KDM70 Controller User Guide

Order Number EK-KDM70-UG-003

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Preface

This user guide's primary purpose is to provide instructions for installing the KDM70 controller in a system cabinet with an XMI backplane. Its secondary purpose is to disseminate product specifications and customer acceptance test verification information.

Although this manual is intended for the user, the KDM70 controller should be installed by qualified Digital Customer Services personnel only.

Chapter 1

General Information

1.1 KDM70 Controller Introduction

The KDM70 controller is a member of the Digital Storage Architecture (DSA) family of mass storage products. DSA is a formal definition of the characteristics and functionality common to Digital's mass storage subsystems.

Table 1–1 describes the major features of the KDM70 controller and the advantages they provide. The KDM70 controller supports storage on XMI based systems, including VAX and RISC architectures. The KDM70 controller has eight SDI/STI (Standard Disk Interface/Standard Tape Interface) ports and two data channels. The ports may be used with any combination of RA-series disk drives, TA-series tape drives, or ESE-series solid-state disk drives, provided only two ports are used for tape formatters.

1.2 DSA and KDM70 Controller Performance Features

The KDM70 controller makes full use of its resources to provide user benefits in configuration flexibility, performance optimization, data integrity, reliability, system availability, and maintainability.

Table 1–1: KDM70 Controller Features and Benefits

Feature	Benefit
All RA-series disk drives and storage arrays, TA-series tape drives, and ESE-series solid-state disk drives are supported	Compatible with existing and future clustered storage devices; migration path from standalone to clustered configurations
RA-series disk drive support advantages	Low-cost disk drive connection; up to 9.7 gigabytes on-line storage per KDM70 controller
TA-series tape drive support advantages	Two TA90 formatters with slaves have 2.4 gigabytes unattended backup or data collection
Request rate of more than 1000 I/O requests per second	High performance I/O handling capability
CI traffic reduced, HSC facilities off-loaded	Improved VAXcluster performance; high-performance local storage for page/swap disk, or staging (temporary storage) of scientific data
Performance optimization: – Command fragmentation – Seek ordering	Data and request rates optimized, even under heavy workload
Fastest response time for hot files on a KDM70 controller with ESE-series disk drives	Enhanced DECtp performance; low latency with ESE20
Striped RA-series disk drives	Increased I/O performance due to use of multiple read/write heads or multiple actuators
VAX VMS, VAX ULTRIX, and RISC ULTRIX supported	DSA controller for all XMI based systems; investment protection; easy migration between systems

The features defined and supported by DSA are listed below. Some of these features are specific to the KDM70 controller.

- **Performance:**

  Enhanced sustainable throughput (on selected host and disk drive configurations)

  Controller-based performance optimization

- **Data Integrity:**

  Extensive internal diagnostic features

  Advanced error detection, error correction, and data recovery

- **Maintainability:**

  On-line self-diagnosis

  Control software can be upgraded without incurring hardware changes

1.2.1 Performance Optimization Features

The KDM70 controller incorporates the following performance optimization features:

- **Seek Ordering:** The controller reorders incoming host requests, taking advantage of disk geometry, and thereby reducing average seek times.

- **Fully Overlapped Seeks:** This technique maximizes the amount of work the controller can do in parallel on multiple disk drives.

- **On-Line Service Tools:** These tools allow disk and tape drives to be serviced while the KDM70 controller is on line and servicing other disk and tape drives.

- **Dual Data Channels:** The KDM70 controller SI interface module provides two data channels, which are optimized for maximum throughput. KDM70 controller data channels are code-optimized and provide dynamic, simultaneous service to multiple ports. Data channel use is transparent to the user.

1.2.2 Data Integrity Features

The following data integrity features have been designed into the KDM70 controller:

- **Error Detection Code (EDC):** EDC is a mathematical method that ensures data integrity within the controller.

- **Error Correction Code (ECC):** ECC is a mathematical method that corrects errors in data caused by media or circuit problems. ECC consists of symbols representing 512 data bytes, as well as the EDC word contained within a block. A block is considered bad if it exceeds its symbol error threshold limit. The bad block is replaced using a bad block replacement algorithm.

Note

The KDM70 controller is able to correct eight 10-bit symbols per sector.

- **Bad Block Replacement (BBR):** BBR is initiated by the KDM70 controller and requires no host assistance. BBR dynamically substitutes good blocks for blocks that have exceeded a predetermined read retry threshold limit, thereby saving the customer's data before data corruption occurs.

- **Replacement Block Number (RBN):** When a block exceeds its retry threshold, the block in question is dynamically replaced with an RBN that has been allocated specifically for replacement purposes.

- **Automatic Revectoring:** Revectoring is a technique used in BBR to redirect defective blocks to good block locations. Revectoring is transparent in that block address redirection is performed by the controller hardware without software intervention and is invisible to the host.

1.3 KDM70 Configuration Guidelines

Certain guidelines should be considered before configuring your system with KDM70 controllers. The maximum number of KDM70 controllers per system depends on available XMI backplane slots—each KDM70 controller requires two adjacent XMI backplane slots. Every system has its own XMI backplane slot restrictions. The KDM70 controller will not function properly in some XMI backplane slots. Refer to your system documentation for system-specific guidelines.

Table 1–2 gives examples of the maximum number of KDM70 controllers that can be installed in various Digital systems.

Table 1–2: Maximum System Capacities for KDM70 Controllers

System Type	Maximum Number of KDM70 Controllers
DECsystem 5810, 5820	2
VAX 6000	4
VAX 9000, Model 210	5
VAX 9000, Model 410, 420	11
VAX 9000, Model 430, 440	23

Different combinations of RA-series disk drives, TA-series tape drives, or ESE-series disk drives may be configured with a single KDM70 controller. However, it is recommended that no more than two ESE-series disk drives be attached to a given KDM70 controller.

When an integral formatter tape drive (such as the TA81) is used, only two tape drives can be attached. When a formatter-slave tape drive (such as the TA90) is used, eight tape drives (two formatter-master tape drives and six slave drives) can be attached. Figure 1–1 is an example of this configuration.

Figure 1–1: Example of a KDM70 Controller Configuration
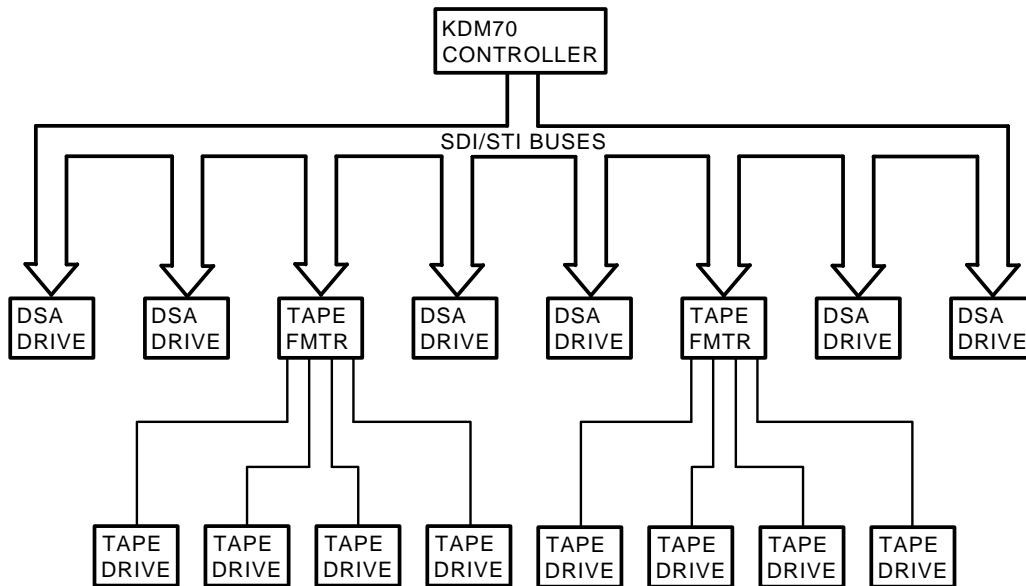
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1.4 Architecture

The KDM70 controller is designed with the DSA approach to mass storage control. DSA defines the functional characteristics of mass storage subsystems and the subsystem interface with host computer environments. The DSA approach guarantees KDM70 controller compatibility with current and future host and DSA mass storage products. DSA removes device-dependent requirements (such as disk geometry and error-recovery strategies) from the host.

Communication within the KDM70 controller I/O subsystem is divided into two interfaces: host to controller and controller to mass storage device. Communication occurs over the XMI bus. Figure 1–2 is a block diagram showing the main communication pathways and the protocol used in the KDM70 subsystem. Refer to this diagram while reading the sections that follow.

1–6   General Information

Figure 1–2: KDM70 Controller Communication Pathways


```
        HOST SYSTEM                                    KDM70
                                                                        SDI/STI
                                                                        BUSES

  MSCP      DUP      TMSCP      LOGICAL    MSCP     DUP      TMSCP
  CLASS     CLASS    CLASS      CONNEC-    CLASS    CLASS    CLASS          0
  DRIVER    DRIVER   DRIVER     TION       SERVER   SERVER   SERVER
                                                                           1

                                                                           2

                                                                           3

                               COMMUNI-                                    4
                               CATIONS
  XMI PORT                     PROTOCOL   XMI PORT                         5
  DRIVER                                  DRIVER
                                                                           6

                                                                           7

                                                                        DEVICE

                              XMI BUS
```
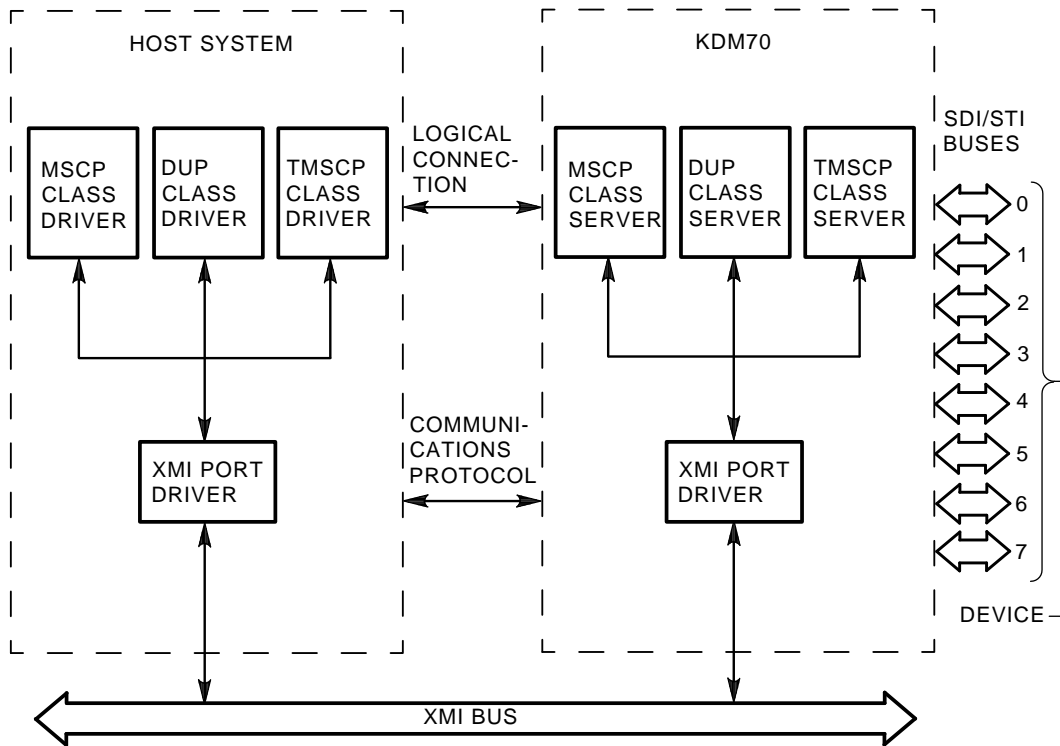
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1.4.1 MSCP and TMSCP

MSCP (Mass Storage Control Protocol) and TMSCP (Tape Mass Storage Control Protocol) are sets of rules that define how DSA hosts and controllers communicate. MSCP and TMSCP communications are packet-oriented. The host sends a command packet (containing a command message) to the controller. The controller performs the command, then sends a response packet (containing a response message) back to the host.

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1.4.2 SDI, STI, and Related Protocols

An SDI bus connects the KDM70 controller to a DSA disk drive. An STI bus connects the KDM70 controller to a tape formatter. Both buses are physically the same; however, protocols that define command and response message transfers across the buses differ.

The SDI and STI buses consist of four coaxial lines. Two of the four lines carry information from the KDM70 controller to a storage device. The remaining two lines carry information from a storage device to the KDM70 controller.

The buses are radial configurations with a separate copy of the bus connected to each storage device. Each bus receives service independent of the other buses and of equal priority.

The protocols further define specific attributes of the SDI and STI. For example, the SDI protocol defines commands and responses that support disk operations. Similarly, the STI protocol defines commands and responses that support tape operations.

1.4.3 XMI Bus Interface

The XMI (eXtended Memory Interconnect) interface manages communications with the host bus. The XMI interface implements XMI protocol required for XMI transactions and provides command and data ports used by the KDM70 controller to transfer data across the XMI bus.

The XMI bus provides the physical communications link between the KDM70 controller, the host central processing units (CPUs), and the memory I/O subsystem in an XMI-based host system. In other systems, the XMI bus provides the physical communications link between the KDM70 controller and the XMI bus adapter.

The XMI interface identifies each device, including the KDM70 controller, as a node. Although the KDM70 controller occupies two backplane slots, the KDM70 processor module slot determines the node identification number.

The XMI system may be configured in different ways, depending upon customer needs. Figures 1–3 and 1–4 are examples of how the KDM70 controller is used in two possible configurations, using the XMI as either a system or an I/O bus.

Figure 1–3: Example of a KDM70 Controller Configured with XMI as a System Bus

```
┌─────────┐         ┌─────────┐     ┌─────────┐         ┌─────────┐
│  CPU 0  │ • • • │  CPU N  │     │  MEM 0  │ • • • │  MEM N  │
└─────────┘         └─────────┘     └─────────┘         └─────────┘

◄══════════════════ XMI (SYSTEM BUS) ══════════════════►

              ┌──────────────┐
              │ KDM70        │
              │ CONTROLLER   │
              └──────────────┘

                  SDI/STI BUSES

  ▼       ▼       ▼       ▼       ▼       ▼       ▼       ▼
┌─────┐ ┌─────┐ ┌─────┐ ┌─────┐ ┌─────┐ ┌─────┐ ┌─────┐ ┌─────┐
│DEV 0│ │DEV 1│ │DEV 2│ │DEV 3│ │DEV 4│ │DEV 5│ │DEV 6│ │DEV 7│
└─────┘ └─────┘ └─────┘ └─────┘ └─────┘ └─────┘ └─────┘ └─────┘
```
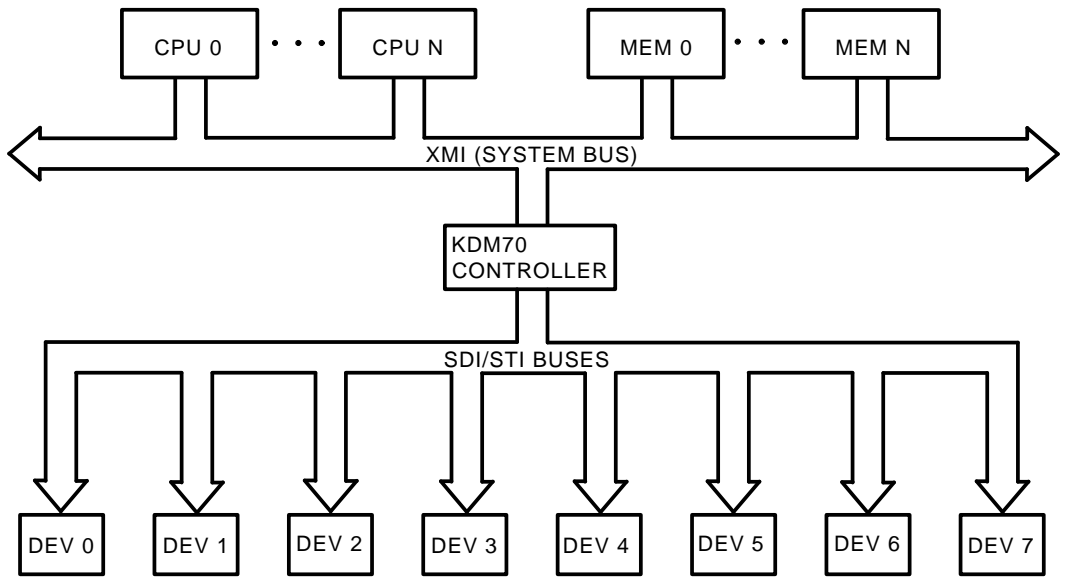
CXO-2832A

Figure 1–4: Example of a KDM70 Controller Configured with XMI as an I/O Bus
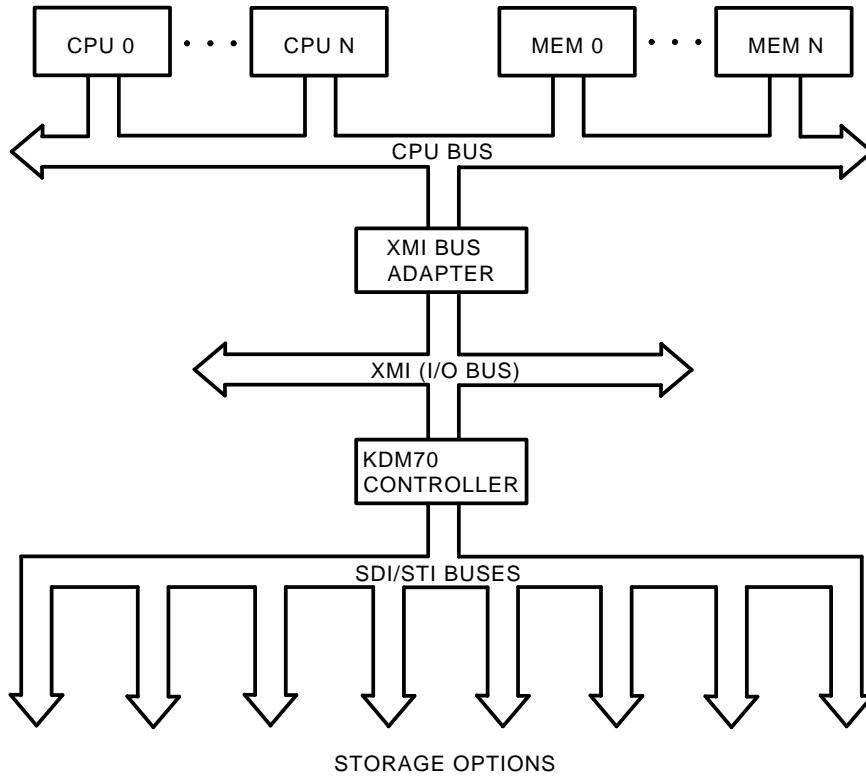
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1.4.4 KDM70 Controller Specifications

The physical and electrical specifications of the KDM70 controller are described in Table 1–3.

Table 1–3: KDM70 Controller Specifications

Characteristics	Specifications
Physical components	KDM70 processor module (T2022), board #1 KDM70 SI interface module (T2023), board #2 SDI/STI cables Intermodule connector KDM70 quad I/O bulkhead distribution panels
Logical unit number restrictions	The KDM70 addresses storage device logical units numbered 0–4094 for disk drives; 0–9999* for tape drives
Power consumption	65 W nominal 87 W maximum
Heat dissipation	Approximately 268.8 Btu/h
Electrical voltage and current requirements	17.4 A at +5.0 V
Operating temperature range	10°C to 40°C (50°F to 104°F), with a temperature gradient of 20°C/h (36°F/h)
Operating relative humidity range	10 to 90%, with a wet bulb temperature of 32°C (90°F) and a minimum dew point of 2°C (36°F)
Operating altitude range	Sea level to 2400 meters (8000 ft); reduce the maximum allowable operating temperature by 1.8°C/1000 m (1°F/1000 ft) for operation above sea level
Mounting restrictions	Mounts in two adjacent XMI module slots in XMI backplanes

*The logical unit number limit for TA78, TA79, and TA81 tape drives is 255; the logical unit number limit for TA90 tape drives is 9999.

1.5 Electrostatic Discharge

Electrostatic discharge (ESD) is caused by the buildup and release of static electricity. An electrical charge from a person or object can damage hardware components and result in premature component or option failure.

1.5.1 Electrostatic Protection

The basic concept of complete static protection for electronic components is both the prevention of static buildup, where possible, and the quick, reliable discharge of static buildup. If the charged object is a conductor, complete discharge can be achieved by grounding.

Use the following guidelines when handling static-sensitive components and modules:

CAUTION

To avoid product damage, always use the ESD wrist strap when handling static-sensitive modules and components.

1. Ensure proper grounding when handling modules, components, or static-sensitive devices.

2. Use static-protective containers to transfer modules and components (including bags and tote boxes).

3. Read all instructions and installation procedures included with static control materials and kits.

The ESD wrist strap and grounding cord are usually contained within a pouch which is adhered to the inside front of the cabinet (refer to Figure 1–5). The ESD grounding cord connects the ESD wrist strap to the cabinet ground. The ESD grounding cord will already be securely attached to the metal surface of the system cabinet.

When using an ESD wrist strap:

1. Ensure that the wrist strap fits snugly for proper conductivity.

2. Do not overextend the grounding cord.

Figure 1–5: Locating the ESD Wrist Strap and Grounding Cord (VAX 6000)

INSIDE FRONT DOOR

CONTROL PANEL

TK TAPE DRIVE

INSIDE FRONT CABINET

VAXBI CARD CAGE

XMI CARD CAGE

FAN

ESD KIT

CXO-2883A
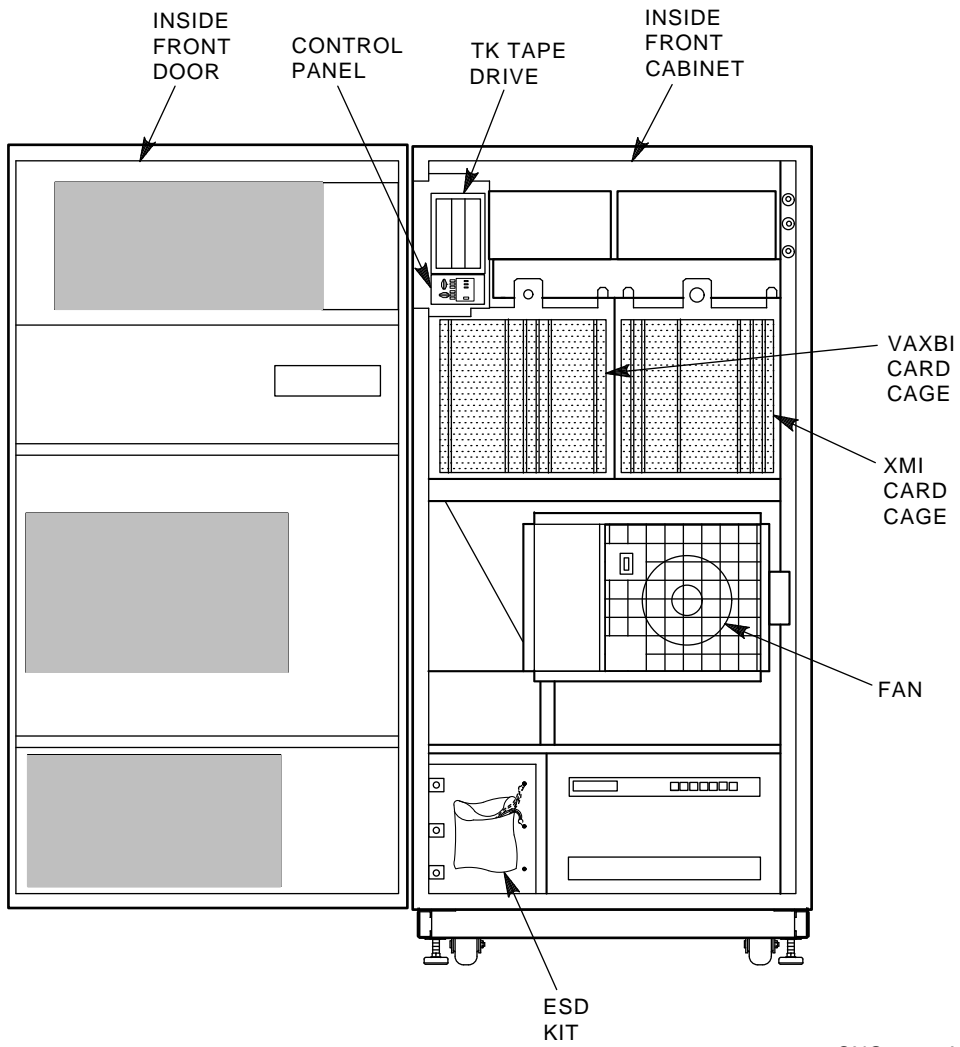
1.6 KDM70 Controller Service

Digital Equipment Corporation offers comprehensive warranty coverage and services for the KDM70 hardware and software. Contact your local Digital Customer Services office for complete details.

Chapter 2

Installation

This chapter provides the information required for installing the KDM70 controller. Three stages of installation are necessary:

1. Operating system version verification

2. KDM70 controller module set installation

3. Quad I/O bulkhead distribution panels and internal SDI/STI cables installation

2.1 Minimum Operating System Version

The KDM70 controller is supported by VMS and ULTRIX operating systems. Refer to the KDM70 Software SPD or consult your Digital Customer Services representative for the minimum operating system version to support your KDM70 controller.

2.2 Parts Checklist

Table 2–1 lists all possible options and components required for the KDM70 controller installation. All options listed are available from Digital. Although part numbers are provided, some of the individual components cannot be purchased separately. Ensure all required components are available before starting the installation procedure (refer to Table 2–1).

Note

Choose one of the three CK kits listed in Table 2–1 with the appropriate system type (VAX 6000 or VAX 9000) and SDI/STI cable length (3 ft or 5 ft).

Table 2–1: KDM70 Controller Kits

Option	Description	Quantity	Digital Part Number
KDM70–AA	Processor module (module #1)	1	T2022
	SI interface module (module #2)	1	T2023
	Intermodule cable	1	17–02191–01
	Package label	1	EN–03573–03
	KDM70 Controller User Guide	1	EK–KDM70–UG
	Spine label	1	EK–KDM70–SP
	Binder	1	00–07704–01
	KDM70 software SPD	1	31–62–00
QA–YG5AA–H5	KDM70 software TK50 and documentation kit	1	QA–YG5AA–H5
CK–KDM00–LF (VAX 6000, 3 ft cables)	SDI/STI I/O bulkhead distribution panel (quad)	2	74–31369–01
	Port ID label kit for VAX 6000	1	70–28706–01[1]
	SDI/STI cable group (3 ft cables)	2	70–28703–01[2]
	Cable ties	6	90–09617–00
	Adhesive-backed cable tie mounts	5	90–08264–00

[1]Consists of three sheets of labels, part numbers 36–32174–01, –02, and –03.
[2]A group consists of one 2-ported cable, part number 17–02185–02, and two 3-ported cables, part number 17–02185–01; cables are 3 ft long.

Table 2–1 (Cont.): KDM70 Controller Kits

Option	Description	Quantity	Digital Part Number
	Screws, pan-head, Sems, Phillips, 6–32	16	90–09984–00
CK–KDM00–LG (VAX 9000, 3 ft cables)	SDI/STI I/O distribution bulkhead panel (quad)	2	70–27891–01
	Port ID label kit for VAX 9000	1	70–28706–02[3]
	SDI/STI cable group (3 ft cables)	2	70–28703–01[2]
	Cable ties	10	90–09617–00
	Adhesive-backed cable tie mounts	8	90–08264–00
	Screws, pan-head, Sems, Phillips, 6–32	16	90–09984–00
CK–KDM00–LJ (VAX 9000, 5 ft cables)	SDI/STI I/O distribution bulkhead panel (quad)	2	70–27891–01
	Port ID label kit for VAX 9000	1	70–28706–02[3]
	SDI/STI cable group (5 ft cables)	2	70–28703–02[4]
	Cable ties	10	90–09617–00
	Adhesive-backed cable tie mounts	8	90–08264–00
	Screws, pan-head, Sems, Phillips, 6–32	16	90–09984–00

[2]A group consists of one 2-ported cable, part number 17–02185–02, and two 3-ported cables, part number 17–02185–01; cables are 3 ft long.

[3]Consists of six sheets of labels, part numbers 36–32174–01 through –06.

[4]A group consists of one 2-ported cable, part number 17–02185–06, and two 3-ported cables, part number 17–02185–05; cables are 5 ft long.

If all or a portion of the KDM70 controller kit must be returned and additional packaging is needed, refer to Table 2–2 for a list of Digital part numbers for controller kit components packaging.

Table 2–2:   KDM70 Controller Kit Packaging

Digital Part Number	Description	Quantity	Used For
99–06487–01	Tape	A/R	As required
99–06557–10	PE recloseable bag	1	Screws
99–06557–10	PE recloseable bag	1	Cable tie mounts
99–06557–27	PE recloseable bag	1	Cable ties
99–07004–06	Module assembly carton	2	Modules
99–07092–04	Static shield bag	2	Modules
99–06200–00	Bubble wrap	A/R	Quad bulkhead panels
99–07025–01	Bubble bag	1	Intermodule cable
99–07025–06	Bubble bag	2	Modules
99–07372–01	Outer carton	2	Module installation kit

2.3 KDM70 Controller Module Set Functional Description

The KDM70 controller is a two-module controller designed for use with the XMI bus. Although the modules physically occupy two adjacent slots in the XMI backplane, the KDM70 controller uses only one logical node identification number, which is determined by the slot number occupied by the T2022 processor module (module #1). The functions of the T2022 processor module and the T2023 SI interface module are described in the sections that follow.

2.3.1 KDM70 Controller Processor Module

The KDM70 controller processor module (T2022) is the control portion
of the KDM70 controller. The processor module provides the interface to
the XMI bus and performs the following functions:

- Implements and controls all high-level software processes and diag-
  nostic functions of the KDM70 controller

- Connects the XMI interface to the KDM70 internal bus and data
  buffer

- Generates and checks EDC

- Provides extensive error checking

- Executes self-tests (MIST) at power-up

2.3.2 KDM70 Controller SI Interface Module

The SI interface module (T2023) is the communications interface between
the KDM70 processor module and any mass storage units attached to its
ports. The SI interface module performs the following functions:

- Connects the SDI/STI interface to the KDM70 internal bus

- Generates and checks ECC and EDC

- Detects errors on the SDI or STI bus

- Monitors drive state and positioning using optimization algorithms

2.4 XMI Backplane Slot Restrictions

The KDM70 controller module set may be installed in any two adjacent
and available XMI backplane slots, with certain restrictions. It is
recommended that the T2022 processor module be installed in the lower-
numbered adjacent slot.

In certain instances (for example, if no other slots are available), the
T2022 processor and T2023 SI interface modules can occupy reversed
backplane slots from those shown in the examples and illustrations in
this user guide. System-specific XMI backplane restrictions will dictate
when this practice is feasible. Some backplane slots do not support the
signals necessary for KDM70 controller functionality.

Note

If the recommended backplane slot restrictions are not followed, the SDI/STI cabling diagram illustrations in this user guide will appear incorrect.

Providing specific XMI backplane slot restrictions for the KDM70 controller for every system type is beyond the scope of this manual. The following list is an example of XMI backplane slot restrictions for VAX 6000 model 400 systems:

1. The T2022 processor module will not function correctly in XMI backplane slots 5–A.

2. The T2023 SI interface module will not function correctly in XMI backplane slots 6–9.

Note

If reversed order is used, the T2022 processor module will function correctly in slot B and the T2023 SI interface module will function correctly in slot A.

2.5 Installing the KDM70 Controller Module Set

Refer to Figures 2–1 and 2–2 while installing the KDM70 controller module set. The KDM70 controller must be installed in an XMI backplane. The following steps must be closely adhered to during installation of the KDM70 controller module set:

1. Power the system down before installing the KDM70 controller module set.

CAUTION

Proper ESD grounding techniques should be used before handling the KDM70 controller modules. Use the ESD wrist strap provided with your system to eliminate static discharge when handling the modules. Component damage will occur if proper grounding is not observed. Refer to Section 1.5.1 for ESD grounding information.

2. Gain access to the XMI module cage. (Refer to the CPU user guide or installation manual for your system.)

Figure 2–1:   Inserting KDM70 Controller Modules in the XMI Backplane
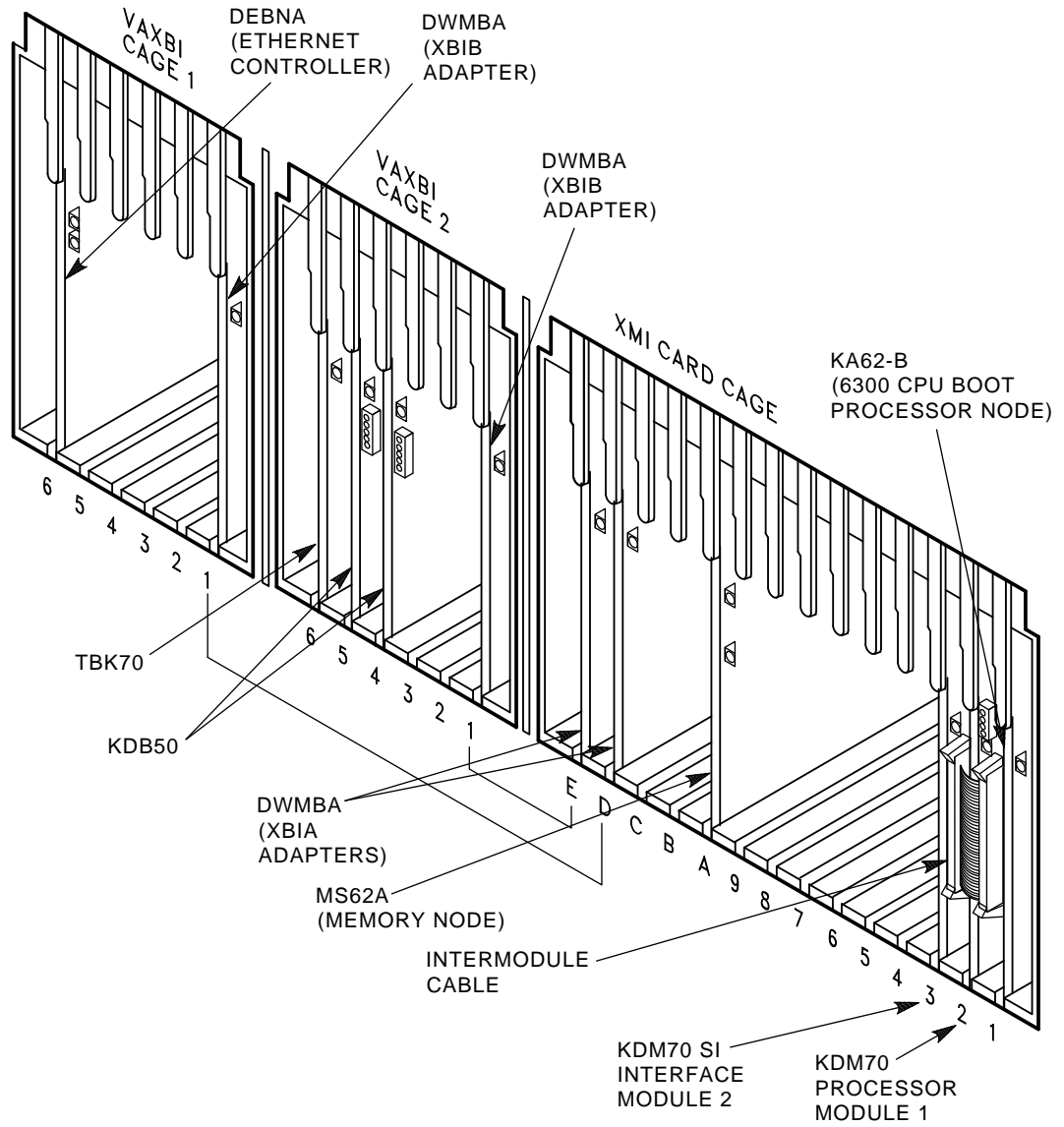
NOTE: THE KDM70 OCCUPIES TWO ADJACENT BACKPLANE SLOTS, BUT USES
ONLY ONE LOGICAL NODE ID.

CXO-2834A

Installation   2–7

Figure 2–2: Installing the Intermodule Cable

XMI CARD CAGE

E D C B A 9 8 7 6 5 4 3 2 1

KDM70 SI
INTERFACE
MODULE 2

KDM70
PROCESSOR
MODULE 1

KA62-B
(6300 CPU BOOT
PROCESSOR
NODE)

MODULE
CONNECTOR
EARS

INTERMODULE
CABLE

CXO-2835B

2–8 Installation
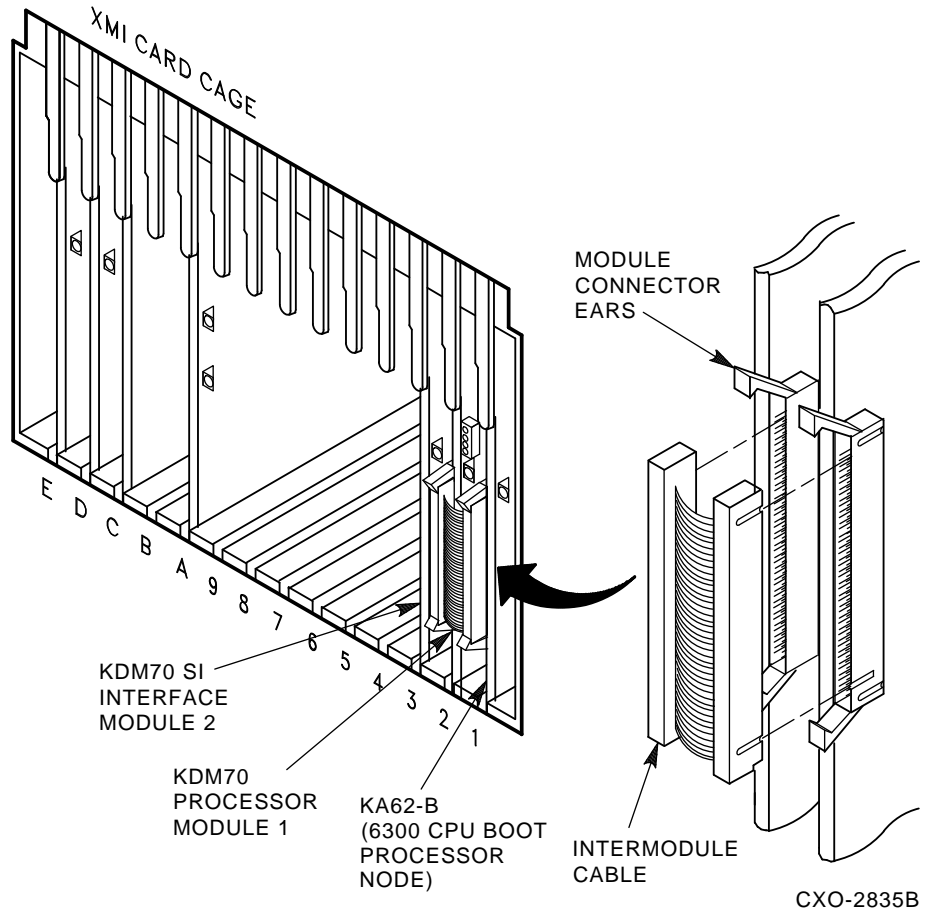
3. Locate two empty adjacent slots in the XMI module cage.

Note

> The following steps are provided only as examples. Slot numbers should not be taken literally for every system type.

4. Install the T2022 processor module in the lower-numbered adjacent slot. For example, if slots 2 and 3 are used, install the T2022 processor module into slot 2. (The processor module slot determines the node identification number.)

Note

> In certain instances, the T2022 processor and T2023 SI interface modules can occupy opposite slots from those discussed in this example. System-specific XMI backplane restrictions will determine when this practice is feasible (refer to Section 2.4).

5. Install the T2023 SI interface module into the next adjacent slot (slot 3 in this example).

6. Locate the intermodule ribbon cable (part number 17–02191–01). This cable is keyed, so it is important to ensure that it is properly oriented.

7. Plug the intermodule cable connectors into the connector of each KDM70 module. Gently apply pressure until each intermodule cable connector locks in place (refer to Figure 2–2).

CAUTION

> Take care when positioning the KDM70 module connector ears to the open position. Excessive pressure will break the connector ears.
>
> The intermodule cable connectors are keyed. Exercise caution when connecting or disconnecting these intermodule cables. Damage to KDM70 module connector pins could occur if improperly handled.

2.6 Installing Quad I/O Bulkhead Distribution Panels and SDI/STI Cables

After installing the KDM70 module set in the XMI backplane slots, go to the rear of the system cabinet to install the quad I/O bulkhead distribution panels and SDI/STI cables. Refer to system-specific documentation for information on accessing the quad I/O distribution panel tray.

The sections that follow describe installation of the quad I/O bulkhead distribution panels and internal SDI/STI cable-to-backplane and cable-to-bulkhead connections.

2.6.1 Installing Quad I/O Bulkhead Distribution Panels

Install the two quad I/O bulkhead distribution panels using the following procedure (refer to Figure 2–3):

1. Remove enough filler panels from the back of the system cabinet quad I/O distribution panel tray to install two quad I/O bulkhead distribution panels. (Filler panel configuration is not the same on all systems, so the number of filler panels to be removed may vary from system to system.)

2. Mount the two quad I/O bulkhead distribution panels (from the KDM70 controller kit) on the system cabinet. (On the VAX 6000, each panel is mounted with four captive, spring-loaded screws—the VAX 9000 has a different distribution panel kit without captive screws.)

2.6.2 Installing Internal SDI/STI Cables

Table 2–1 lists the various part numbers for internal SDI/STI cables. Figure 2–4 shows the two styles of internal SDI/STI cables used with the KDM70 controller. Refer to the port diagram in Figure 2–5 during internal SDI/STI cable-to-backplane installation. Figure 2–6 is an example of how the SDI/STI cables look after they have been connected to the backplane connectors.

Use the following procedure to connect the internal SDI/STI cables to the XMI backplane:

1. Locate the appropriate XMI backplane slot (slot 3 on Figure 2–2). The internal SDI/STI cable connectors must be plugged into the same backplane slot location as the KDM70 controller T2023 SI interface module.

Figure 2–3: Installing the Quad I/O Bulkhead Distribution Panels (VAX 6000)

BULKHEAD 1   BULKHEAD 2

PORT

PORT 3

PORT
LABEL

PORT 1

PORT 2

PORT 0

QUAD I/O BULKHEAD DISTRIBUTION PANELS
INSIDE VIEW WITH TRAY OPEN (DOWN POSITION)

PORT 7

PORT 5

PORT 6

PORT 4

QUAD I/O
DISTRIBUTION
PANEL TRAY

I/O
PANELS

TERMINAL
PORT

ETHERNET
PORT

BULKHEAD 1   BULKHEAD 2

PORT
0

PORT
2

PORT
LABEL

PORT
1

PORT
3

PORT

PORT
4

PORT
6

PORT
5

PORT
7

QUAD I/O BULKHEAD DISTRIBUTION PANELS
OUTSIDE VIEW WITH TRAY CLOSED (UP POSITION)

CXO-2836B

Installation   2–11

Figure 2–4: KDM70 Controller Internal SDI/STI Cable Styles

BACKPLANE
CONNECTOR

I/O PANEL
CONNECTOR

KEYING

PORT
LABEL

2-PORT INTERNAL SDI/STI

BACKPLANE
CONNECTOR

I/O PANEL
CONNECTOR

KEYING

PORT
LABEL

3-PORT INTERNAL SDI/STI
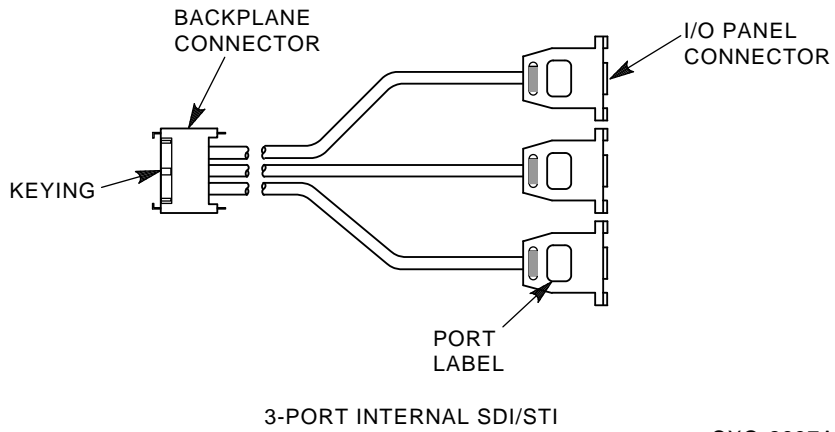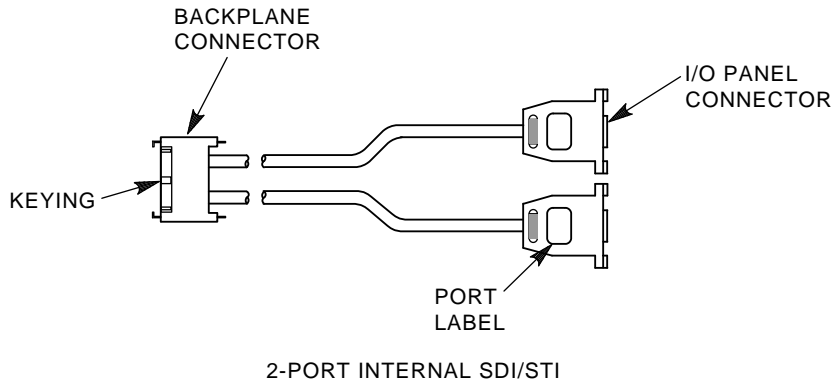
CXO-2837A

Figure 2–5:   Internal SDI/STI Cable-to-XMI Backplane Port Diagram

XMI BACKPLANE SDI
PORT CONNECTIONS

3-PORTED SDI
CABLE CONNECTION

EMPTY

PORT 4

PORT 5

2

PORT 0

PORT 1

1

PORT 6

PORT 2

PORT 3

3

PORT 7

2-PORTED SDI
CABLE CONNECTION

3-PORTED SDI
CABLE CONNECTION

CXO-2838A
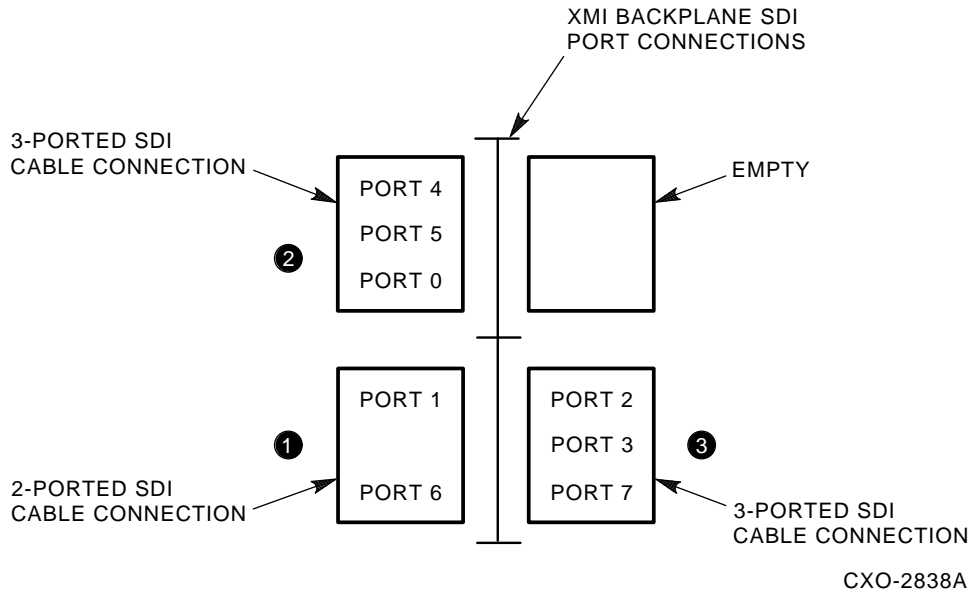
2. Install the internal SDI/STI cables in the order shown in Figure 2–5.
    Figure 2–6 shows the internal SDI/STI cable connections to the
    backplane.

CAUTION

Internal SDI/STI cable connectors are keyed and must be
properly oriented for installation. Do not force the SDI/STI
cable connectors into the XMI backplane connectors or
forcefully remove the connectors.

The SDI/STI cable connectors are equipped with locking
mechanisms. Ensure that all locking mechanisms are in
the **open** (unlocked) position before installing the cable
connectors and before removing the cable connectors from
the backplane.

Figure 2–6: Example of VAX 6000 SDI/STI Cable-to-XMI Backplane Connections

PROCESSOR MODULE SLOT 2

SI INTERFACE MODULE SLOT 3

PORT 4

PORT 5

PORT 0

PORT 1

PORT 6

PORT 2

PORT 3

PORT 7

SLOTS

1 2 3 4 5 6 7 8 9 A B C D E

XMI BACKPLANE

CXO-2839B

2–14 Installation
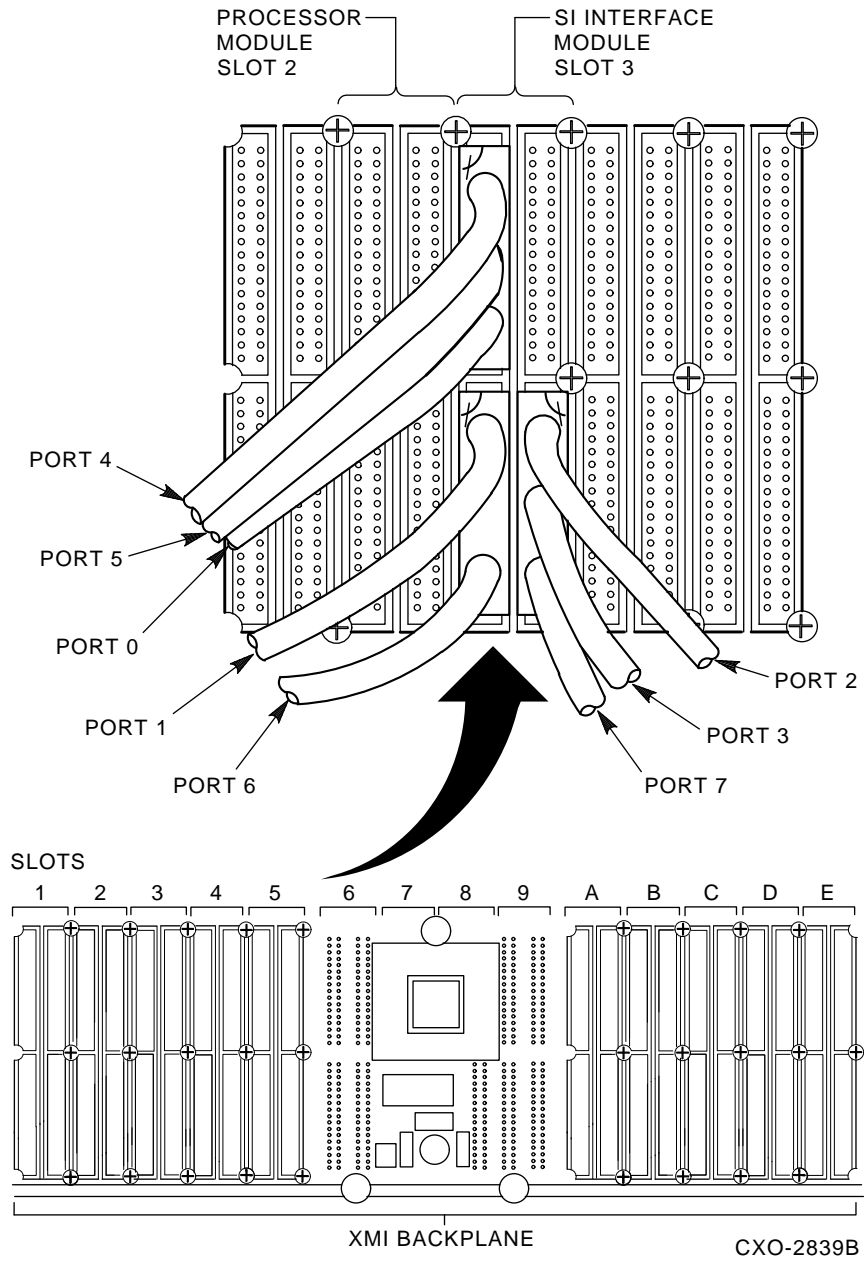
3. Select the 2-ported internal SDI/STI cable (part number 17–02185–xx) and install it using as guides Figures 2–5, 2–6, and 2–7. Turn the retaining lever (connector locking mechanism) to the locked (closed) position to secure the cable connector to the backplane.

4. Select one 3-ported internal SDI/STI cable (part number 17–02185–xx) and install using Figure 2–5 as a guide. Turn the retaining lever to the closed (locked) position to secure the cable connector to the backplane.

5. Select the remaining 3-ported internal SDI/STI cable (part number 17–02185–xx). Rotate the connector 180 degrees from the previous cable installation. Note the keying on the connector. Plug in the connector and turn the retaining lever to the closed (locked) position to secure the connector to the backplane.

6. Using the screws provided in the KDM70 controller kit, connect four of the eight available internal SDI/STI cables to one of the KDM70 controller quad I/O bulkhead distribution panels. Follow the suggested installation order shown in Figure 2–3.

7. Attach the I/O port labels (provided in the KDM70 controller kit) to each SDI/STI cable connector and to both sides of each I/O bulkhead distribution panel slot. To avoid confusion, apply these labels after each internal SDI/STI cable is installed, rather than waiting until all SDI/STI cables are attached to the I/O panel. Refer to Figure 2–3.

8. Repeat steps 6 and 7 for the remaining four internal SDI/STI cables.

2.6.3 Installing the External SDI/STI Cables

After the internal SDI/STI cables have been plugged into the backplane and into the I/O bulkhead distribution panel and secured with cable ties and cable tie mounts, close the I/O distribution bulkhead panel tray and secure it to the system cabinet frame. You are now ready to install the external SDI/STI cables. (Refer to Figure 2–8.)

CAUTION

Appropriate external SDI/STI cable lengths can be ordered to fit your system's needs. However, only external SDI/STI cable lengths of 12 feet or longer are supported for use with the KDM70 controller. Consult your Digital Sales or Customer Services representative for Digital external SDI/STI cable part numbers.

Figure 2–7: Internal SDI/STI Cable Connector Locking Mechanisms

LEVER LOCKING
DETAIL (LOCKS
OPEN AND CLOSED)

RETAINING
LEVER (LOCKED
POSITION)

RETAINING
LEVER (OPEN
POSITION)

KEYED
EDGE

RETAINING
LEVER
HOOK
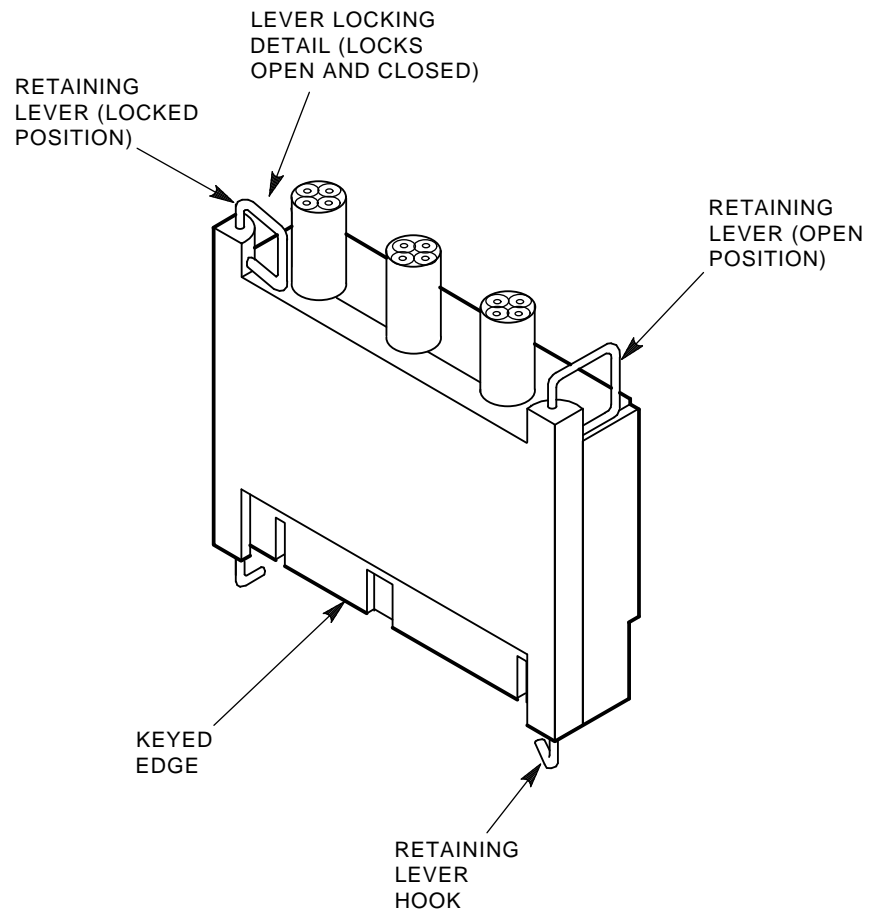
NOTE: INTERNAL SDI/STI CABLE CONNECTOR PART NUMBER 17-02185-XX.

CXO-2840A

Figure 2–8: Installing External SDI/STI Cables

PORT LABEL
LOCATION

I/O
BULKHEAD 1

I/O BULKHEAD
PORT

PORT LABEL
LOCATION

I/O
BULKHEAD 2

I/O BULKHEAD
PORT

CAPTIVE
SCREW

EXTERNAL SDI
CABLE (4) TO
STORAGE DEVICES

EXTERNAL SDI
CABLE (4) TO
STORAGE DEVICES

CAPTIVE
SCREW

CXO-2841A

Installation   2–17
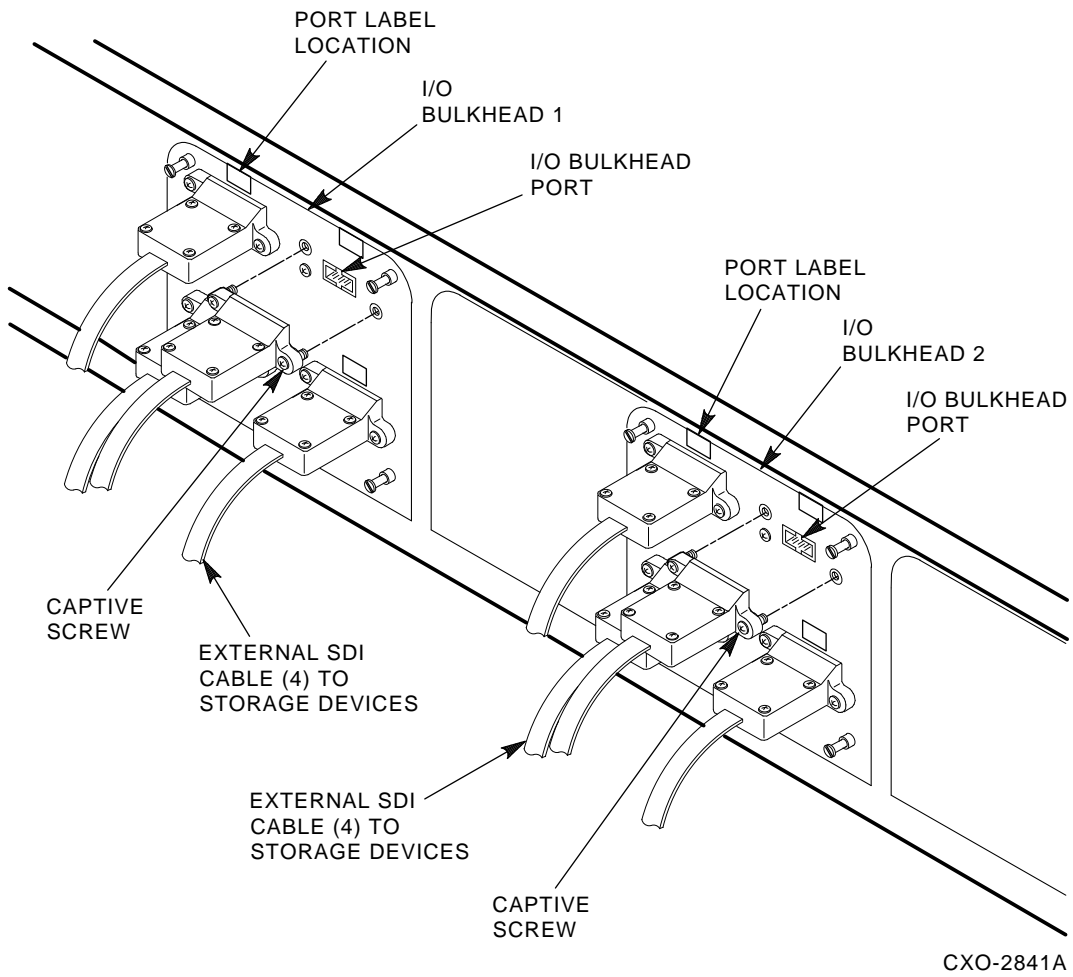
Chapter 3

Customer Acceptance and Verification

3.1 Customer Acceptance

After the KDM70 controller hardware has been installed, run the following tests to verify KDM70 controller functionality:

1. **KDM70 Module Internal Self-Tests (MIST):** KDM70 controller-resident diagnostics. These diagnostics are automatically activated when the system is powered up.

2. **KDM70 InLine Exerciser (ILEXER):** KDM70 Controller-resident subsystem test. This program exercises the devices attached to the KDM70 controller and tests the functionality of the KDM70 I/O ports.

3.2 Customer Acceptance Test Procedures

The sections that follow describe the tasks to be performed to verify the KDM70 controller functionality after KDM70 hardware installation. At the successful completion of MIST and ILEXER (defined in Section 3.1), customer acceptance testing is complete.

Section 3.3 discusses KDM70 controller error detection for failures that may occur during customer acceptance testing.

The MIST and ILEXER programs are not intended as customer troubleshooting tools. If either program fails, call your Digital Customer Services representative.

CAUTION

Back up customer data before performing any tests on user data areas. ILEXER writes in customer data areas and will destroy customer data.

3.2.1 Running MIST

KDM70 controller-resident diagnostics (MIST) are ROM-based and require no manual intervention. These diagnostics run under the following conditions:

- KDM70 controller power-up

- Host initiation of a node reset

KDM70 controller-resident diagnostics (MIST) are Go/No Go tests. Two events occur upon successful completion of the diagnostics:

1. Both amber Go/No Go LEDs (located on both of the KDM70 controller modules) are illuminated.

Note

The amber LEDs have only two states: either both ON or both OFF.

2. A successful completion code (0000) is displayed in the red LEDs located on the KDM70 controller T2022 processor module.

Figure 3–1 shows the location of both amber Go/No Go LEDs and the red LEDs on the processor module.

Figure 3–1: LED Indicator Locations on KDM70 Controller Modules

RED LEDs

GO/NO GO
LEDs (AMBER)

INTERMODULE
CABLE

T2023
(SI)

T2022
(PROCESSOR)

CXO-2842A
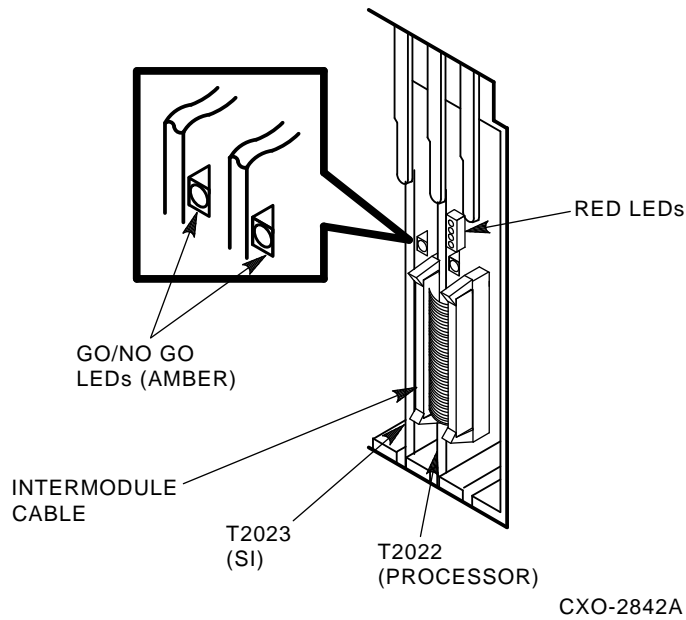
Run the MIST diagnostics as follows:

1. Power up the system (MIST is automatically activated upon system power-up).

2. Check the state of the amber Go/No Go LED indicators on each KDM70 module. Both LEDs should illuminate after approximately 10 seconds. Once both amber LEDs have illuminated, the KDM70 controller has successfully passed the power-up self-tests (MIST).

3. If MIST detects a fatal error during power-up, the red LEDs on the T2022 processor module display a code to assist in problem isolation (refer to Section 3.4.1).

4. After the successful completion of MIST, continue customer acceptance test procedures by running ILEXER.

3.2.2 Running ILEXER from the VAX Diagnostic Supervisor Prompt

The ILEXER program can be invoked from the VAX Diagnostic Supervisor prompt (DS>), or from the Diagnostic Utility Protocol (DUP) connection, VMS DCL prompt ($). This section describes invoking the ILEXER program from the VAX Diagnostic Supervisor prompt (DS>).

Begin by booting the VAX Diagnostic Supervisor (consult the documentation for your specific system).

Run ILEXER from the VAX Diagnostic Supervisor prompt (DS>) using the following example as a guide:

CAUTION

The following test sequence is designed to verify the KDM70 read/write integrity. All user data will be destroyed on the selected device. Back up customer data before running ILEXER.

Note

User response defaults are designated by brackets [].

Example 3–1: Running ILEXER from the VAX Diagnostic Supervisor Prompt

```
DIAGNOSTIC SUPERVISOR.  ZZ-ELSAA-xx.x-xxxx day-month-year time

DS> ATTACH  ❶
Device Type? KDM70  ❷
Device Link? HUB  ❸
Device Name? DUB  ❹
XMI node # (1,2,3,4,B,C,D,E)? 4  ❺
Bus Request Level (4 - 7) ? 5  ❻
DS> SELECT DUB  ❼

DS> RUN EVRLN  ❽

.. Program: EVRLN - KDM70 DIAGNOSTIC CONTROL PROGRAM, revision
x.0, 1 test, at time.
Testing: _DUB

EVRLN> RUNL ILEXER  ❾

***
*** ILEXER (Inline Exerciser) V 001  ***day-month-year time ***
***
```

Example 3–1 Cont'd. on next page

Example 3–1 (Cont.):   Running ILEXER from the VAX Diagnostic Supervisor Prompt

```
Enable Bad Block Replacement  (Y/N)  [N]?   ❿

Available Disk Drives:  D0003 D0009 D0015 D0603 D0606
Available Tape Drives:  T0004 T0099

Select drive to test (Tnnnn/Dnnnn) [] ? D3
Write enable drive (Y/N) [N]? Y
Should user data really be overwritten (Y/N) [N]? Y
Perform initial write (Y/N) [N] ? Y

***Available tests are:

   1. Random I/O
   2. Seek Intensive I/O
   3. Data Intensive I/O
   4. Oscillatory Seek

Select test number (1:4) [1] ? 1
Select start block number (0:1216664) [0] ?
Select data pattern number 0=ALL  (0:15) [0] ?
Data compare (Y/N) [N] ? Y
Data compare on all reads (Y/N) [N] ? Y
Select another drive (Y/N) [] ? N
Select execution time limit, 0=Infinite, minutes (0:65535)[0]? 30   ⓫
Select report interval, minutes (0:65535) [1] ? 1
Select hard error limit (0:32) [0] ?
Report soft errors (Y/N) [N] ?

        Execution Performance Summary at day-mo-yr  time

                                                    ---ERRORS----
Unit  Serial Number Requests KB Read KB Written Hard Soft ECC
----  ------------- -------- ------- ---------- ---- ---- ---
D0003      71607515  3001         0    85528       0    0    0

        Execution Performance Summary at day-mo-yr  time

                                                    ---ERRORS----
Unit  Serial Number Requests KB Read KB Written Hard Soft ECC
----  ------------- -------- ------- ---------- ---- ---- ---
D0003*     71607515  3004         0    85585       0    0    0

***
*** ILEXER is exiting.   ⓬
***

DS>   ⓭
```

Customer Acceptance and Verification   3–5

The following list provides the user line item responses (and screen cues) for Example 3–1, Running ILEXER from the VAX Diagnostic Supervisor Prompt:

❶ Type: **ATTACH <CR>**

❷ Type the controller device type: **KDM70 <CR>**

❸ Type the link: **HUB <CR>**

❹ Type the designated controller name: **DUB <CR>**

❺ Type the appropriate XMI node # (1,2,3,4,B,C,D,E): **? <CR>**

❻ Type the appropriate bus request level # (4 - 7): **? <CR>**

❼ Type: **SELECT DUB <CR>**

❽ Type: **RUN EVRLN <CR>** (the ILEXER program is accessed through EVRLN)

❾ At the EVRLN> prompt, type: **RUNL ILEXER <CR>**

❿ A series of user questions begin, which require user responses.

⓫ A recommended execution time of 30 minutes is the suggested response for customer acceptance verification.

⓬ The *ILEXER is exiting* message is displayed.

⓭ The VAX Diagnostic Supervisor prompt (DS>) is displayed at completion of ILEXER.

3.2.3 Running ILEXER from the DUP Connection (VMS)

The following example shows the ILEXER prompts displayed when running ILEXER from the DUP connection, VMS DCL prompt ($). Lines beginning with the DCL prompt indicate the user is required to enter commands.

CAUTION

The following test sequence is designed to verify the KDM70 read/write integrity. All user data will be destroyed on the selected device. Back up customer data before running ILEXER.

Example 3–2: Running ILEXER from the DUP Connection (VMS)

```
$ SET HOST/DUP/SERVER=DUP/TASK=ILEXER PUA0/DEV  ❶
%HSCPAD-I-LOCPROGEXE, Local program executing - type ^\ to exit

***
*** ILEXER (InLine Exerciser) V 001  *** 29-AUG-1989 17:46:37 ***
***
Enable Bad Block Replacement (Y/N) [N] ?      ❷
Available Disk Drives: D0001 D0002 D0003 D0004 D0010 D0012 D0607
Available Tape Drives: NONE

Select drive to test (Tnnnn/Dnnnn) [] ? D1
Write enable drive (Y/N) [N] ?

*** Available tests are:

    1. Random I/O
    2. Seek Intensive I/O
    3. Data Intensive I/O
    4. Oscillatory Seek

Select test number (1:4) [1] ? 1
Select start block number (0:547040) [0] ?
Select end block number (0:547040) [547040] ?
Select data pattern number 0=ALL (0:15) [0] ?
Select another drive (Y/N) [] ? N
Select execution time limit, 0=Infinite, minutes(0:65535)[0] ? 30
Select report interval, minutes (0:65535) [1] ? 1
Select hard error limit (0:32) [0] ?
Report soft errors (Y/N) [N] ?
          Execution Performance Summary at 29-AUG-1989 17:53:34

                                          -----ERRORS----
Unit  Serial Number Requests   KB Read  KB Written  Hard  Soft ECC
----- ------------- --------  -------- ----------  ----  ---- ---
D0001 182507185      2037      4579             0     0     0   0
      Execution Performance Summary at 29-AUG-1989 17:54:34

                                          -----ERRORS----
Unit  Serial Number Requests   KB Read  KB Written   Hard Soft ECC
----- ------------- --------  -------- ----------   ---- ---- ---
D0001 182507185      4093      9250             0     0     0   0
        Execution Performance Summary at 29-AUG-1989 17:54:34
```

Example 3–2 Cont'd. on next page

Example 3–2 (Cont.): Running ILEXER from the DUP Connection (VMS)

```
                                             -----ERRORS----
Unit   Serial Number Requests  KB Read  KB Written  Hard Soft ECC
-----  ------------- --------  -------- ----------  ---- ---- ---
D0001   182507185        4098     9259          0      0    0   0
***
*** ILEXER is exiting.    ❸
***
$   ❹
```

When running ILEXER from the VMS DCL prompt ($), use the following procedure while referencing Example 3–2:

❶ Type the ILEXER command line (see Example 3–2).

❷ ILEXER user response questions and summary data are displayed. (User responses are the same as those in Example 3–1.)

❸ The *ILEXER is exiting* message is displayed.

❹ The DCL prompt ($) returns.

If the ILEXER program fails, contact your Digital Customer Services representative. The successful completion of the MIST and ILEXER programs concludes the customer acceptance tests.

3.2.4 Running ILEXER from the DUP Connection (ULTRIX)

The following example shows the ILEXER prompts displayed when running ILEXER from the DUP connection, ULTRIX system prompt (>). Lines beginning with the ULTRIX system prompt indicate the user is required to enter commands.

CAUTION

The following test sequence is designed to verify the KDM70 read/write integrity. All user data will be destroyed on the selected device. Back up customer data before running ILEXER.

Note

The command line interpreter in ULTRIX is case-sensitive; most ULTRIX commands are lower case.

Example 3–3: Running ILEXER from the DUP Connection (ULTRIX)

```
> cd /usr/dup/term/vax    ❶

> dupterm ❷

Signalling on.

DUP>> connect uq24 ❸

 Connecting to node uq24 using service DUP            ... done.
 Concurrent access -  Yes
 Local media -  Present
 EXEC_SUP supported - Yes
 Program -  Not active
 SDI -                  Yes
 Progress Indicator =  8703

DUP>> runl ilexer ❹

 Starting execution of local program ilexer ... [started].
Program runs concurrently with other controller activity.
Program supports standard DUP dialogue.
Not passthru.
*** ILEXER (InLine Exerciser) V 001  *** 30-NOV-1990 17:30:20 ***

Enable Bad Block Replacement (Y/N) [N] ?   ❺

   .
   .
   .
```

When running ILEXER from the ULTRIX prompt (>), use the following procedure while referencing Example 3–3:

❶ Change to the correct directory (see Example 3–3).

❷ Start the DUP program (see Example 3–3).

❸ Make the DUP connection to KDM70 (see Example 3–3).

❹ Run the ILEXER diagnostic (see Example 3–3).

❺ ILEXER operation is the same as shown in Example 3–2 (user responses are the same as those in Example 3–2).

If the ILEXER program fails, contact your Digital Customer Services representative. The successful completion of the MIST and ILEXER programs concludes the customer acceptance tests.

3.3 KDM70 Controller Error Detection

If the KDM70 controller fails during its self-test (MIST), the red LEDs (located on the KDM70 controller processor module) display an error code indicating which module has failed. Refer to Figure 3–2 for location and value of the red LEDs.

Looking at the modules from the front of the cabinet, read codes from top, most significant bit (MSB), to bottom, least significant bit (LSB). Refer to Table 3–1 for interpretation of these LED codes. Table 3–1 lists LED code conditions that could occur while running customer acceptance verification programs. LED codes not found in this table are beyond the scope of this manual. Contact your Digital Customer Services representative for proper maintenance if a MIST failure occurs.

Figure 3–2: Red LED Code Location/Values

INTERMODULE
CABLE

8
4
2
1

VALUES FOR
READING RED LEDs

T2023
(SI)

T2022
(PROCESSOR)

CXO-2843A
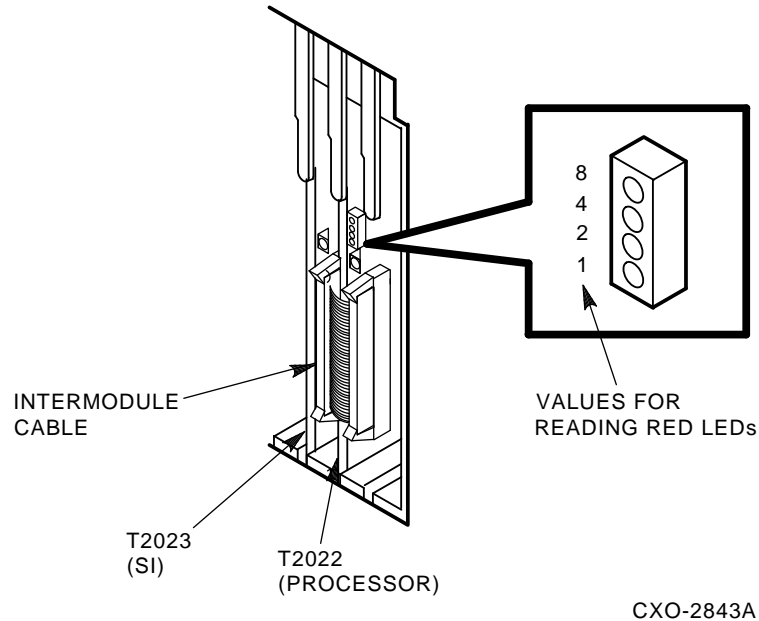
Table 3–1: Red LED Interpretation (Processor Module)

LED Code	Description	Suspect Field Replaceable Unit
0000	Successful completion of MIST	N/A
0100	Host memory test failure	T2022 processor module
0101	Module #2 failure	T2023 SI interface module
0110	Unexpected restart	N/A
0111	Waiting for update initialization	N/A
1000	Code update in progress	N/A
1001	Indeterminate failure	T2022 processor module, T2023 SI interface module, connecting cable(s)
1010	Module #1 failure	T2022 processor module
1011	Forced update mode	N/A
1100	Core SRAM test failure	T2022 processor module
1101	Core CVAX parity test failure	T2022 processor module
1110	Core hardware test failure	T2022 processor module
1111	Failure at power-up	T2022 processor module

3.4 System and Software Considerations

The sections that follow describe common software and system concerns.

3.4.1 Error Logs

The KDM70 controller returns error information to the host operating system for inclusion in an error log. These entries may include specific information on the operation of the KDM70 controller, its attached storage devices, or other parts of the system (host processor, memory, software, and so forth) that may be important in diagnosing problem sources.

Note

To support the fault-tolerant and error-recovery features of the KDM70 controller, the host operating system must support error logging.

Some event messages contained in the error log may represent changes in your system's configuration or operation. These messages are only informational; they do not represent the occurrence of an actual error condition. Examples of events that produce such messages are:

- Completion of the initialization sequence between the system port driver and the KDM70 controller as part of the system boot process

- Attention messages pertaining to the availability of a disk drive (which may be the result of changing a drive unit number)

For further information, refer to the appropriate system and software documentation.

3.4.2 Device Numbering

DSA, SDI, and STI storage devices connected to the KDM70 controller are recognized by means of logical unit numbers 0 to 4094 (for disk drives), and 0 to 9999 (for tape drives).

Note

The logical unit number limit for TA78, TA79, and TA81 tape drives is 255; the logical unit number limit for TA90 tape drives is 9999.

Consult operating system documentation for accepted logical unit numbering ranges. Consult drive device documentation for logical unit number programming instructions. The logical unit numbers assigned to devices attached to a KDM70 controller do not imply any priority or other special property; all devices are treated equally by the KDM70 controller.

The only KDM70 controller logical unit numbering requirement is to avoid duplicating device logical unit numbers. If device logical unit numbers are duplicated, the KDM70 controller will not permit the duplicate numbered devices to be accessed. The KDM70 controller will spin down one of the two storage devices with the duplicate logical unit number. This situation is correctable by assigning unique device logical unit numbers. Unit numbers can easily be changed at the device, although it is recommended the device be taken off line from the KDM70 controller (not mounted by the operating system) when changing logical unit numbers.

Chapter 4

KDM70 Controller Code Update Utility

4.1 Code Update Utility Function

The code update utility (EVRLM) is used to install new versions of KDM70 controller software. New versions of software are periodically released, either to improve overall KDM70 controller performance or to increase the range of functional KDM70 controller features made available after the KDM70 controller's initial introduction.

4.1.1 Running EVRLM

The following is an example of the code update utility screen display (partial) using the VAX Diagnostic Supervisor and booting from a VAX 6000-series system console TK50/70 tape drive.

1. Shut down the system using the **SYSTEM SHUTDOWN** command.

2. Install the supplied code update utility tape that contains the new KDM70 controller code image in the system TK50/70 tape drive device.

3. Boot the tape and complete the code update using the following example as a guide. At the system boot prompt (>>>), type the boot command line as shown on line 1 of Example 4–1.

Note

The CPU key switch must be in the UPDATE position to run the code update utility.

Example 4–1: Code Update Utility—Partial Screen Display

```
>>> B CSA1/R5:8010

Initializing system.

(An initialization chart is displayed....)

Loading system software.

DIAGNOSTIC SUPERVISOR.  ZZ-ExSAA-01.x-xxxx 10-June-1989 12:00:00


.. Program:  *** EVRLM - level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
revision x.x, 1 test, at time 12:00:00
testing: _DUA

Do you wish to update KDM70 Node # 1 [N]?  ❶
    .
    .
    .
(If yes, the selected node will be updated, else query user for
the next node to update.)

Updating . . . . . . . . . . . . . . . . . . . . . . . . . .

CODE UPDATE SUCCESSFULLY COMPLETED

.. End of run, 0 errors detected, pass count is 1,
time is day-month-year  time

>>>
```

❶ You will be queried for each additional KDM70 controller in your system.

After the completion message displays, the tape can be removed from the TK50/70 tape drive and the system rebooted normally.

4.2 Code Update Problems

Generally, the code update utility is an error-free process. However, if controller memory has been degraded or if the code loaded from the tape has been corrupted, problems may arise. If the code update utility fails, it is likely that the KDM70 controller will operate the same as before the code update was attempted. However, if the KDM70 code update process fails and leaves the KDM70 controller in an indeterminate state, refer to Sections 4.2.1 and 4.2.1.1. If the program fails, it will display the time of the failure, the failing device, and information relevant to the failure.

If problems occur during the code update process, contact your local Digital Customer Services representative.

Note

The only time that processing is completely halted is when a system fatal error or a device fatal error occurs.

4.2.1 Error Reporting

EVRLM error reporting follows conventional VMS and VAX Diagnostic Supervisor error report formats. The general reporting format is as follows:

```
***  EVRLM - Level 3  KDM70 EEPROM UPDATE UTILITY 1.0  ***

"pass", "tst", "subtest", "err_num", "date" "time"
"error_type" "device":

"error text"

"type_2_message"
"type_3_message"

***  End of "error_type" number "err_num"  ***
```

where:

- *pass* is the current pass at the time of the error.

- *tst* is the number of the test running at the time of the error.

- *subtest* is the number of the subtest executing at the time of the error.

- *err_num* is the ID number assigned to the error.

- *date* and *time* is the date and time of the error.

- *error_type* identifies one of the five possible error types.

- *device* identifies the failing device.

- *error text* is a brief informational message about the error.

- *type_2_message* is a more detailed informational message to aid in troubleshooting. The information provided in this message depends on the type of error.

- *type_3_message* is an expansion of previous error messages. The information provided in this message also depends on the type of error.

KDM70 Controller Code Update Utility   4–3

The next section depicts EVRLM error messages that may appear when you run the code update utility.

4.2.1.1 EVRLM Error Messages

This section lists the errors that EVRLM can return. An explanation of each error and its possible causes are included.

- **Error 1 — Get Hardware Parameter Table Failed**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass "pass", Initialization section, error 1, "date" "time"
      System fatal error while testing DUA: $DS_GPHARD failed

      Media load error.

      The Get Hardware Parameter Table system service failed.

      Try new load media.

***   End of System error number 1   ***
```

Recovery: The media is suspect. Retry the update procedure. If the same failure occurs, use a different update tape or load device.

- **Error 2 — Allocation of Host Communication Area Failed**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass "pass", Initialization section, error 2, "date" "time"
      System fatal error while testing DUA: "device":
      $DS_GETBUF FAILED

      Media load error.

      Allocation of host communication area failed

      Return status from $DS_GETBUF: 00000009

***   End of System fatal error number 2   ***
```

Recovery: The media is suspect. Retry the update procedure. If the same failure occurs, use a different update tape or load device.

- **Error 3 — Allocation of Scratch Pad Failed**

```
***   EVRLM – Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass "pass", Initialization section, error 3, "date" "time"
      System fatal error while testing DUA: "device":
      $DS_GETBUF FAILED

      Media load error.

      Allocation of scratch pad area failed

      Return status from $DS_GETBUF: 0000000A

***   End of System fatal error number 3   ***
```

Recovery: The media is suspect. Retry the update procedure. If the same failure occurs, use a different update tape or load device.

- **Error 4 — Node Reset Failed**

```
***   EVRLM – Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass "pass", Initialization section, error 4, "date" "time"
      System fatal error while testing DUA: "device":
      NODE RESET FAILED

      type_2_message

***   End of soft error number 4   ***
```

A node reset is used to initialize the KDM70 and invoke the controller self-test sequence. The error message depends on the return status from the system service call. There are four possible error messages:

1. *The logical unit selected is too large.*

   Recovery: The media is suspect. Retry the update procedure. If the same failure occurs, use a different update tape or load device.

2. *An attempt to set/clear a register adapter bit failed.*

   Recovery: The T2022 or current controller EEPROM image is suspect. Retry the update procedure. If the same failure occurs, contact Digital Customer Services.

3. *Node self-test failed.*

   Recovery: The T2022 or current controller image is suspect. Retry the update procedure. If the same failure occurs, contact Digital Customer Services.

Note

The module LED codes may provide additional information.

4. *Unknown status returned.*

   Recovery: The media is suspect. Retry the update procedure. If the same failure occurs, use a different update tape or load device.

   The error message is printed, and EVRLM returns the following prompt:

```
Controller failed self-test, do you wish to continue? [(No), Yes]
```

   You may continue with the code update or abort the utility.

- **Error 100 — Allocation of Controller Image File Buffer Failed**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY - 1.0   ***
      Pass "pass", test 1, subtest 0, error 100, "date" "time"
      System fatal error while testing "device":
      $DS_GETBUF FAILED

      Media load error.

      Allocation of controller image file buffer failed

      Return status from $DS_GETBUF: 00000009

***   End of System fatal error number 100   ***
```

   Before the EEPROM code update is performed, the controller image file is stored in a buffer located in host memory. This error indicates that the allocation of the controller image file buffer failed.

   Recovery: The media is suspect. Retry the update procedure. If the same failure occurs, use a different update tape or load device.

- **Error 110 — Controller Failed to Set Step Bit**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY - 1.0   ***
      Pass "pass", test 1, subtest 0, error 110, "date" "time"
      Hard error while testing "device":

      STEP BIT DID NOT SET IN SA REGISTER DURING INITIALIZATION

      Expected Data : 9C0 (H)

      Returned Data : 8010 (H)

***   End of Hard error number 110   ***
```

Recovery: This is a KDM70 controller error. Retry the code update. If the same failure occurs, contact Digital Customer Services.

- **Error 111 — Controller Fatal Error Detected**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY - 1.0   ***
      Pass "pass", test 1, subtest 0, error 111, "date" "time"
      Hard error while testing "device":

      CONTROLLER DID NOT RETURN CORRECT STATUS IN SA
      REGISTER DURING INITIALIZATION

      Expected data:  9C0 (H)

      Returned data:  9CF (H)

***   End of Hard error number 111   ***
```

Recovery: This is a KDM70 controller error. Retry the code update. If the same failure occurs, contact Digital Customer Services.

- **Error 112 — Call to $SETIMR Failed**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY - 1.0   ***
      Pass "pass", test 1, subtest 0, error 112, "date" "time"
      Hard error while testing "device": UNABLE TO START TIMER

      Media load error.

      $SETIMR returned  a error status of : 00000011

***   End of Hard error number 112   ***
```

Recovery: The media is suspect. Retry the update procedure. If the same failure occurs, use a different update tape or load device.

- **Error 120 — Error While Opening Controller Image File**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY 1.0   ***
      Pass "pass", test 1, subtest 0, error 120, "date" "time"
      System fatal error while testing "device": $DS_LOAD FAILED

      Media load error.

      An error occurred while processing controller image file:
      "filename".

      type_2_message

      Try new load media.
***   End of System fatal error number 120   ***
```

The OPEN EXISTING FILE command makes files available for
processing. If a file cannot be opened, one of the following messages
is displayed and the update is aborted:

- *FILE ACCESS ERROR*
- *DYNAMIC MEMORY EXHAUSTED*
- *BAD DEVICE SPECIFICATION*
- *FILE NOT FOUND ERROR*
- *BAD FILE NAME ERROR*
- *INVALID FILE ORGANIZATION ERROR*
- *FILE READ ERROR*
- *ERROR ACCESSING FILE*

Recovery: The media is suspect. Retry the update procedure. If
the same failure occurs, use a different update tape or load device.

- **Error 130 — Error Reading Update Flag**

```
***   EVRLM – Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass 1, test 1, subtest 0, error 130,"date" "time"
      Device fatal error while testing "device":

      Controller error.

      Controller update flag contains invalid information

***   End of Device fatal error number 130   ***
```

Recovery: This is a KDM70 controller error. Retry the code update.
If the same failure occurs, contact Digital Customer Services.

- **Error 132 — Error Writing Update Flag**

```
***   EVRLM – Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass 1, test 1, subtest 0, error 132,"date" "time"
      Device fatal error while testing "device":

      Controller error.

      Error writing update flag

      This controller appears to be inoperative,
      CALL CUSTOMER SERVICE

***   End of Device fatal error number 132   ***
```

Recovery: This is a KDM70 controller error. Retry the code update.
If the same failure occurs, contact Digital Customer Services.

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- **Error 137 — One Byte Verified Written Incorrectly**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass 1, test 1, subtest 0, error 137,"date" "time"
      Soft error while testing "device": Verify failed

      Controller error.

      One byte verified written incorrectly.

***   End of soft error number 137   ***
```

A byte-by-byte comparison is performed after KDM70 EEPROM is written. This error indicates one byte of EEPROM was found to be in error. The code update process will continue.

Note

This is an informational message only. No operator action is required.

- **Error 138 — Excessive Bytes Written Incorrectly**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass 1, test 1, subtest 0, error 138, "date" "time"
      Device fatal error while testing "device":

      Controller error.

      The number of allowable bytes in error has been exceeded.

      ABORTING...

***   End of Device fatal error number 138   ***
```

More than eight bytes verified as being written incorrectly within a 1K boundary. A byte-by-byte comparison is performed after KDM70 EEPROM is written.

Recovery: This is a KDM70 controller error. Retry the code update. If the same failure occurs, the T2022 module is suspect. Contact Digital Customer Services.

- **Error 139 — Illegal Command Received From Host**

  ```
  ***   EVRLM – Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
        Pass 1, test 1, subtest 0, error 139, "date" "time"
        Device fatal error while testing "device": Illegal Command

        Media error.

        The command from the host was not recognized.
  ***   End of Device fatal error number  139   ***
  ```

  This is a controller-detected error. The controller received an illegal command from the host.

  Recovery: The media is suspect. Retry the update procedure. If the same failure occurs, use a different update tape or load device.

- **Error 140 — No Address Specified**

  ```
  ***   EVRLM – Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
        Pass 1, test 1, subtest 0, error 140, "date" "time"
        Device fatal error while testing "device":
        NO ADDRESS SPECIFIED

        Media error.

        The host tried to do a READ DATA or WRITE DATA
        without first setting an address.
  ***   End of Device fatal error number  140   ***
  ```

  This is a controller-detected error. The host attempted to transfer data to the controller without first specifying an address.

  Recovery: The media is suspect. Retry the update procedure. If the same failure occurs, use a different update tape or load device.

- **Error 141 — Controller Parity Error**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass 1, test 1, subtest 0, error 141, "date" "time"
      Device fatal error while testing "device": PARITY ERROR

      Controller error.

      The controller had a parity error on the
      most recent READ DATA or WRITE DATA command.

***   End of Device fatal error number  141    ***
```

The controller detected a parity error while attempting to transfer data from host memory.

Recovery: This is a KDM70 controller error. Retry the code update. If the same failure occurs, contact Digital Customer Services.

- **Error 142 — Illegal Address**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass 1, test 1, subtest 0, error 142, "date" "time"
      Device fatal error while testing "device": ILLEGAL ADDRESS

      Media error.

      The address used was an illegal address.

***   End of Device fatal error number  142    ***
```

This is a controller-detected error. The host specified an illegal address to the controller.

Recovery: The media is suspect. Retry the update procedure. If the same failure occurs, use a different update tape or load device.

- **Error 143 — Operation Failed**

```
***   EVRLM - Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass 1, test 1, subtest 0, error 143, "date" "time"
      Device fatal error while testing "device": OPERATION FAILED

      Controller error.

      The READ or the WRITE operation failed.

***   End of Device fatal error number  143    ***
```

Recovery: This is a KDM70 controller error. Retry the code update. If the same failure occurs, contact Digital Customer Services.

- **Error 144 — Unknown Error Code**

```
***   EVRLM – Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass 1, test 1, subtest 0, error 144, "date" "time"
      Device fatal error while testing "device":
      UNKNOWN ERROR CODE

***   End of Device fatal error number  144   ***
```

An undefined error code was received from the controller.

Recovery: The media is suspect. Retry the update procedure. If the same failure occurs, use a different update tape or load device.

- **Error 150 — Unknown Interrupt Encountered**

```
***   EVRLM – Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass 1, test 1, subtest 0, error 150, "date" "time"
      Device fatal error while testing "device":
      UNKNOWN INTERRUPT ENCOUNTERED

      Unknown interrupt received through vector xxxxxxxx

      Expected interrupt vector                xxxxxxxx

***   End of Device fatal error number  150   ***
```

Device interrupted through the wrong vector.

Recovery: This is a KDM70 controller error. Retry the code update. If the same failure occurs, contact Digital Customer Services.

- **Error 151 — Unexpected Channel Interrupt**

```
 ***   EVRLM – Level 3 KDM70 EEPROM UPDATE UTILITY 1.0 ***
      Pass 1, test 1, subtest 0, error 151, "date" "time"
      Device fatal error while testing "device":

      UNEXPECTED CHANNEL INTERRUPT

      CSR contents: xxxxxxxx (H),  BER contents: xxxxxxxx (H)
      Interrupt received through vector: xxx (H)

 ***   End of Device fatal error number  151   ***
```

Recovery: This is a KDM70 controller error. Retry the code update. If the same failure occurs, contact Digital Customer Services.

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