
VAXft
SYSTEMS

VAXft Systems
System Technical Description

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Digital Equipment Corporation

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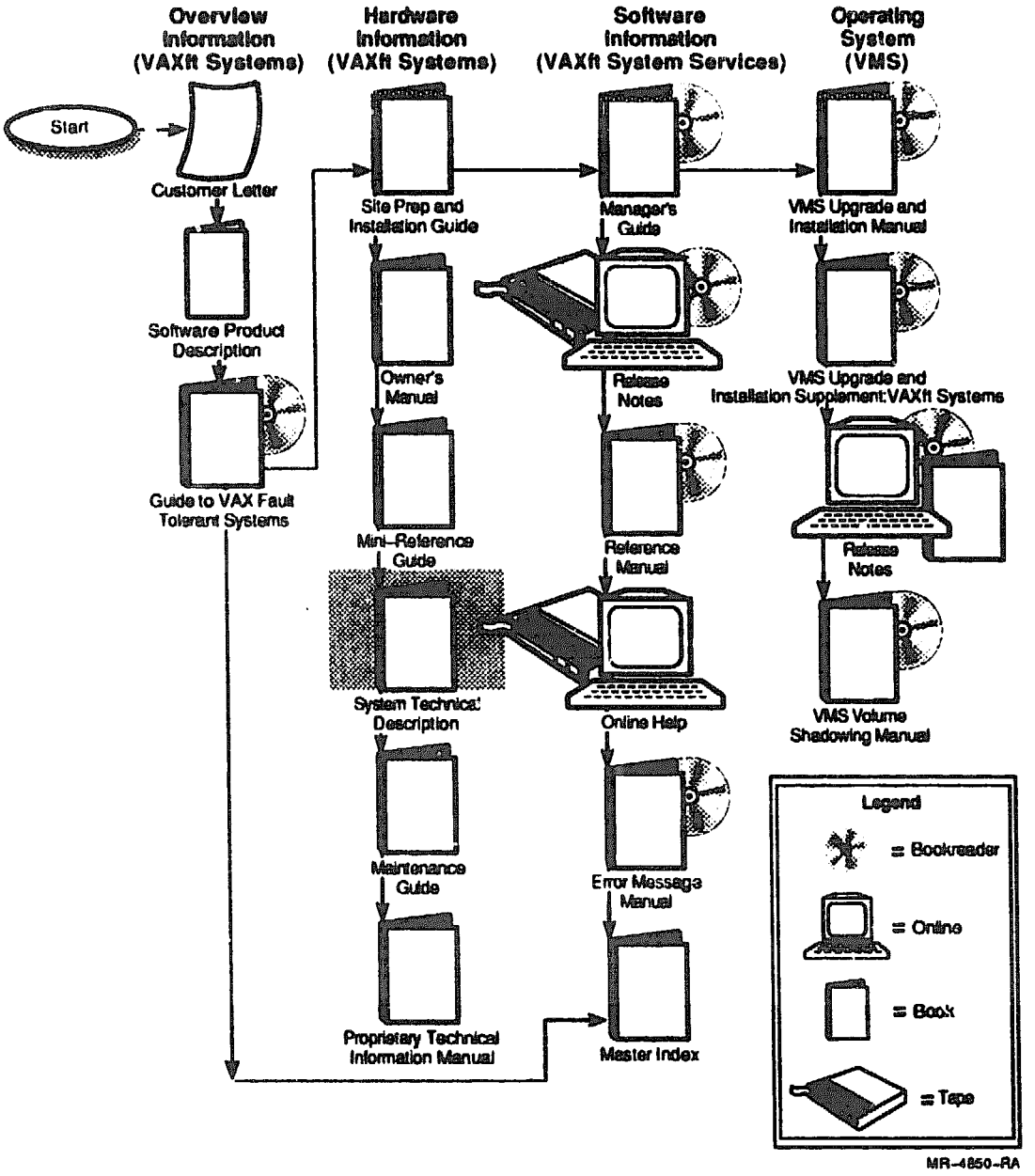
VAXft Systems Documentation Road Map



Contents

Index

Figures

Tables

About This Manual

Intended Audience

This manual is a reference document for customers and Digital Customer Services personnel.

Document Structure

This manual provides functional descriptions of VAXft system components. It is made up of the following chapters:

- **Chapter 1, VAXft System Description** — Provides a functional overview of the VAXft system including the system architecture, hardware, fault detection, and system configurations.
- **Chapter 2, VAXft Module Functional Descriptions** — Describes the VAXft modules including specifications and operation.

Related Documentation

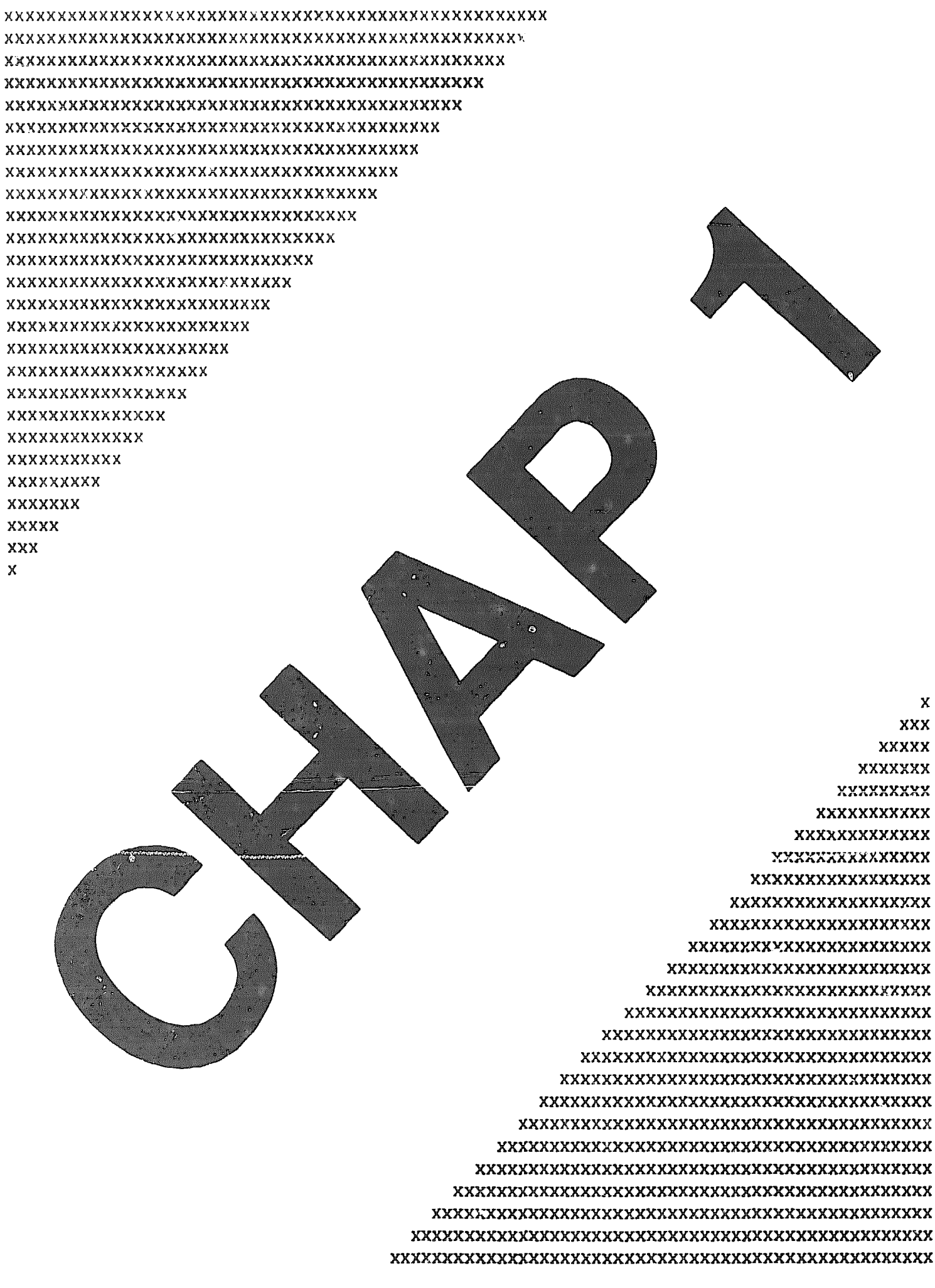
The VAXft documentation set includes the following manuals:

- *VAXft Systems Site Preparation and Installation Guide* (EK-VXFT1-IN) — Provides site preparation guidelines and the system specifications. Describes how to install, boot, and verify the system. Provides procedures for removing, handling, and replacing logic modules, and for removing and replacing the system drives.
- *VAXft Systems Owner's Manual* (EK-VXFT1-OM) — Provides a functional description of the VAXft system. Describes the system controls and indicators, console commands, bootstrap functions, and tape drive operation. Provides procedures for removing and replacing the system drives and for removing, handling, and replacing logic modules.
- *VAXft Systems Mini-Reference Guide* (EK-VXFT1-HR) — Provides summaries of the system controls and indicators, console operation, console commands, bootstrap functions, and system registers.

Additional Documentation

Other documents related to the VAXft system include:

- *VAXft Systems Guide to VAX Fault Tolerant Systems* — Describes the VAXft system and describes fault-tolerant computing.
- *VAX Wide Area Network Device Drivers* — Describes the software utilities used in wide area network communications.
- *VAXft System Services Installation Guide* — Provides step-by-step procedures for installing the VAXft system services software on your VAXft system.
- *VAXft System Services Manager's Guide* — Describes the VAXft system and the VAXft system services software. Provides information on managing a fault tolerant system that is running VAXft system services software.
- *VAXft System Services Release Notes* — Provides information related to the current version of VAXft system services. Provides additional information for installing and maintaining your VAXft system.
- *VAXft System Services Reference Manual* — Provides reference information on VAXft system services operation. Describes the DCL commands used on a VAXft system.
- *VAXft System Services Online Help* — Provides information about using the VAXft system services specific information and the DCL commands used on a VAXft system.
- *VAXft System Services Error Message Manual* — Provides descriptions of error messages that may be encountered in using VAXft system services. Provides a reference for fault tolerant and system error messages.
- *VAXft System Services Master Index* — Provides a complete index for the software documentation set.
- *VMS Upgrade and Installation Manual* — Describes the installation and upgrade procedures for the current release of the VMS operating system. Provides information on the user environmental test package (UETP).
- *VMS Upgrade and Installation Supplement: VAXft Systems* — Supplements the *VMS Upgrade and Installation Manual* with information specific to the VAXft computer including startup, shutdown, and backup procedures.
- *VMS Release Notes* — Provides notes on various aspects of the VMS operating system.
- *VMS Volume Shadowing Manual* — Provides an in-depth discussion of volume shadowing (phase II), shadow sets, the mount utility, and DCL commands used to mount, monitor, and dismount volume shadow sets.


СНАР 1

1
VAXft System Description

1.1 Introduction

The VAXft system is a fault-tolerant VAX computer that provides high levels of availability and reliability for a variety of applications. Hardware redundancy and failover techniques ensure uninterrupted operation in the event of a single point of failure anywhere in the system. Modular components simplify repair and maintenance procedures, reducing the time required to bring components back into service.

1.2 System Architecture

The VAXft system consists of two identical sets of components housed in separate cabinets. Each cabinet is designated as a zone and is capable of servicing an application by itself. Figure 1–1 shows the system diagram.

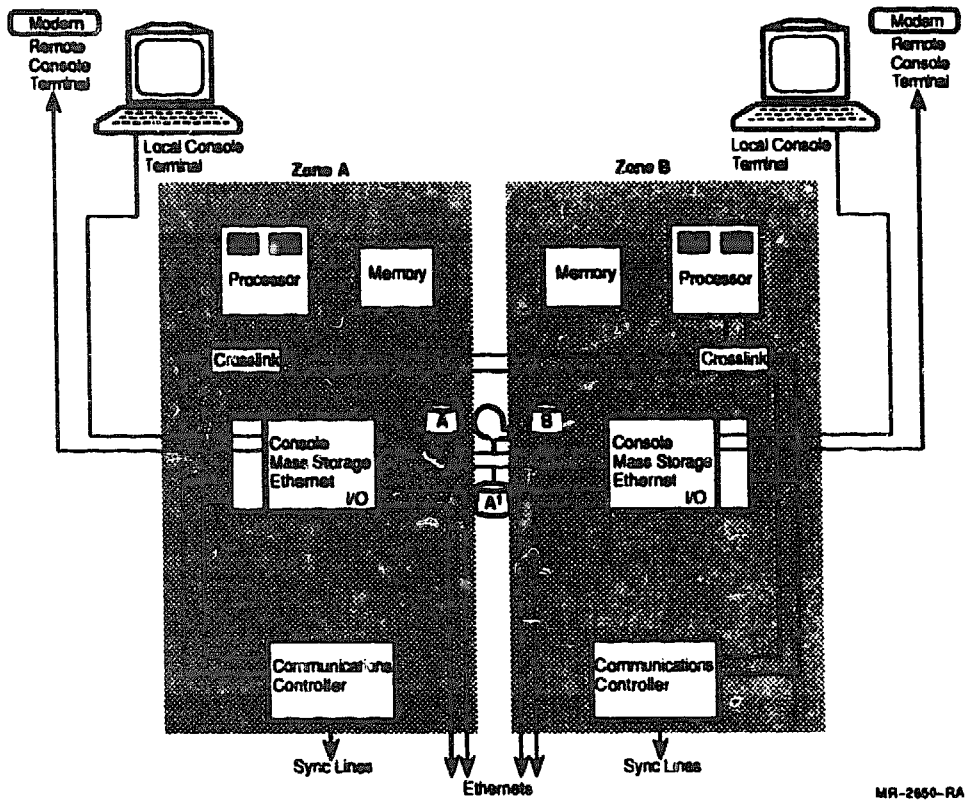


Figure 1–1 VAXft System Diagram

The dual zone design of the VAXft system ensures that a single fault in one zone does not cause a system failure. Separate system zones allow the isolation of each zone during repairs. Separate power supplies and power cords for each zone minimize system failure due to loss of external power in a single zone. The power cords should be connected to separate power circuits for maximum redundancy.

Each zone in the VAXft system contains identical CPU and memory modules. The CPUs and memory in each zone run in lockstep mode (execute the same instruction at the same time). Since the zones operate in this synchronous manner, there is no delay created by a transfer of operations from a failed zone to the remaining zone. The remaining zone continues to operate while the failed zone is repaired.

The VAXft system interconnects are also duplicated to eliminate any connectivity losses due to a cable failure. Both system zones are connected by cross-link cables that provide parallel data paths between the zones.

1.3 System Hardware

There are seven module slots in each zone that are used for four types of modules (Figure 1–2):

1. Central processor unit (CPU)
2. Memory
3. System I/O controller
4. Communication controller (WAN module)

The modules are designed for simple maintenance and are inserted or removed from the front of the system cabinet. Other system hardware components are: cross-link, clock system, system interconnection, power, and cooling.

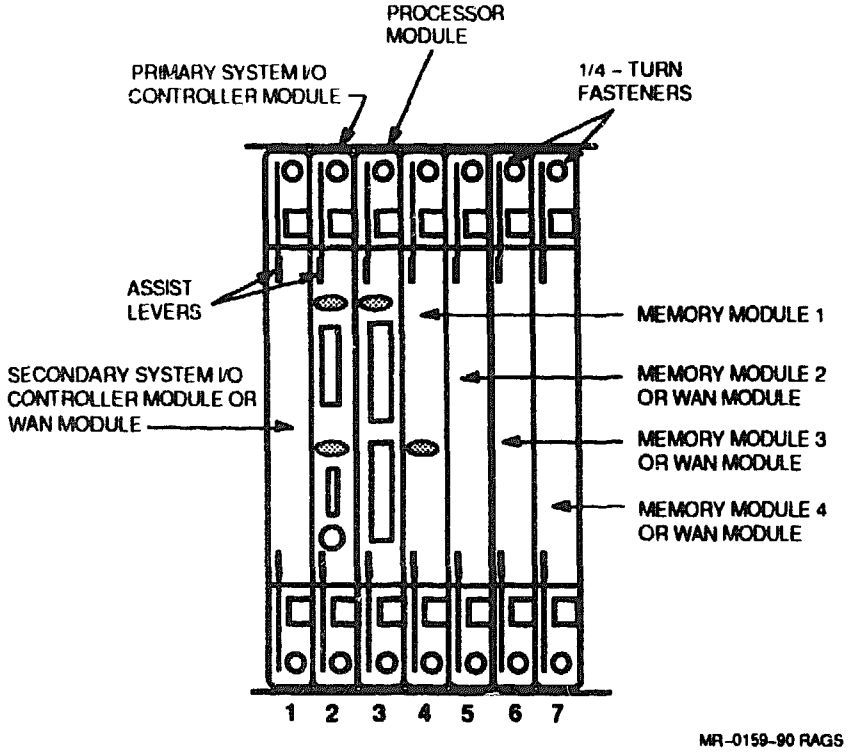


Figure 1–2 Logic Module Placement

1.3.1 Processor Module

A VAXft system has two processor modules, one in each zone. When the two zones are synchronized, the CPU modules run in lockstep. If one CPU module fails during operation, the other processor module continues to service the application.

1.3.2 Memory

The VAXft system uses the 32-Mbyte MS520 memory module. The MS520 is a fully checked, single board module that features single-bit correction, double-bit detection, address and function verification, and parity checking. Up to four memory modules (128 megabytes) can be configured in each zone. A minimum system configuration requires one memory module in each zone. An equal amount of memory in each zone is required for lockstep operation.

1.3.3 Cross-Link

Cross-link cables provide two communications paths between CPU modules in each zone: a serial and a parallel path. The serial path establishes initial communication between the zones. The parallel path starts to operate after the clocks in each zone are synchronized.

1.3.4 Clock System

The two zones in the VAXft system share a common clock system. The clock system consists of a programmable divider, programmable timer, and a 100-Hz clock.

1.3.5 System I/O Controller

System I/O controller modules provide the data paths from I/O devices through the CPU module to the memory arrays. The I/O devices include disks, tapes, consoles, modems, and thickwire and ThinWire Ethernet support devices.

1.3.6 Communication Support

Communication support is provided for both synchronous and asynchronous operation.

1.3.6.1 Synchronous

The DEC wide area network controller 620 (DEC WANcontroller 620 or WAN module) is used for synchronous communication. This two-line communications controller option is designed specifically for the VAXft system. The two lines are independently managed and operated so that different protocols can be run at the same time. The WAN module is capable of line speeds up to 64 kilobits per second.

A system can be configured with up to eight modules (four in each zone), providing 16 synchronous communications lines. If the modules are configured in a redundant configuration, a maximum of eight logical lines are provided.

The WANcontroller 620 supports Digital standard layered communications software for DECnet-VAX, VAX packetnet system interface (PSI), VAX 2780/3780 BISYNC protocol emulator, and DECnet/SNA products.

1.3.6.2 Asynchronous

Support for asynchronous communication devices, such as user terminals and modems, is provided by the system I/O controller module. An Ethernet port can be connected to a thickwire or ThinWire Ethernet line. A typical terminal interface would consist of a VAXft system, DELNI network, DECserver hardware, and the terminal connected in sequence.

1.3.7 System Interconnection

There are two main buses used in the VAXft system: memory interface bus (MIB) and module interconnect bus (MI). The MIB connects the CPU module to the memory array(s), and the MI connects the CPU module to the input/output (I/O) subsystem.

The I/O module connects to peripheral devices over the Digital storage system interconnect (DSSI) bus, thickwire and ThinWire Ethernet lines, console/modem serial lines, and the power and cooling intelligence module (PCIM).

1.3.8 Power

The VAXft system features an ac power system that supports 120 Vac for the United States, and 240 Vac for the international market. The power system provides the voltages to operate all internal components of the system including: computer logic, memory, disks, tape, and cooling fans.

Loss of external power causes the VAXft system to switch to the uninterruptible power supply (UPS), which allows for a controlled shutdown of the system to prevent the data loss. The UPS in each zone allows the system to tolerate brownouts and brief or full outages caused by external power loss. The UPS supplies power to all internal components for up to 30 minutes in each 24-hour period. If external power returns within 30 minutes, the system automatically switches back to the external power source. External devices such as console terminals, user's terminals, modems, and terminal servers are not supported by the VAXft system in the event of a power outage. An external UPS can be used to support these systems.

For critical applications that cannot tolerate downtime, an external generator should be included in the installation for times when power is lost for more than 30 minutes.

1.3.9 Cooling

The VAXft system is designed to operate in a temperature-controlled office space. Temperature thresholds are 10°C and 40°C (50°F and 104°F). There are internal cooling monitors in each zone to ensure that thresholds on the high temperature end are not exceeded. Fan speed is increased when room temperature rises above the acceptable threshold. The monitor reports harmful temperature fluctuations to the system.

1.4 Fault Detection and FRU Isolation

The dual zone design of the VAXft system allows fault detection and repair procedures to be implemented without interruption. The operational zone continues to service the application while repairs are made to the zone that is shut down. Each zone displays a flashing red light to identify a failure in that zone. Magnetic fault indicators (MFIs) on the logic modules visually indicate a fault (Figure 1–3).

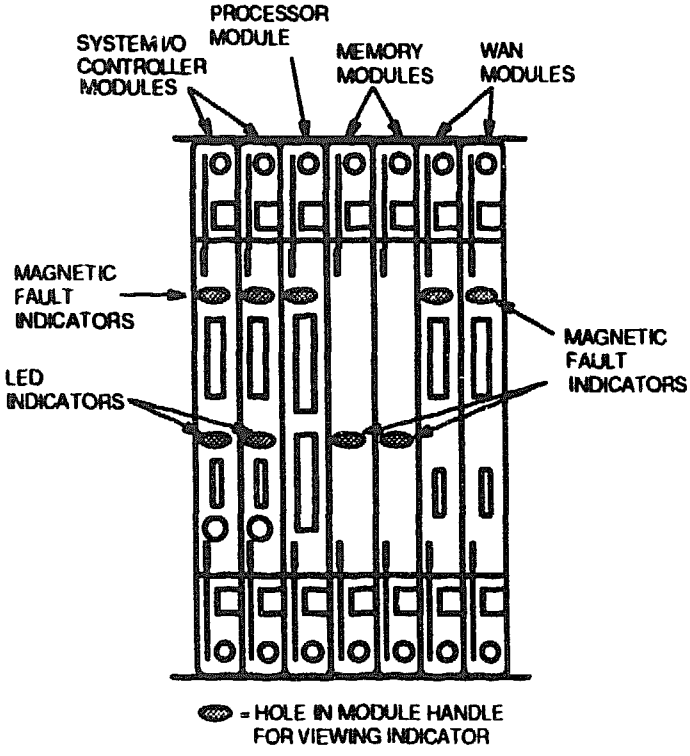


Figure 1–3 Logic Module LED Indicators and MFIs

1.5 FRU Removal/Replacement

All field replaceable units (FRUs) are accessible from the front of the cabinets.

1.6 System Configurations and Options

The following sections describe the entry-level and expanded system configurations.

1.6.1 Entry-Level System

The entry-level system (Figure 1–4) is the minimum system available. This system has limited mass storage where the requirement for on-line shadowed storage does not exceed 381 megabytes for an RF31 disk and 1 gigabyte for an RF72 disk.

Each cabinet in the entry-level system has a seven-slot backplane for logic modules. Three of the available slots are used for the processor, memory, and system I/O controller modules. The system I/O module must be located in slot 2 of the cabinet backplane because this is the only slot wired for internal DSSI and console capability.

The entry-level system supports a maximum of four DSSI mass storage devices, two in each cabinet. All mass storage devices are located in the system cabinets and are removable.

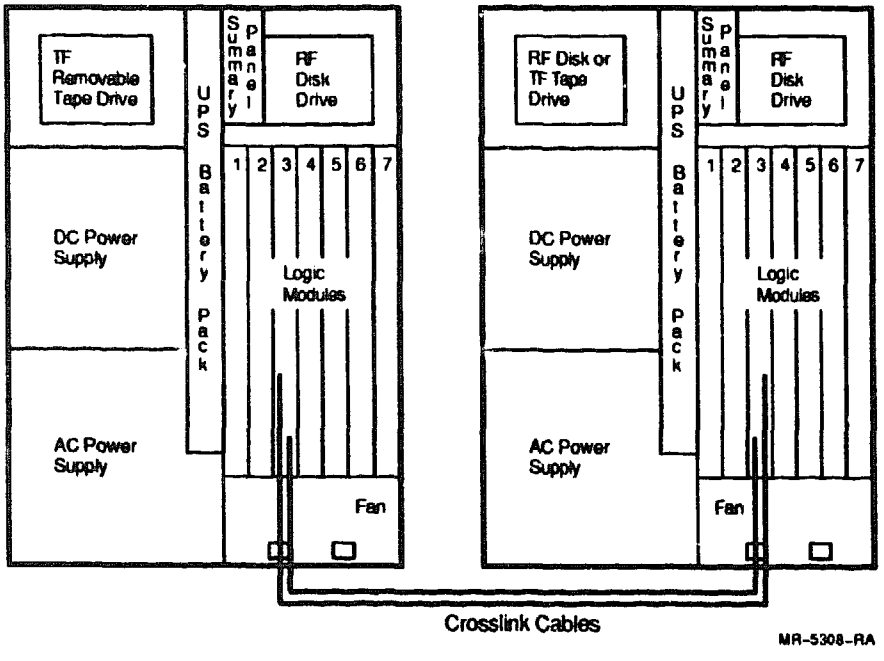


Figure 1–4 Entry-Level System

1.6.2 Expanded System

The expanded system (Figure 1–5) offers the maximum configuration available. This system provides 1.9 gigabits of shadowed RF31 mass storage or 5 gigabits of shadowed RF72 mass storage. The expanded system consists of two system cabinets and two expander cabinets. The system cabinets are similar to the entry-level system cabinets, except they do not contain any mass storage options. Each system cabinet contains a processor module, memory modules, one system I/O controller module, and an additional I/O controller module to support connection to the expansion cabinet.

All mass storage devices are located in the expander cabinets. Up to six mass storage devices are allowed in each expander cabinet. Dual DSSI cables connect the expander cabinets to the system cabinets, which allows both zones to access mass storage.

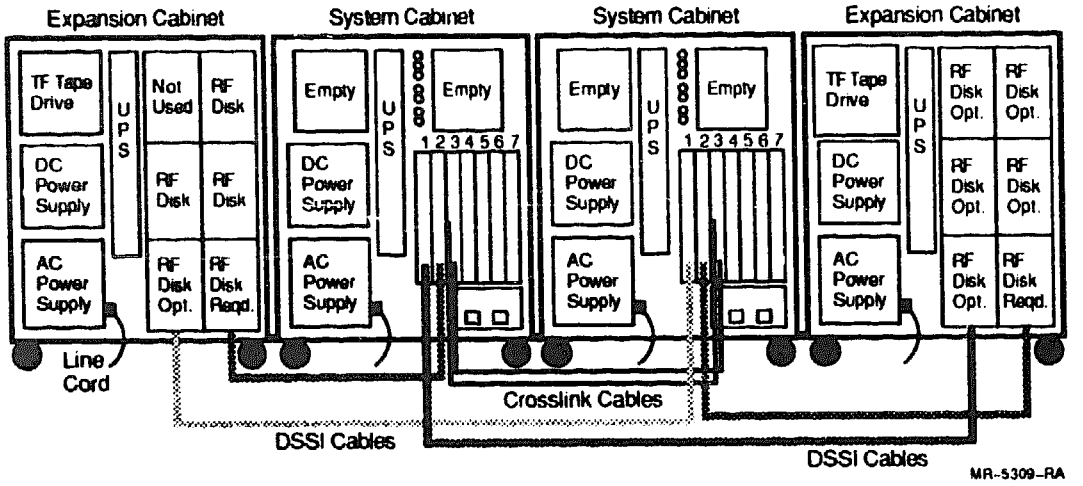


Figure 1–5 Expanded System

1.6.3 System Console

The VAXft system console enables the system to boot itself and allows routine system maintenance to be performed.

The console functions enable the user to:

- Issue console commands
- Boot the system either automatically or interactively
- Install the VMS operating system
- Examine control and status registers
- Run diagnostic tests
- View messages from the console program, diagnostics, and VMS operating system
- Provide remote dial-in/dial-out capability
- Provide input to the operating system for the system manager or operator

System I/O controller modules contain DSSI/Ethernet/console adapter interfaces. These modules are configured redundantly, one in each zone, to enable four console ports. The ports support one local terminal and provide access to one remote terminal in each zone through a modem.

The four console lines operate as a single logical system console. Identical output appears on all four console terminals, and input can be entered from any console terminal.

Local terminals can be a combination of video display terminals, hard-copy terminals, or video terminals with printer. A minimum of two terminals are required with the system.

During normal system operation, only one terminal is required. Two terminals are normally required during system repair. One terminal is used to manage the system, while the other is used to manage the repair. Remote console ports are used for system access from remote locations.


CHAP 2

2
VAXft Module Functional Descriptions

2.1 KA520 CPU Module

2.1.1 Introduction

The KA520 central processor unit (CPU) module is a single T3000-series module that provides the VAXft system with control logic and data paths for transferring data between the memory subsystem, the I/O subsystem, and the KA520 module in the other zone. The KA520 module provides the following functions:

- Memory control
- RAM/ROM and system support
- Cross-link
- Interrupt control
- Error detection and handling
- Trace RAM control
- DMA support
- System timers

2.1.2 KA520 Module Specifications

Table 2–1 lists the KA520 module specifications.

Table 2–1 KA520 Processor Module Specifications

Specification	Description
Module Number	T3005
Dimensions	26.507 × 21.361 × 0.236 cm (10.436 × 8.41 × 0.093 in)
Technology	
RAM	8K × 8 (80 Kbytes)
ROM	128K × 8 (256 Kbytes)
	32K × 8 (64 Kbytes)
Temperature	
Storage Range	-40.0°C to +66°C (-40°F to +150.8°F)
Operating Range	5°C to 50°C (41°F to 122°F)
Relative Humidity	
Storage	10 to 95% noncondensing
Operating	10 to 95% noncondensing
Altitude	
Storage	Up to 4.8 km (16,000 ft)
Operating	Up to 2.4 km (8000 ft)
Power Requirements	
Voltage	+5 V: 5.0 A typical
	+12 V: 0.05 A typical
	+10 V: 0.05 A typical
Wattage	30.0 W nominal, 40.0 W maximum

2.1.3 KA520 Module Functional Overview

As shown in Figure 2–1, the KA520 module interfaces to the memory modules and input/output (I/O) modules in it zone, and the KA520 module in the other zone. Each KA520 module can interface wi up to four memory modules and two KFE52 I/O modules and up to four DSF32 modules. The minimum configuration in each zone is one memory module, one I/O module, and one KA520 module. For detailed configuration information, refer to Chapter 1 of the *VAXft Systems Owner's Manual*.

The KA520 module consists of two complete central processor unit systems that mirror each other except for a single clock system that they both share. The two systems, referred to as the primary rail and the mirror rail, share a common 32-bit bidirectional memory interface bus (MIB). Each rail has the following additional buses: a 16-bit bidirectional module interconnect (MI) bus, a parallel cross-link interzone (IZ) bus, a 16-bit bidirectional cross-link memory controller (CROME) bus, and a 2-bit unidirectional serial cross-link bus.

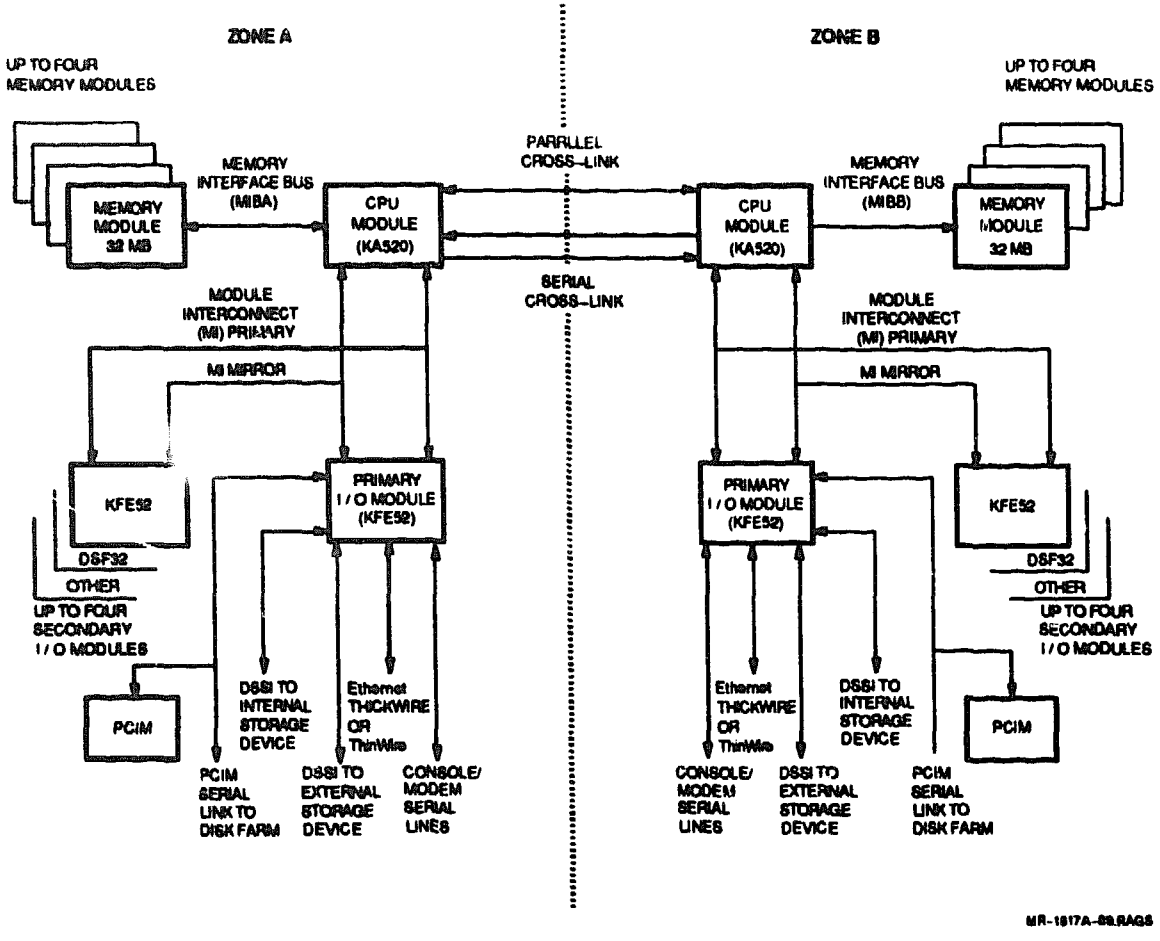


Figure 2–1 VAXft System Top Level Functional Diagram (KA520 Modules)

The dual rail KA520 module is comprised of three major functional sections: central processor unit, memory controller chip, and cross-link chip. Each rail consists of a CPU module processor, floating-point accelerator, cache, memory controller, cross-link, and read only memory (ROM). The two rails are connected at the main memory and I/O modules. The two KA520 module processors in a zone are designed to run in lockstep. In lockstep operation both processors perform the same operation at the same time.

Error checking is performed on transfers between the KA520 module and points external to the module. Errors generated by the KA520 module do not affect the user unless they propagate to main memory or the I/O space. Errors originating in the I/O space, or memory, must be caught before they reach the KA520 module processor. Whenever a disagreement is discovered between KA520 module processors, an error recovery procedure is started. Generally, error detection between rails is performed in the memory controllers, main memory, cross-link, and the firewall on the I/O module. Error detection between zones is done in the I/O module.

The dual rails on the KA520 module cannot remain in lockstep when handling unique data during error recovery and diagnostic operations. Occasionally unique data must be handled by the two zones without performing an error recovery operation.

2.2 KA550 CPU Module

2.2.1 Introduction

The KA550 central processor unit (CPU) module is a single T3000-series module that provides the VAXft system with control logic and data paths for transferring data between the memory subsystem, the I/O subsystem, and the KA550 module in the other zone. The KA550 module provides the following functions:

- Memory control
- RAM/ROM and system support
- Cross-link
- Interrupt control
- Error detection and handling
- Trace RAM control
- DMA support
- System timers

2.2.2 KA550 Module Specifications

Table 2–2 lists the KA550 module specifications.

Table 2–2 KA550 Processor Module Specifications

Specification	Description
Module Number	T3007
Dimensions	26.507 × 21.361 × 0.236 cm (10.436 × 8.41 × 0.093 in)
Technology	
RAM	32K × 8, 8K × 8 (272 Kbytes)
ROM	256K × 8 (512 Kbytes)
Temperature	
Storage Range	-40.0°C to +66°C (-40°F to +150.8°F)
Operating Range	5°C to 50°C (41°F to 122°F)
Relative Humidity	
Storage	10 to 95% noncondensing
Operating	10 to 95% noncondensing
Altitude	
Storage	Up to 4.8 km (16,000 ft)
Operating	Up to 2.4 km (8000 ft)
Power Requirements	
Voltage	+5 V: 5.0 A typical
	+12 V: 0.150 A typical
	+10 V: 0.05 A typical
Wattage	30.0 W nominal, 40.0 W maximum

2.2.3 KA550 Module Functional Overview

As shown in Figure 2–2, the KA550 module interfaces to the memory modules and input/output (I/O) modules in its zone, and the KA550 module in the other zone. Each KA550 module can interface with up to four memory modules and two KFE52 I/O modules and up to four DSF32 modules. The minimum configuration in each zone is one memory module, one I/O module, and one KA550 module. For detailed configuration information, refer to Chapter 1 of the *VAXft Systems Owner's Manual.*

The KA550 module consists of two complete central processor unit systems that mirror each other except for a single clock system that they both share. The two systems, referred to as the primary rail and the mirror rail, share a common 32-bit bidirectional memory interface bus (MIB). Each rail has the following additional buses: a 16-bit bidirectional module interconnect (MI) bus, a parallel cross-link interzone (IZ) bus, a 16-bit bidirectional cross-link memory controller (CROME) bus, and a 2-bit unidirectional serial cross-link bus.

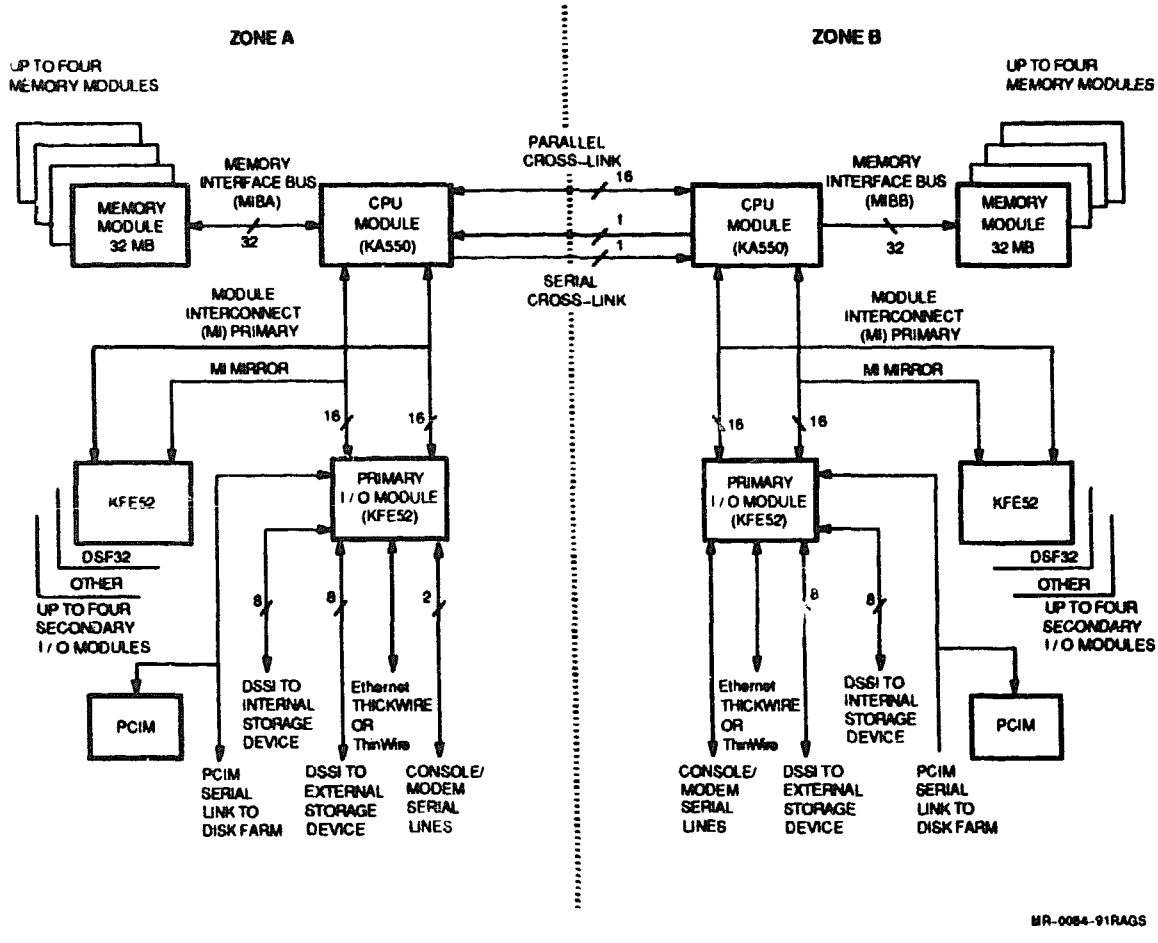


Figure 2–2 VAXft System Top Level Functional Diagram (KA550 Modules)

The dual rail KA550 module is comprised of three major functional sections: central processor unit, memory controller chip, and cross-link chip. Each rail consists of a CPU module processor, floating-point accelerator, cache, memory controller, cross-link, and read only memory (ROM). The two rails are connected at the main memory and I/O modules. The two KA550 module processors in a zone are designed to run in lockstep. In lockstep operation both processors perform the same operation at the same time.

Error checking is performed on transfers between the KA550 module and points external to the module. Errors generated by the KA550 module do not affect the user unless they propagate to main memory or the I/O space. Errors originating in the I/O space, or memory, must be caught before they reach the KA550 module processor. Whenever a disagreement is discovered between KA550 module processors, an error recovery procedure is started. Generally, error detection between rails is performed in the memory controllers, main memory, cross-link, and the firewall on the I/O module. Error detection between zones is done in the I/O module.

The dual rails on the KA550 module cannot remain in lockstep when handling unique data during error recovery and diagnostic operations. Occasionally unique data must be handled by the two zones without performing an error recovery operation.

2.3 MS520 Memory Module

2.3.1 Introduction

The MS520 memory module is a 32-Mbyte memory module used in the VAXft system. MS520 modules fit into specific backplane slots in the system cabinet. However, the minimum memory contained in either zone of a redundant VAXft system determines the total usable system memory. For example, if one zone contains 64 Mbytes of memory and the other zone contains 128 Mbytes of memory, the total usable system memory is 64 Mbytes. Unbalanced memory configurations are not recommended.

2.3.2 MS520 Module Specifications

Table 2–3 lists the MS520 memory module specifications.

Table 2–3 MS520 Memory Module Specifications

Specification	Description
Module Number	T3003-BA
Etch	8 layers
Dimensions	21.6 cm (8.5 in) high, and 26.7 cm (10.5 in) wide
Technology	
DRAMs	1 Mbit dynamic RAMs
Gate Arrays	DC7133 gate array
Address Range	0 to 512 Mbytes
Temperature	
Storage Range	-40°C to +66°C (-40°F to +151°F)
Operating Range	5°C to 50°C (41°F to 122°F)

Table 2–3 (Cont.) MS520 Memory Module Specifications

Specification	Description
Relative Humidity	
Storage	10 to 95% noncondensing
Operating	10 to 95% noncondensing
Altitude	
Storage	Up to 4.8 km (16,000 ft)
Operating	Up to 2.4 km (8000 ft)
Voltage	+5.0 V +/- 0.25 V
Current	3.9 A maximum standby, 5.9 A maximum operating
Power	19.5 W nominal, 29.5 W maximum
Clock Period	30.0 ns
Refresh Request Interval	15.6 μs
Refresh Cycle Duration	12 clock periods

2.3.3 MS520 Memory Module Functional Overview

The MS520 memory module contains six functional logic blocks (Figure 2–3) used in the operations required for transferring data between the CPU module and I/O space. A brief physical description of each block follows.

2.3.3.1 Memory Interface Bus

The memory interface bus (MIB) consists of 79 signal/data lines (excluding power and ground). Thirty-two lines are data lines that interface the CPU to the data transceivers on the memory module. The other 47 signal and control lines interface the CPU to the gate array on the memory module.

2.3.3.2 Transceivers/Registers

The transceivers/registers are used to transmit and receive data between the MS520 memory module and the interface bus. When data is written into memory, transceivers on the memory module accept the data and send it to the correct memory banks. When data is read from memory, the data contents of a selected memory bank is read and sent to the enabled transceivers. The transceivers then send the data over the MIB to the CPU module.

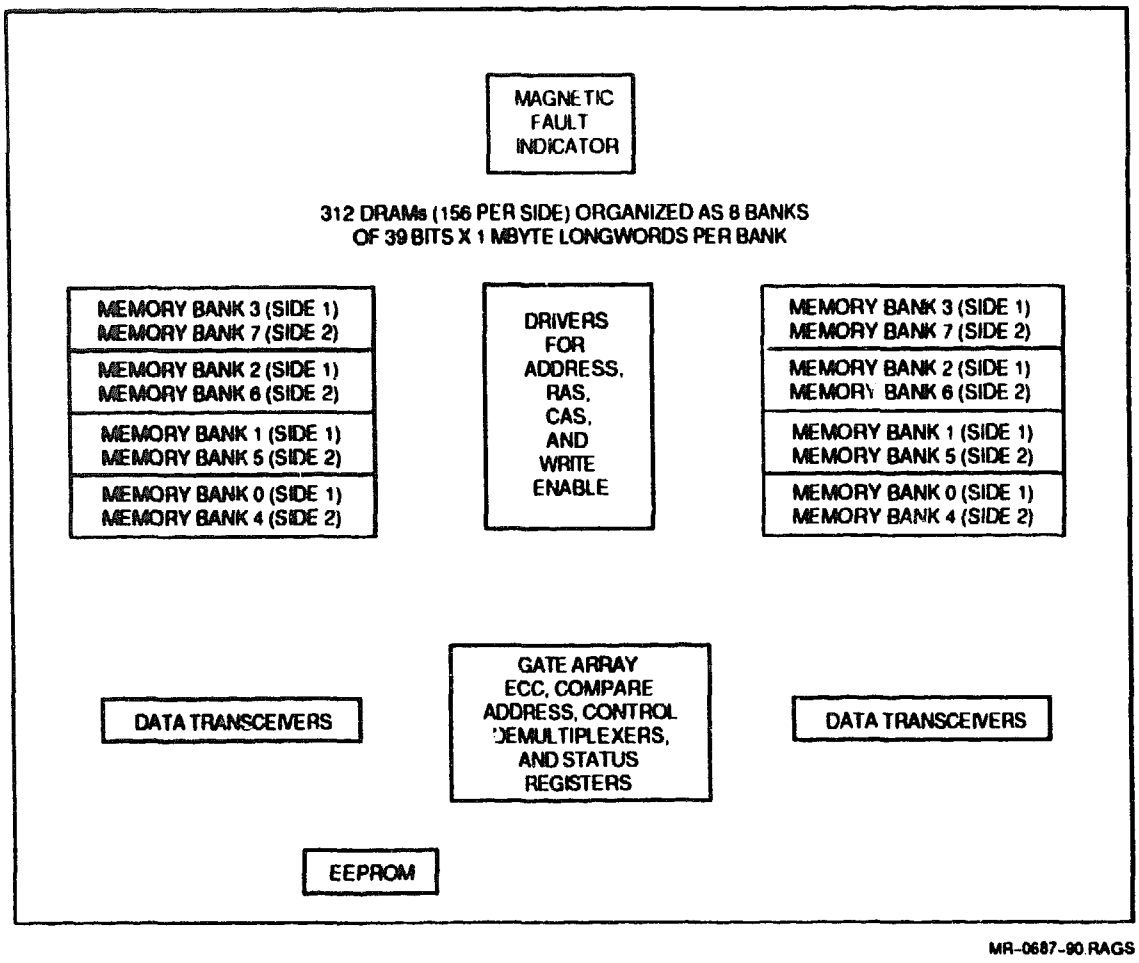


Figure 2–3 MS520 Memory Module — Top Level Block Diagram

2.3.3.3 Gate Array

Each memory module contains a DC7133 gate array. The gate array contains status registers, ECC logic, a control demultiplexer, and comparators.

2.3.3.4 Drivers

Drivers are used to send address and control signals from the memory controller gate array to the memory array modules. Another driver is used to send control signals between the gate array and the magnetic fault indicator (MFI).

2.3.3.5 Memory Storage Array

The storage array consists of 312 DRAMs arranged in 8 banks of 4 Mbytes per bank. Each bank is comprised of 39 DRAMs (1 Mbit × 1). Memory is formatted in 32-bit longwords with an associated 7-bit ECC. All memory transfers are executed in longword formats of longword or more.

2.3.3.6 EEPROM

The 2K × 8 EEPROM provides system initialization data, diagnostic and status register information for fault locating, and a fault and repair history. The EEPROM contains the serial number of the module, the serial number of the subsystem (zone) in which it resided, the revision level, and data from the status registers and memory controllers obtained during the memory operation in which a fault was detected and by the diagnostics run after a fault detection. Data from previous problems provide some historic background to the service depot repairing the module.

2.3.3.7 Magnetic Fault Indicator

The magnetic fault indicator provides a visible indication that diagnostics declared a memory module in need of repair or replacement. This magnetic indicator is located on the edge of the MS520 memory module and is visible through the module's handle. Its functions (set or cleared) are controlled by the primary memory controller (PMC) through the gate array.

2.4 KFE52 System Input/Output Module

2.4.1 Introduction

The KFE52 input/output (I/O) module is a single T3000-series module that provides the VAXft system with control logic and data paths for transferring data to and from input/output devices connected to the system. The KFE52 module provides the following functions:

- Mass storage I/O (DSSI, RFnn, TKnn)
- Network I/O (Ethernet)
- Console function (terminal I/O, modem)
- Power and cooling intelligence module I/O
- Self-test diagnostics

2.4.2 KFE52 Module Specifications

Table 2–4 lists the KFE52 module specifications.

Table 2–4 KFE52 I/O Module Specifications

Specification	Description
Module Number	T3001
Etch	8 layers
Dimensions	21.4 cm (8.41 in) high, and 26.5 cm (10.436 in) wide
Technology	
DRAMs	32 Kbytes static RAMs
ROM	128K × 8 (256 Kbytes)
Temperature	
Storage Range	-40°C to +66°C (-40°F to +151°F)
Operating Range	5°C to 50°C (41°F to 122°F)
Relative Humidity	
Storage	10 to 95% noncondensing
Operating	10 to 95% noncondensing
Altitude	
Storage	Up to 4.8 km (16,000 ft)
Operating	Up to 2.4 km (8000 ft)
Power Requirements	
Voltage	+5 V: 2.8 A +/- 0.1 typical
	+12 V: 0.25 A +/- 0.2 typical
	-10 V: 0.03 A typical
Wattage	18.0 W typical, 40.0 W maximum

2.4.3 I/O Module Functional Overview

The following sections provide a brief description of the KFE52 I/O module.

2.4.3.1 I/O Module System Connections

The KFE52 module connects to other VAXft system components as shown in Figure 2–1. The system KFE52 I/O module must occupy slot 2 in the BA22A system cabinet backplane and is designated as the primary KFE52 I/O module. In addition to data input/output functions, the I/O module in this slot provides console input/output, modem communication, and power and cooling monitoring (PCM) I/O functions. Up to one additional KFE52 I/O module can be installed in the system cabinet backplane. If system expansion is required, a second KFE52 module is installed in slot 1 of the backplane. The KFE52 module in slot 1 does not perform console I/O and PCIM functions because this slot does not have physical connections for these functions. DSF32 communication option modules can be installed in slots 1 (if system expansion is not used), 5, 6, and 7. Module use is shown in the *VAXft Systems Site Preparation and Installation Guide* (EK-VXFT1-IN).

2.4.3.1.1 Module Interconnect Bus

The I/O modules connect to the CPU processor module by way of the module interconnect (MI) bus, which is routed through all slots of the cabinet backplane. The MI is a dual rail 16-bit synchronous bus that allows the processor on the CPU module to access and control various I/O module functions. This processor also performs direct memory access (DMA) between MS520 memory modules and the I/O module buffer RAM.

2.4.3.1.2 Mass Storage I/O and Network I/O

Mass storage devices, such as RF-series disk drives and TF-series tape drives, are connected to the I/O module by the DSSI bus. One DSSI bus is required for each I/O module. The DSSI bus is an 8-bit bus routed to both the backplane and the module handle. The backplane connection is used for internal device connections and the module handle is for external device connections.

There are two dual in-line package (DIP) jumpers that allow the DSSI bus to be configured for either internal or external storage device use. When the KFE52 is configured in slot 2 for internal DSSI devices only, a DSSI terminator for each I/O module is required on the external DSSI connector (module handle). The terminator contains an LED that lights when the correct terminator power is present. If the LED is not lit, the terminator power fuse (F2) on the I/O module must be checked.

The KFE52 module can interface to either ThinWire or thickwire Ethernet devices (transceivers) by means of two connectors on the module handle. A coaxial cable connector provides ThinWire Ethernet access, and a 15-pin connector provides access to thickwire Ethernet transceivers. The KFE52 cannot interface to both at the same time. The connector used is selected by a switch located on the I/O module.

The KFE52 module also supports IEEE Std. 802.3 compliant transceivers over the thickwire Ethernet connection. For IEEE Std. 802.3 compliance, a jumper must be installed on the I/O module at W1.

NOTE

Refer to the *VAXft Systems Site Preparation and Installation Guide* (EK-VXFT1-IN) for correct jumper, terminator, and switch settings.

2.4.3.1.3 Console Terminal Connection

The console terminal connector is a modular jack located on the BA22A system cabinet and wired to the primary I/O module through the backplane.

2.4.3.1.4 Modem Connection

A 25-pin connector on the system cabinet, wired to the primary module through the backplane, allows a modem to be connected to the system.

2.4.3.1.5 Power and Cooling Intelligence Module (PCIM) Connection

The PCIMs are connected to the primary I/O module by a serial, multidrop, bidirectional, differential communication line that is routed to the backplane.

2.5 DEC WANcontroller 620 Synchronous Communications Controller

2.5.1 Introduction

The DEC WANcontroller 620 synchronous communications controller consists of a T3004 communications module, a 100-conductor communications cable, a Y-box, and a 100-pin terminator. These components form a DSF32-AA option kit. A second option kit, the DSF32-AB, consists of a T3004 communications module, a 100-conductor communications cable, and a 20-conductor interconnect cable. A full set of DSF32 configurations can be found in the *VAXft Systems Site Preparation and Installation Guide*.

2.5.2 WANcontroller 620 Module Specifications

Table 2–5 lists the WANcontroller 620 module specifications.

Table 2–5 DSF32 Synchronous Communications Module Specifications

Specification	Description
Module Number	T3004
Etch	8 layers
Dimensions	21.4 cm (8.41 in) high, and 26.5 cm (10.436 in) wide
Technology	
SRAMs	256K × 8 array (shared RAM)
	128K × 8 array (local RAM)
ROM	128K × 8 array
EEPROM	32K × 8 array
FIFO	Two 2K × 2 arrays
Gate Arrays	DC7179C firewall chip
VLSI	DC333 MicroVAX 32-bit CPU
	DC349 MicroVAX direct memory access
	DC511 MicroVAX system support chip
	DC506 MicroVAX vectored interrupt controller
	68562 dual universal serial communications controller
Temperature	
Storage Range	-40°C to 66°C (-40°F to 151°F)
Operating Range	5°C to 50°C (41°F to 122°F)
Relative Humidity	
Storage	10 to 95% noncondensing
Operating	10 to 95% noncondensing
Altitude	
Storage	Up to 4.8 km (16,000 ft)
Operating	Up to 2.4 km (8000 ft)

Table 2–5 (Cont.) DSF32 Synchronous Communications Module Specifications

Specification	Description
Power Requirements	
Voltage	+5 V: 7.8 A maximum, 3.8 A typical
	+12 V: 0.25 A maximum, 0.06 A typical
	-10 V: 0.46 A maximum, 0.3 A typical
Wattage	40.0 W maximum

2.5.3 WANcontroller 620 Controller Module Functional Overview

NOTE
When the term WAN module is used in this manual, it refers to the T3004 module.

The WAN module interfaces external communication equipment with the VAXft system. The WAN module is a synchronous multiplexer module that supplies communication data at rates of up to 64 Kbits per second per port. It provides a high level of availability, reliability, and data integrity to the VAXft processor. DSF32 options can be configured redundantly (active and standby) to provide automatic failover to the standby controller in the event of a failure in the active controller.

The WAN module can be installed in any available I/O slot in the system module cabinet backplane. As shown in Figure 2–4, the DSF32 option set (DSF32-AA and DSF32-AB) includes two WAN modules, the Y-connection box, and a set of interconnect cables.

The Y-box connects the drivers and receivers of DSF32 option pairs. Connectors on the edge of the board connect the module to the communication cables from the Y-box. The purpose of the Y-box is to connect two WAN modules so that either module can drive either of the two synchronous data channels. Two 100-conductor communications cables connect the Y-box to each WAN module with a 100-pin connector at each module. Each cable contains a full set of signals for full-duplex synchronous channel operation with full modem control for both channels. Provision is made for three types of electrical interfaces.

If only one WAN module is configured to drive the two synchronous lines (simplex mode), the Y-box must still be used. In this case, the unused 100-pin connector on the box must have the terminator installed.

Two 50-conductor personality cables connect the Y-box to user equipment. Each cable represents a synchronous communications line and is designed to select the correct electrical interface signals.

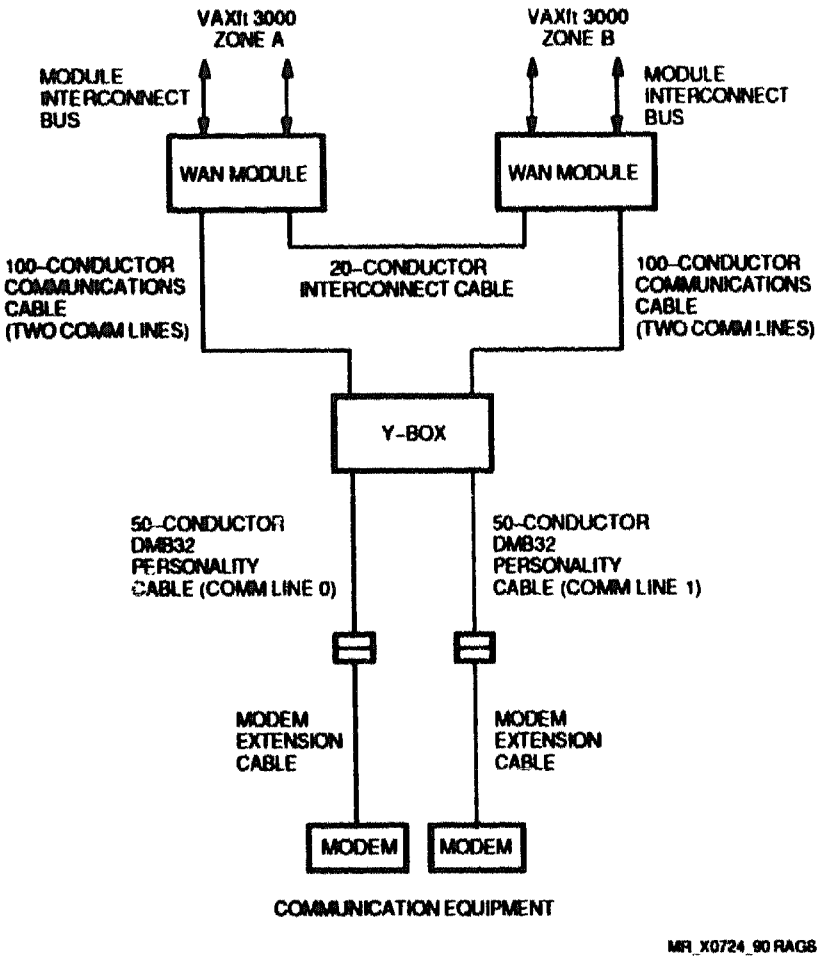


Figure 2–4 DSF32 Option Set — Redundant Configuration

There are no active components in the Y-box. All synchronous line connections are made through the Y-box, with the exception of resistor terminations required for each electrical interface. The terminations are designed to appear as if there is only one load for each synchronous line. Some of the terminations require passive pull-up resistors to +5 volts. Diodes and a current limiter circuit in the WAN module are used to protect the 5 volt line against short circuit conditions. An LED on the Y-box lights to indicate that the +5 volt line to the Y-box is present.

Data to be transmitted to external communication sources is read by the DSF32 software driver from the host memory over the dual path module interconnect bus, to the firewall chips on the WAN module. A cyclic redundancy check (CRC) is calculated and appended to the data, which is then stored in the shared memory to await transmission over the synchronous communications line.

In the case of received data, the WAN module does not strip the CRC from the received data packet. This data is passed, by software driver control, from the shared memory through the firewall chips where the packet CRC is verified. Once the CRC is verified, the data is copied over the module interconnect bus to host memory. Extended CRC checking throughout the module verifies integrity of data passing through the module ports.

The WAN module detects and reports all received synchronous data errors. It can also detect transmitted data errors if a redundant WAN module is configured in monitor mode.

The WAN module supports full modem control on two channels to permit full duplex point-to-point operation or dial-up (auto answer) operation over a public switched telephone network. HDLC/SDLC, DDCMP, and BISYNC protocols are supported. The characteristics for each line can be set by program control.


INDEX

Index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