCUIT BD ASSY:MEMORY MODULE II (OPTIONS 1B,1C,1D,1E,1F,1G,1H,1J,1K,1M)	80009	671-0926-00
					(ATTACHING PARTS)		
-9	211-0722-00			2	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-10	211-0485-00			3	SCREW,MACHINE:2-56 X 0.250 L,PAN HEAD(T7)TO RX DRIVE	80009	211-0485-00
					(ATTACHING PARTS)		
-11	210-0053-00			3	WASHER,LOCK:#2 SPLIT,0.02 THK STL	78189	ORDER BY DESCR
					(ATTACHING PARTS)		
-12	214-4119-00			3	PIN,GUIDE:RCPT,W/2-56 THD	80009	214-4119-00
					(ATTACHING PARTS)		

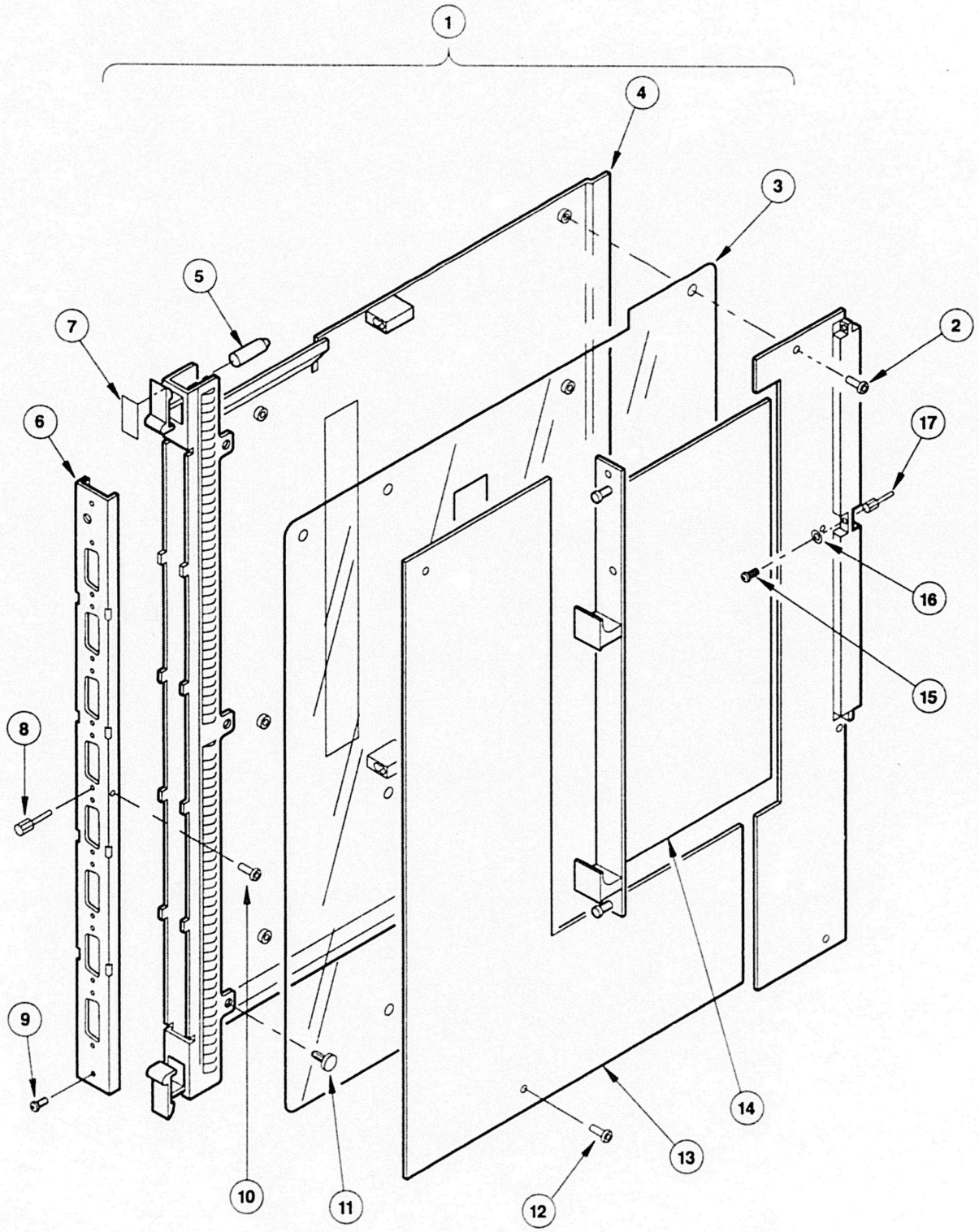

FIG. 7 OPTION 3A, 3G

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
7-1	671-0221-00			1	CIRCUIT BD ASSY:VME ADAPTER (OPTIONS 3A AND 3G) (ATTACHING PARTS)	80009	671-0221-00
-2	211-0722-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,STL (END ATTACHING PARTS)	80009	211-0722-00
-3	342-0898-00			1	INSULATOR:VME/DRIVER INTERFACE CKT BD,PLAST IC	80009	342-0898-00
-4	386-5973-00			1	STIFFENER:ALUMINUM,CKT BD	80009	386-5973-00
-5	214-4067-00			2	PIN,GUIDE:0.25,SST (ATTACHING PARTS)	80009	214-4067-00
-6	386-5974-00			1	PANEL,REAR:ALUMINUM (OPTION 3A ONLY) (ATTACHING PARTS)	80009	386-5974-00
	386-5992-00			1	PANEL,REAR:BLANK,ALUMINUM (OPTION 3G ONLY) (ATTACHING PARTS)	80009	386-5992-00
-7	334-6530-00			1	MARKER,IDENT:MKD TEK (OPTION 3A ONLY)	80009	334-6530-00
	334-7660-00			1	MARKER,IDENT:MKD VME ADAPTER (OPTION 3G ONLY) (ATTACHING PARTS)	80009	334-7660-00
-8	214-3903-00			18	SCREW,JACK:4-40 X 0.312 LONG,HEX HEAD (ATTACHING PARTS)	80009	214-3903-00
-9	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25,PNH,STL (ATTACHING PARTS)	93907	ORDER BY DESCR
-10	211-0101-00			1	SCREW,MACHINE:4-40 X 0.25,FLH,100 DEG,STL (ATTACHING PARTS)	93907	ORDER BY DESCR
-11	344-0425-00			3	CLIP,GUIDE:0.330 L,NYLON (ATTACHING PARTS)	80009	344-0425-00
-12	211-0722-00			5	SCREW,MACHINE:6-32 X 0.25,PNH,STL (END ATTACHING PARTS)	80009	211-0722-00
-13	671-1113-00			1	CIRCUIT BD ASSY:DRIVER INTERFACE (OPTION 3A ONLY) (ATTACHING PARTS)	80009	671-1113-00
-14	119-3584-00			1	CONTROLLER,MDL:8 PORT SERIAL PLUS PRINTER I NTERFACE (OPTION 3A ONLY) (ATTACHING PARTS)	80009	119-3584-00
-15	211-0485-00			3	SCREW,MACHINE:2-56 X 0.250 L,PAN HEAD(T7)TO RX DRIVE (ATTACHING PARTS)	80009	211-0485-00
-16	210-0053-00			3	WASHER,LOCK:#2 SPLIT,0.02 THK STL (ATTACHING PARTS)	78189	ORDER BY DESCR
-17	214-4119-00			3	PIN,GUIDE:RCPT,W/2-56 THD (ATTACHING PARTS)	80009	214-4119-00

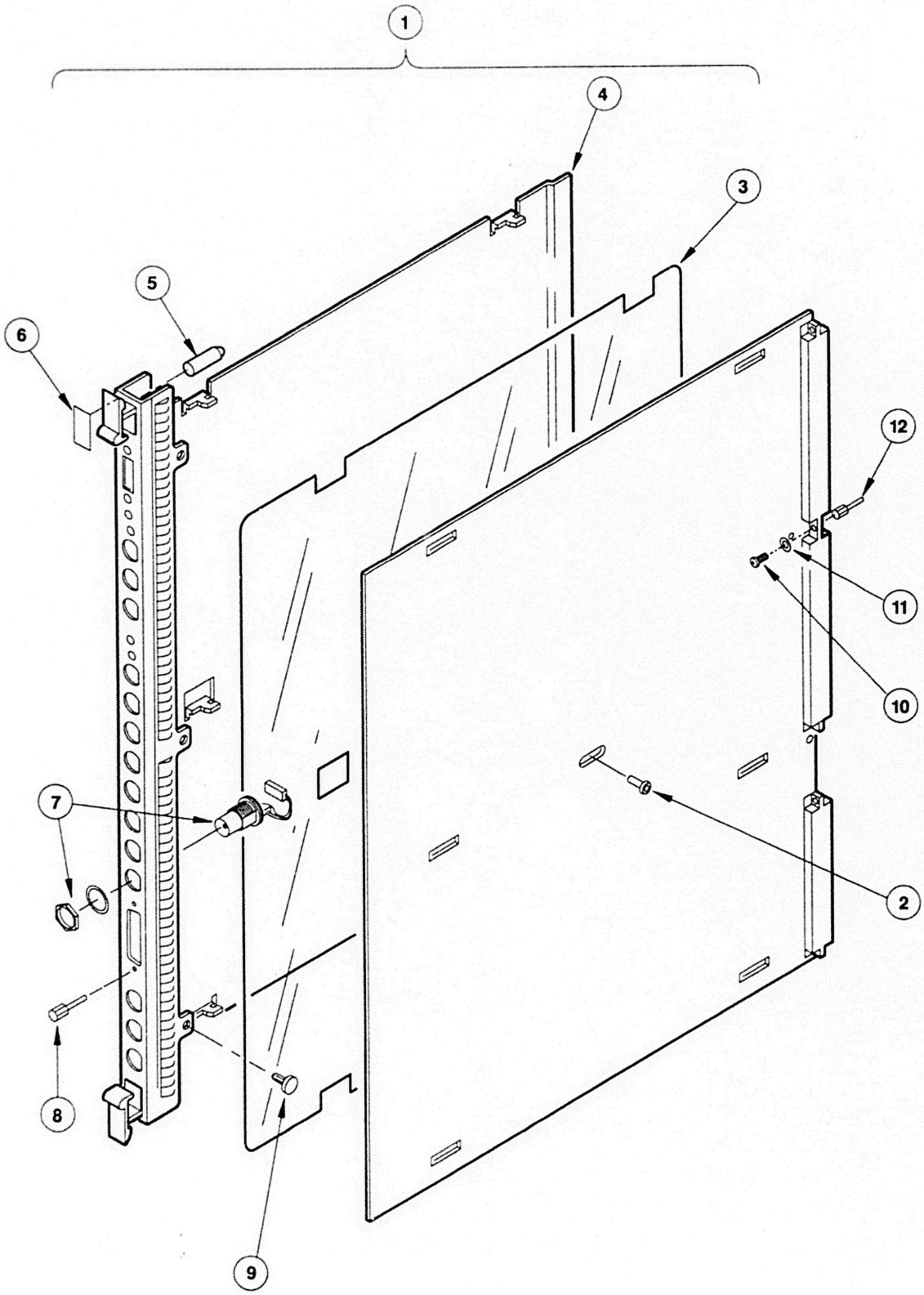

FIG. 8. VIDEO OUT OPTIONS 8,9

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
8-1	671-0923-00			1	CIRCUIT BD ASSY:VIDEO OUT (OPTION 09 ONLY)	80009	671-0923-00
					(ATTACHING PARTS)		
-2	211-0722-00			1	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-3	342-0882-00			1	INSUL,CKT BOARD:POLYPROPYLENE	80009	342-0882-00
-4	386-0038-00			1	STIF,CIRCUIT BD:VIDEO OUT,ALUMINUM	80009	386-0038-00
-5	214-4067-00			2	PIN,GUIDE:0.25,SST	80009	214-4067-00
					(ATTACHING PARTS)		
-6	334-7357-00			1	MARKER,IDENT:MARKED VIDEO OUT	80009	334-7357-00
-7	174-0499-00			14	CA ASSY,SP,ELEC:3,26 AWG,RIBBON	80009	174-0499-00
					(ATTACHING PARTS)		
-8	214-3903-00			2	SCREW,JACK:4-40 X 0.312 LONG,HEX HEAD	80009	214-3903-00
					(ATTACHING PARTS)		
-9	344-0425-00			3	CLIP,GUIDE:0.330 L,NYLON	80009	344-0425-00
					(ATTACHING PARTS)		
-10	211-0485-00			3	SCREW,MACHINE:2-56 X 0.250 L,PAN HEAD(T7)TO RX DRIVE	80009	211-0485-00
					(ATTACHING PARTS)		
-11	210-0053-00			3	WASHER,LOCK:#2 SPLIT,0.02 THK STL	78189	ORDER BY DESCR
					(ATTACHING PARTS)		
-12	214-4119-00			3	PIN,GUIDE:RCPT,W/2-56 THD	80009	214-4119-00
					(ATTACHING PARTS)		

Section 8

DIAGRAMS

This section contains an illustration that diagrams the interconnection relationship between the CEM's FRUs and includes connections to other available graphics subsystems.

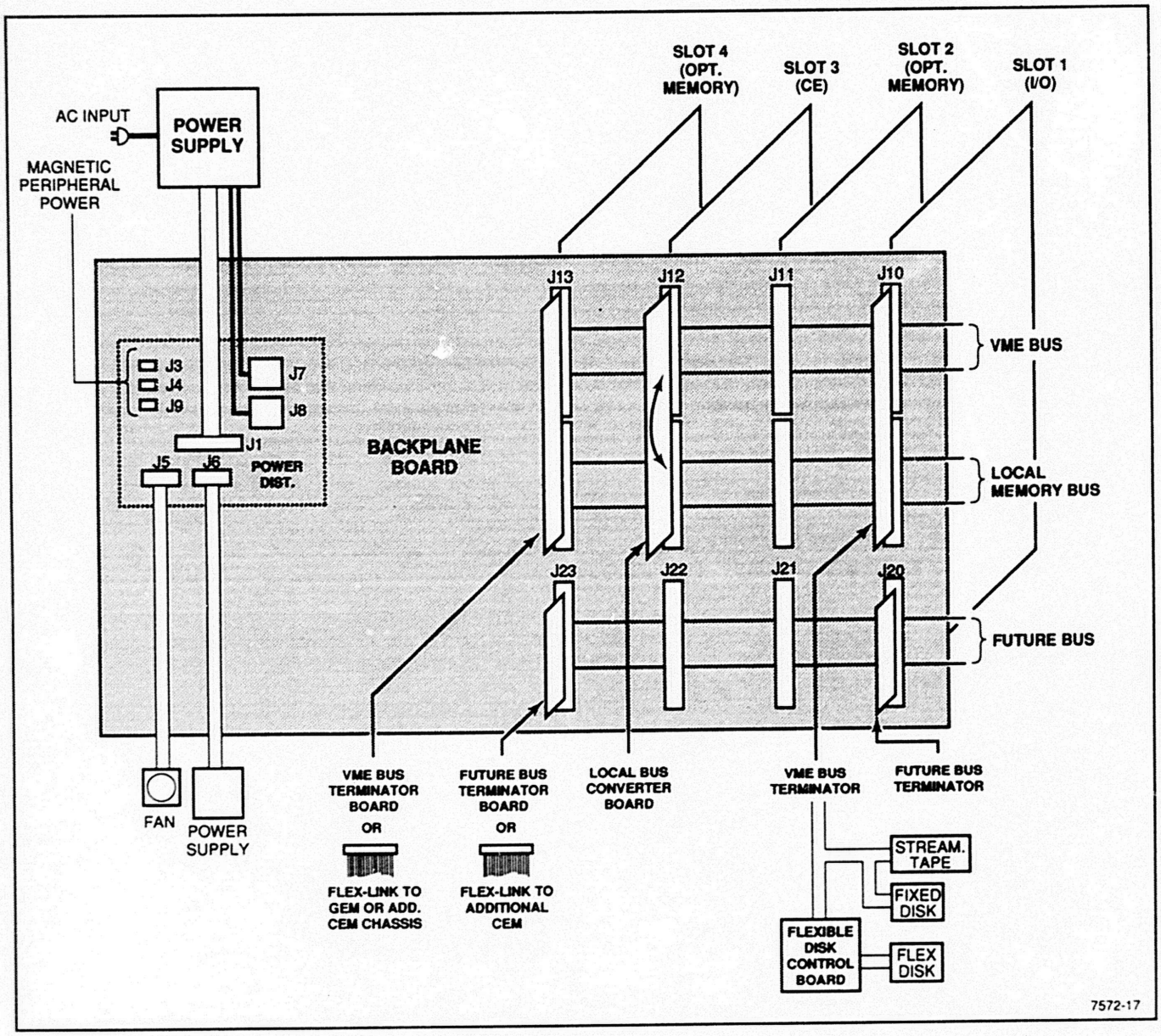

Figure 8-1. CEM System Interconnect.

Appendix **A**

CONNECTOR DESCRIPTIONS

INTRODUCTION

This appendix presents pinout information on the Backplane board's connectors in indivdual tables. Each table shows the connector's designation, pin numbers, and the signals present at each pin. For the location of the Backplane board's connectors, see Figure A-1.

The CEM's Backplane board provides four slots on the inside for the installation of modular logic boards. On its reverse side, is an equivalent set of four slots comprised of eight connectors (J10 through J13 in combination with J20 through J23) that accept Terminator boards, Local Bus Converter boards, or flex-link connectors that bridge the multiple parallel bus structure between additional Backplane boards.

Three types of terminator boards are used in the CEM. The VMEbus (256-pin) terminators consist of two different boards. One terminator includes a connector that allows magnetic peripherals access to the SCSI interface located on the I/O board, while the other provides the resistive network only. The third type of Terminator board terminates the 96-pin Futurebus connectors.

In system configurations using a single CEM, connectors J10 and J13 contain a VMEbus Terminator board and connectors J20 and J23 hold a Futurebus Terminator board. In graphics workstation configurations that use a single CEM and one or more GEMs, a VMEbus Terminator board resides in J10 and a VMEbus flex link jumps from J13 to the left connector of the GEM Backplane board. The second VMEbus Terminator board moves from connector J13 on the CEM's Backplane board to physical end of the VMEbus on the GEM. The set of two Futurebus Terminator boards remain on the CEM's Backplane board in connectors J20 and J23. In configurations using multiple CEM chassis, replace the Futurebus Terminator board installed in J23 with a Futurebus flex link to extend the Futurebus to the adjacent CEM Backplane board. Then, install the Futurebus Terminator board in connector J23 of the last CEM Backplane board. In any configuration, the maximum number of Backplane boards interconnected is three.

The Backplane board also contains connectors that furnish power and control signals to the remaining system peripherals.

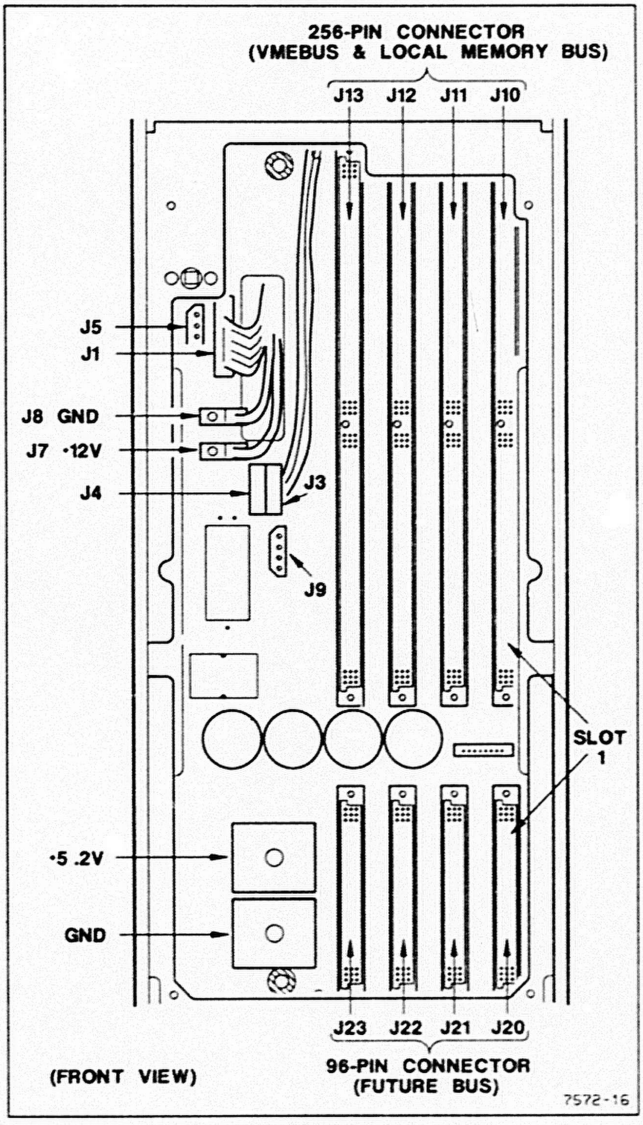

Figure A-1. Backplane Board Connector Locations.

Table A-1 details connector J1. This 14-pin connector is located on the front side of the Backplane board when viewed from the front of the CEM.

Table A-1
POWER SUPPLY SIGNALS J1

Pin	Signal	Function
1	+FAN	Positive fan voltage
2	-FAN	Negative fan voltage
3	GND	Logic ground
4	ACFAIL-0	Loss of input power
5	SCL	Set current limit
6	-12V	-12V supply voltage
7	+5.2V RTN SENSE	Sense for +5.2V return
8	+FAN	Positive fan voltage
9	-FAN	Negative fan voltage
10	GND	Logic ground
11	PONCMD-0	Signal to turn power on/off
12	SFV	Set fan voltage
13	-12V	additional -12V pin
14	+5.2V SENSE	Sense point for +5.2V

Table A-2 provides the pinout for the 4-pin disk drive power connectors J3 and J4 and the auxiliary 4-pin power connector J9. The filtered +5.2V output (pin 4) should have no more than 50mv of ripple.

Table A-2
DEVICE POWER SIGNALS J3

Pin	Signal	Function
1	+12V	Power
2	GND	Ground
3	GND	Ground
4	+5.2V	Filtered power

Table A-3 lists the pins and signals associated with the SCSI signal connector located on the 256-pin Terminator board. This 50-pin connector provides a path for control and data signals between the installed magnetic peripherals and the SCSI interface on the I/O board.

To reduce the table's complexity, odd-numbered pins are not included. The odd-numbered pins tie directly to ground with the single exception of pin 25. Pin 25 has no connection.

Table A-3
SCSI SIGNALS

Pin	Signal	Function
2	DB0	LSB Data
4	DB1	Data
6	DB2	Data
8	DB3	Data
10	DB4	Data
12	DB5	Data
14	DB6	Data
16	DB7	MSB Data
18	DBP	Data parity bit
20	GND	Ground
22	GND	Ground
24	GND	Ground
26	+5V	Power for terminator
28	GND	Ground
30	GND	Ground
32	ATN	Attention
34	GND	Ground
36	BSY	Busy
38	ACK	Acknowledge
40	RST	Reset
42	MSG	
44	SEL	Select
46	C/D	
48	REQ	Request
50	I/O	Input/Ouput select

Table A-4 gives the pinout for the fan power connector J5. This connector has its signals mirrored across pin three so it can connect either way.

Table A-4
FAN POWER CONNECTOR J5

Pin	Signal	Function
1	+ Fan voltage	Positive fan power
2	- Fan voltage	Negative fan power
3	N/C	No connection
4	- Fan voltage	Negative fan power
5	+ Fan voltage	Positive fan power

Connector J6 connects the CEM's front panel controls to the Backplane board. Table A-5 lists these signals and shows on which J6 pin the signal occurs.

Table A-5
FRONT PANEL CONNECTOR J6

Pin	Signal	Function
1	GND	Ground
2	N/C	No connection
3	PONSW-0	Connects to ON/OFF switch
4	N/C	No connection
5	N/C	No connection
6	PONCMD-0	Connects to ON/OFF switch
7	GND	Ground
8	GND	Ground

The lower portion of the modular board connectors (J20, J21, J22, and J23) provide the connection to the Futurebus. These 96-pin connectors consist of three rows (A, B, and C) of 32 pins each. Table A-6 lists the signals available on the Futurebus connectors.

Table A-6
FUTUREBUS CONNECTORS J20, J21, J22, J23

Pin	Row A	Row B	Row C
1	GND	GND	GND
2	+5VDC	+5VDC	+5VDC
3	AD0	AD1	AD2
4	AD3	GA0	AD4
5	AD5	AD6	AD7
6	GND	BPZ	AD8
7	AD9	AD10	GND
8	AD11	AD12	AD13
9	AD14	GA1	AD15
10	BPY	AD16	AD17
11	GND	AD18	AD19
12	AD20	AD21	GND
13	AD22	AD23	BPX
14	AD24	GA2	AD25
15	AD26	AD27	AD28
16	GND	AD29	AD30
17	AD31	BPW	GND
18	CM0	CM1	CM2
19	CM3	GA3	CM4
20	CP	CM5	STO
21	GND	ST1	ST2
22	AS	AK	GND
23	A1	DS	DK
24	DI	GA4	AP
25	AQ	AR	AC
26	GND	AB0	AB1
27	AB2	AB3	GND
28	AB4	AB5	AB6
29	SB0	RE	SB1
30	TG	ST3	TP
31	+5VDC	+5VDC	+5VDC
32	GND	GND	GND

Table A-7 presents the signals available on the upper portion of the modular board connectors J10, J11, J12, and J13. As with the lower portion, these 276-pin connectors contain three rows (A, B, and C) of 92 pins. Depending on the board installed, signals available at each pin posistion varies. Table A-7 lists the signals produced by the I/O board and Table A-8 lists those signals specific to the CE board

Table A-7
I/O BOARD SIGNALS

Pin	Row A	Row B	Row C
1	GND	VMEBBSY-0	+5V
2	VMED(0)	VMED(8)	VMEBCLR-0
3	VMED(9)	GND	VMED(1)
4	VMED(10)	VMEACFAIL-0	VMED(2)
5	GND	VMEBG0IN-0	VMED(11)
6	VMEBG0OUT-0	VMED(3)	+5V
7	VMED(4)	VMED(12)	VMEBG1IN-0
8	VMED(13)	GND	VMED(5)
9	VMED(14)	VMEBG1OUT-0	VMED(6)
10	GND	VMEBG2IN-0	VMED(15)
11	VMEBG2OUT-0	VMED(7)	+5V
12	VMESYSFAIL-0	VMEBG3IN-0	VMESYSCLK
13	VMEBG3OUT-0	+5V	VMEBERR-0
14	VMESYSRESET-0	VMEBR0-0	VMEDS1-0
15	GND	VMEBR1-0	VMELWORD-0
16	VMEBR2-0	VMEDS0-0	+5V
17	VMEWRITE-0	VMEAM5-1	VMEBR3-0
18	VMEA(23)	GND	VMEAM0-1
19	VMEDTACK-0	VMEA(22)	VMEAM1-1
20	GND	VMEA(21)	VMEAM2-1
21	VMEA(20)	VMEAS-0	+5V
22	VMEA(19)	VMEA(18)	VMEAM3-1
23	SERCLK	+5V	IACK-0
24	IACKIN-0	SERDAT-0	VMEA(17)
25	GND	IACKOUT-0	VMEA(16)
26	VMEA(15)	VMEAM4-1	+5V
27	VMEA(14)	VMEA(7)	VMEIRQ7-0
28	VMEA(13)	GND	VMEIRQ6-0
29	VMEIRQ5-0	VMEA(12)	VMEA(6)
30	GND	VMEIRQ4-0	VMEA(5)
31	VMEA(11)	VMEA(4)	+5V
32	VMEA(10)	VMEA(3)	VMEIRQ3-0
33	VMEA(9)	+5V	VMEIRQ2-0
34	VMEIRQ1-0	VMEA(8)	VMEA(2)
35	GND	VMEA(1)	+5V
36		GSPARE1	
37		GSPARE2	
38		GND	
39		SLOT3-1	
40		SLOT2-1	
41	GND	SLOT1-1	+5V
42		SLOT0-1	
43		VTIM-0	
44			
45		PONSW-0	
46		+5V	

Table A-7 (cont.)
I/O BOARD SIGNALS

Pin	Row A	Row B	Row C
47		GND	
48		PONCMD-0	
49		+5V	
50		SCL	
51		SFV	
52	GND	RESERVED	+5V
53		VMEA(24)	
54		VMEA(25)	
55		GND	
56		VMEA(26)	
57		VMEA(27)	
58	GND	VMEA(28)	+5V
59		VMEA(29)	
60		VMEA(30)	
61		+5V	
62		VMEA(31)	
63		VMED(16)	
64	GND	VMED(17)	+5V
65		VMED(18)	
66		VMED(19)	
67		GND	UAD10
68		VMED(20)	
69		VMED(21)	
70	GND	VMED(22)	+5V
71	SB(0)	VMED(23)	
72	SB(1)	VMED(24)	
73	SB(2)	GND	
74	SB(3)	VMED(25)	
75	SB(4)	VMED(26)	
76	GND	VMED(27)	+5V
77	SB(5)	VMED(28)	
78	SB(6)	VMED(29)	
79	SB(7)	+5V	
80	SB(8)	VMED(30)	
81	GND	VMED(31)	+5V
82	TERM PWR	UAD(30)	
83	ATN-0	UAD(30)	
84	BSY-0	GND	
85	ACK-0		
86	RST-0		
87	MSG-0		
88	GND		+5V
89	SEL-0	-12V	
90	C/D-0	GND	
91	REQ-0	+12V	
92	I/O-0	+12V	

Table A-8
CE BOARD SIGNALS

Pin	Row A	Row B	Row C
1	GND		+5V
2			
3		GND	
4			
5	GND		
6			+5V
7			
8		GND	
9			
10	GND		
11			+5V
12			
13		+5V	
14			
15	GND		
16			+5V
17			
18		GND	
19			
20	GND		
21			+5V
22			
23		+5V	
24			
25	GND		
26			+5V
27			
28		GND	
29			
30	GND		
31			+5V
32			
33		+5V	
34			
35	GND		+5V
36	LMBFGRANT-0		LMBFGRANT-0
37	LMBLEFT-0		LMBRIGHT-0
38	LMBUDACK-0	GND	LMBUDACK-0
39	LMBUIV-0		LMBUIV-0
40	LMBUDS-0		LMBUDS-0
41	GND		+5V
42	LMBUAS-0		LMBUAS-0
43	LMBCENTER-0		LMBCENTER-0
44	LMBUAAK-0	GND	LMBUAAK-0
45	LMBUDTACH-0		LMBUDTACH-0
46	LMBBB-0	+5V	LMBBB-0

Table A-8 (cont.)
CE BOARD SIGNALS

Pin	Row A	Row B	Row C
47	LMBUST0-0	GND	LMBUST0-0
48	LMBUCM(0)		LMBUCM(0)
49	LMBUCM(1)	+5V	LMBCM(1)
50	LMBUCM(2)		LMBCM(2)
51	LMBUCM(3)		LMBCM(3)
52	GND		+5V
53	LMBUCM(4)		LMBCM(4)
54	LMBUAD(0)		LMBAD(0)
55	LMBUAD(1)	GND	LMBAD(1)
56	LMBUAD(2)		LMBAD(2)
57	LMBUAD(3)		LMBAD(3)
58	GND		+5V
59	LMBUAD(4)		LMBAD(4)
60	LMBUAD(5)		LMBAD(5)
61	LMBUAD(6)	+5V	LMBAD(6)
62	LMBUAD(7)		LMBAD(7)
63	LMBUBPZ		LMBBPZ
64	GND		+5V
65	LMBUAD(8)		LMBAD(8)
66	LMBUAD(9)		LMBAD(9)
67	LMBUAD(10)	GND	LMBAD(10)
68	LMBUAD(11)		LMBAD(11)
69	LMBUAD(12)		LMBAD(12)
70	GND		+5V
71	LMBUAD(13)		LMBAD(13)
72	LMBUAD(14)		LMBAD(14)
73	LMBUAD(15)	GND	LMBAD(15)
74	LMBUBPY		LMBUBPY
75	LMBUAD(16)		LMBUAD(16)
76	GND		+5V
77	LMBUAD(17)		LMBUAD(17)
78	LMBUAD(18)		LMBUAD(18)
79	LMBUAD(19)	+5V	LMBUAD(19)
80	LMBUAD(20)		LMBUAD(20)
81	GND		+5V
82	LMBUAD(21)	LMBUAD(30)	LMBUAD(21)
83	LMBUAD(22)	LMBUAD(30)	LMBUAD(22)
84	LMBUAD(23)	GND	LMBUAD(23)
85	LMBUBPX	LMBUAD(31)	LMBUBPX
86	LMBUAD(24)	LMBUAD(31)	LMBUAD(24)
87	LMBUAD(25)	LMBUBPW	LMBUAD(25)
88	GND	LMBUBPW	+5V
89	LMBUAD(26)	-12V	LMBUAD(26)
90	LMBUAD(27)	GND	LMBUAD(27)
91	LMBUAD(28)	+12V	LMBUAD(28)
92	LMBUAD(29)	+12V	LMBUAD(29)

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