VMZ/32 Controller Preliminary User's Guide

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CHAPTER 1

How to Use This Manual

Congratulations on your purchase of a VMZ/32 Controller from ABLE Computer. We are sure it will provide you with years of satisfactory service. We have prepared this manual to help you maximize the effectiveness of the VMZ/32 in your system.

This manual is provided to assist you with the installation, use and care of VMZ/32; it does not provide repair information. If you have problems with your VMZ/32, we prefer that you let us repair it in our factory.

NOTE

> Throughout this manual, the terms VMZ/32 Controller and VMZ/32 will be used interchangably to make reference to the VMZ/32 Controller Module. The VMZ/32 is a component of several communication subsystems offered by ABLE Computer. These subsystems are documented separately.

The manual assumes that you are familiar with the VAX-11 architecture and Unibus structure. For further information refer to the following Digital documents:

* VAX-11 Hardware Handbook
* VAX-11 Architecture Handbook
* PDP-11 Bus Handbook

This manual is organized into the following chapters:

* Chapter 2 contains a general description of VMZ/32 and lists its special features. General, electrical and physical specifications are included.

* Chapter 3 contains detailed instructions for installation. The functions of switches on the VMZ/32 are described. Procedures for preparation of the computer system and installation verification are described.

* Chapter 4 contains information on the care of the VMZ/32 Controller and troubleshooting tips in the event that a problem occurs. The procedure for obtaining assistance from ABLE Computer is also described.

* Chapter 5 contains descriptions of typical applications for the VMZ/32 Controller.

* Chapter 6 contains information for programming the VMZ/32 Controller.

* Appendices included in this document contain system and application-specific information.

CHAPTER 2

What is the VMZ/32 Controller?

2.1 GENERAL DESCRIPTION

The VMZ/32 Controller is a microprocessor-based communications controller which contains two eight-line multiplexers programmed to emulate the asynchronous line functions of two Digital DMF32 controllers. Each line provides EIA standard RS-232-C interface levels and modem controls.

Data transfer from the VAX-11 computer system is initiated under system software control in a manner compatible with procedures which operate a Digital DMF32. For output requests, software selects a silo or DMA mode of operation depending on parameters established by the system manager. During silo operation, each transmit line buffer may be loaded with up to 32 characters under program control. When DMA operation is selected, characters are transferred from the VAX-11 memory by the VMZ/32 itself. For input operations, a 48 character input silo is available for each group of eight lines. A program interrupt is generated after a silo becomes non-empty and a software selectable time delay has elapsed or 18 characters have been received. The time delay parameter is established by the system manager.

Modem control capabilities are available on each line to permit full-duplex dial-up (auto-answer) operations on modems such as Bell models 103, 112, 212, or equivalent. Modem status changes are reported to system software under interrupt control, compatible with the operation of the Digital DMF32.

Physically, the VMZ/32 Controller consists of a single hex-width module which is installed in a small peripheral controller (SPC) slot of a standard DD11 Unibus backplane.

The selected SPC slot must be configured for DMA operation and provide adequate power and cooling.

The VMZ/32 Controller is shown in Figure 2-1.

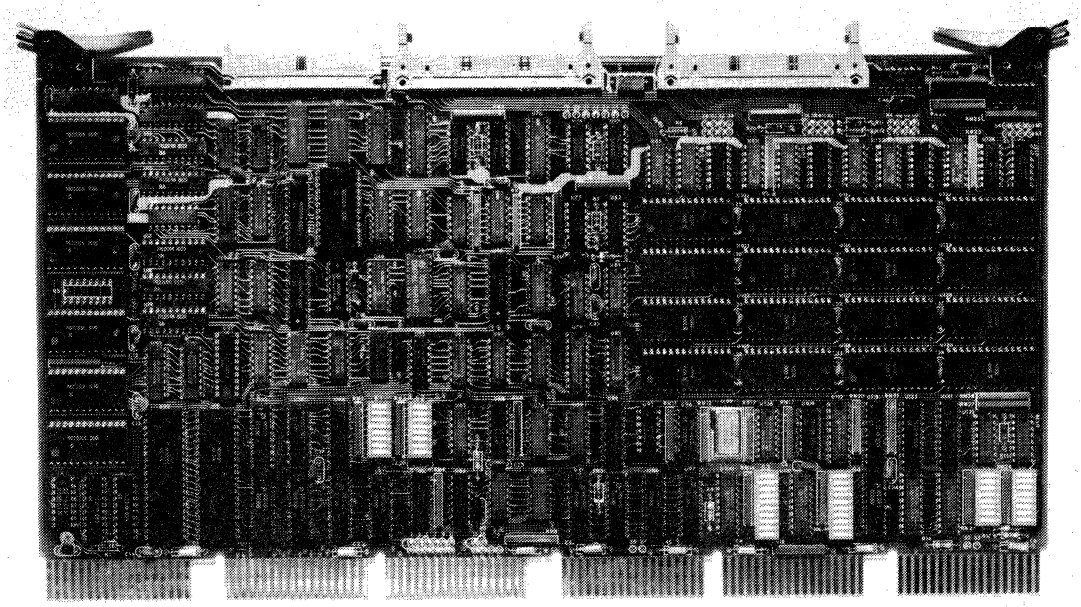

Figure 2-1: VMZ/32 Controller Module

2.2 FEATURES

* The ABLE VMZ/32 provides:
* Substantial performance improvement and reduction of system overhead in VAX-11 systems.
* VAX/VMS Version 3.0 software compatibility.
* Word DMA operations with byte alignment handled by microcode to reduce Unibus bandwidth requirements.
* Modem events reported under interrupt control to eliminate system overhead associated with DZ11-style modem scanning.
* High-density design reduces physical mounting requirements.
* Low-cost migration path to DMF32 performance levels for users of the ABLE VX/DZ .

* Hardware output flow-control capability that allows serial printers, communications devices and remote computer systems to regulate system output without XON/XOFF overhead.

* High-reliabilty and rapid fault isolation. On-board micro-diagnostics automatically check basic functions of the controller at every power-on and report exceptions in a LED display.

* Full support from ABLE Computer with documentation, application engineering support, and rapid board replacement and repair.

2.3 SPECIFICATIONS

2.3.1 General Specifications

Model	ABLE Part No.	Description
ABLE VMZ/32 Controller	10184	Hex-width module

Operating Mode: Full duplex

Signal Compatibility: EIA RS-232-C, CCITT V.24

EIA/CCITT Interface Leads

	EIA	CCITT V.24
Protective Ground	AA	101
Signal Ground	AB	102
Transmitted Data	BA	103
Received Data	BB	104
Data Terminal Rdy	CD	108/2
Ring Indicator	CE	125
Carrier Detect	CF	109

Subsystem Compatibility: Power is available at the signal connector for compatibility with ABLE Computer signal distribution systems which implement level conversions.

2.3.2 Electrical Specifications

Bus Loading	One dc load
Power Required	+5 volts 6.90 amps +15 volts 0.35 amps -15 volts 0.15 amps

2.3.3 Physical Specifications

Controller Module	Standard hex board 15.7 inches (39.7 cm) by 8.4 inches (21.3 cm).

CHAPTER 3

How to Install the VMZ/32 Controller

3.1 INSTALLATION PROCEDURE

This chapter explains in detail how to install your VMZ/32. Below is a brief, step-by-step procedure.

1. Unpack your VMZ/32 and verify that you have received the proper equipment using Sections 3.2 and 3.3.

2. Determine address assignments using Section 3.5. Refer to Table 3-1 for the starting address switch settings for the VMZ/32.

3. Verify mandatory switch settings for normal operation using Section 3.6.

4. If an interrupt level other than BR5 is required, modify the jumper connections per Section 3.9 and Appendix E.

5. Remove power from the system, using both the front panel switch and the master breaker switch (Section 3.10).

6. Install the VMZ/32 Controller in a DMA configured hex slot of a DD11-type Unibus backplane (Sections 3.10 and 3.11).

7. Attach EIA signal distribution cables.

8. Apply power to the system, checking the LEDs to verify internal operation of the VMZ/32 (Section 3.12).

9. Verify the functions of VMZ/32 with an operational test.

3.2 UNPACKING THE VMZ/32

The VMZ/32 is shipped in a special container to prevent damage during shipment. It is recommended that this container be saved for use in the event that the product requires subsequent reshipment. Unpack the contents carefully and inspect for any signs of damage. If damage is found, notify the carrier immediately.

3.3 VERIFY THAT YOU RECEIVED WHAT YOU ORDERED

Be sure that you received what you ordered by checking the module part number. The VMZ/32 part number is 10184. The number is located on the solder side of the VMZ/32 printed circuit board.

If you have not received the correct equipment, please notify our factory.

3.4 EQUIPMENT NEEDED TO USE THE VMZ/32

You will need the following equipment to use the VMZ/32:

* A computer system supporting a Unibus.
* One vacant hex Unibus SPC (small peripheral controller) slot providing adequate power and cooling to support the VMZ/32.
* Cables to facilitate distribution of EIA signals.

3.5 HOW TO DETERMINE DEVICE ADDRESS ASSIGNMENTS

The VMZ/32 emulates two Digital DMF32 controllers assigned to consecutive addresses. The address of the first of these two units is controlled by switches on the VMZ/32. The second unit automatically assumes addresses immediately

following the first. Each unit requires 40 octal contigious bytes of Unibus address space and no unit may span a 100 octal address boundary. Therefore, the VMZ/32 must be addressed at 100 octal address intervals.

For compatibility with software, it is desirable to observe standards established by Digital Equipment Corporation for addressing communications devices such as the VMZ/32. These standards assign a rank to each type of device. The address of any type of device depends upon the presence of any devices that have lower rank.

To determine the address at which the VMZ/32 should be installed, two procedures are available. The easier of the two procedures requires access to a running VAX/VMS system. It is described in Appendix A. The second procedure may be used when VAX/VMS is not available. It is described in Appendix B. One of the two procedures should be performed before proceeding with the installation.

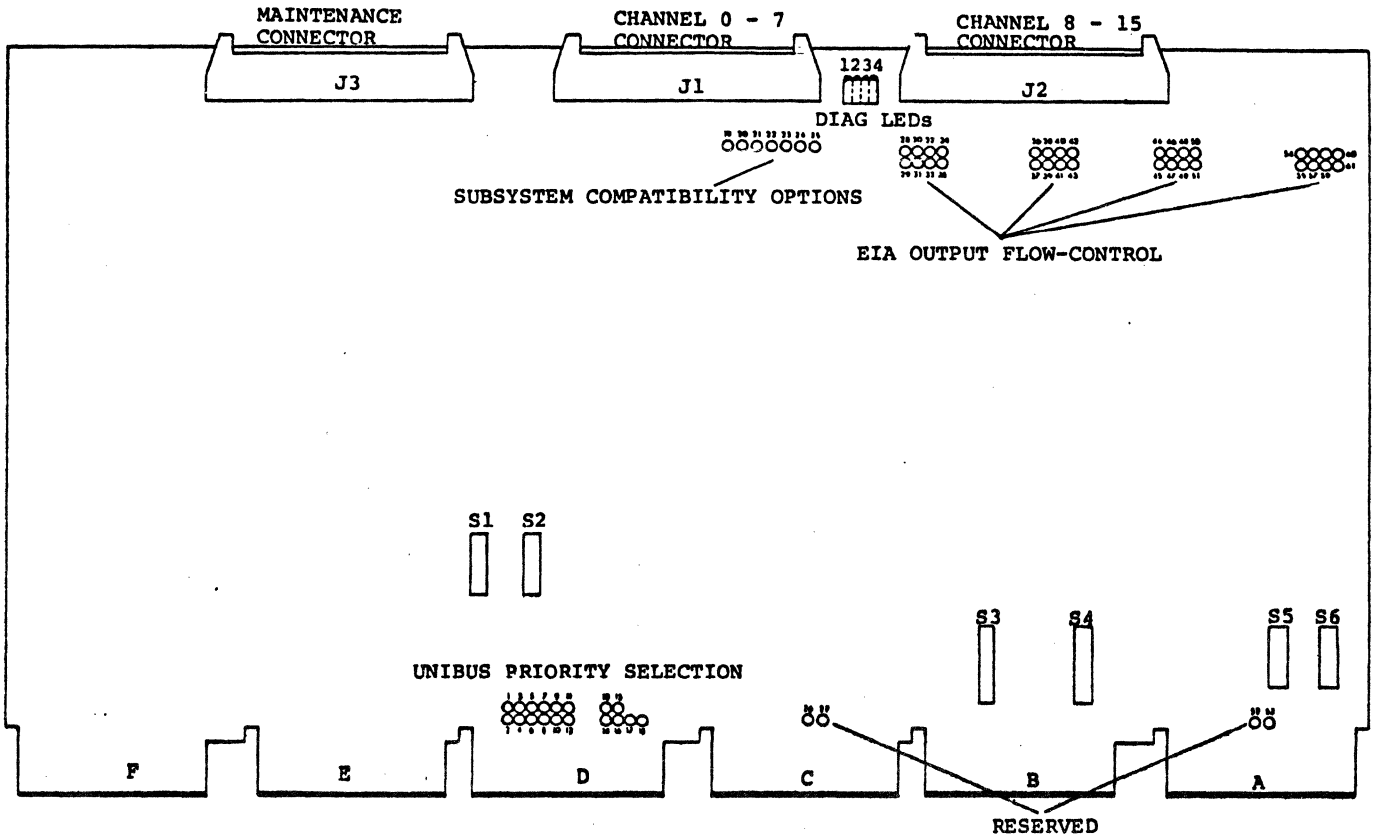

Figure 3-1: VMZ/32 Controller Module Layout

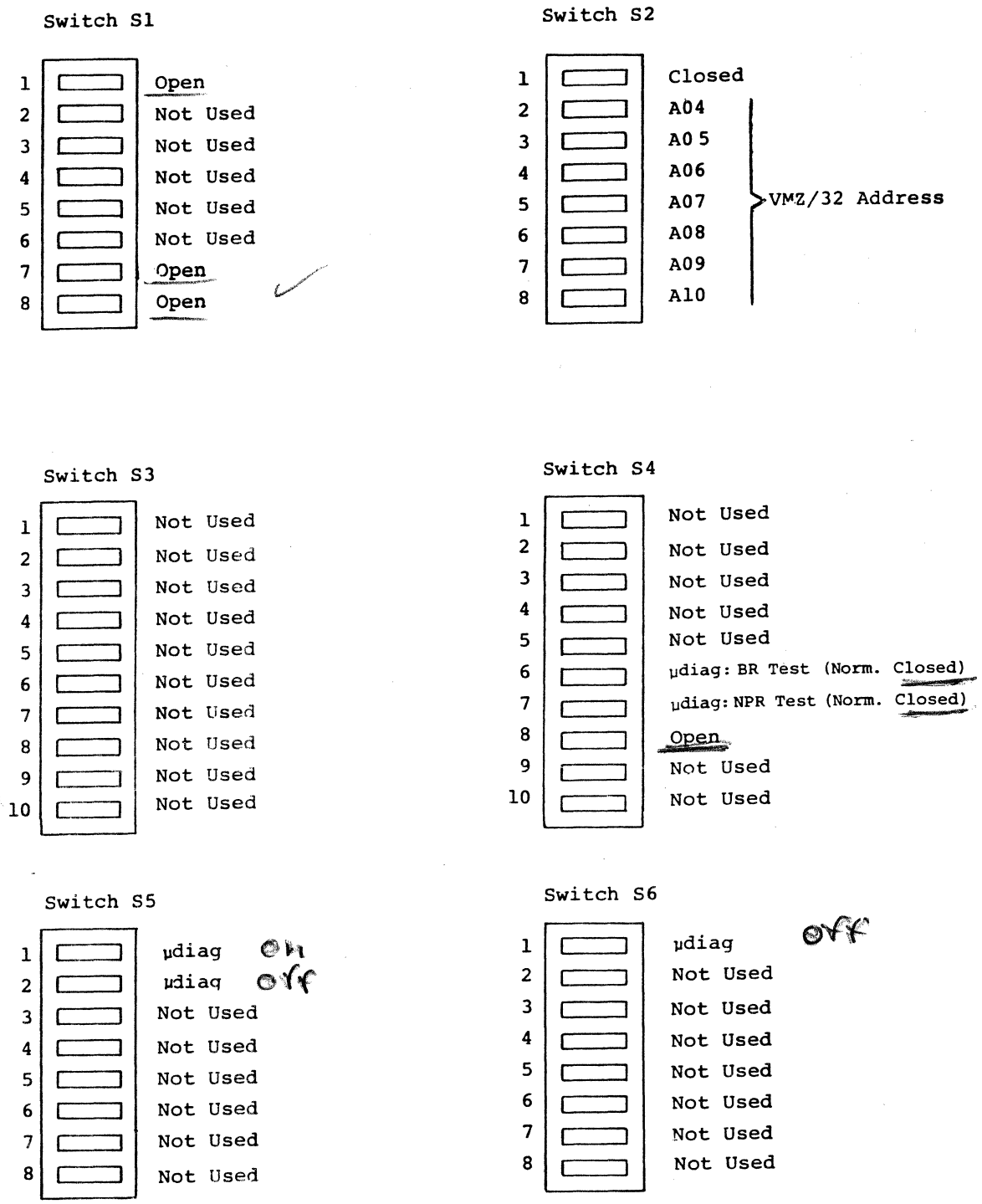

Figure 3-2: VMZ/32 Switch Descriptions

Starting Address	Switch S2 8 7 6 5 4 3 2 1	Starting Address	Switch S2 8 7 6 5 4 3 2 1
760100	C C C C - - - C	762000	- C C C C - - C
760200	C C C - C - - C	762100	- C C C - - - C
760300	C C C - - - - C	762200	- C C - C - - C
760400	C C - C C - - C	762300	- C C - - - - C
760500	C C - C - - - C	762400	- C - C C - - C
760600	C C - - C - - C	762500	- C - C - - - C
760700	C C - - - - - C	762600	- C - - C - - C
761000	C - C C C - - C	762700	- C - - - - - C
761100	C - C C - - - C	763000	- - C C C - - C
761200	C - C - C - - C	763100	- - C C - - - C
761300	C - C - - - - C	763200	- - C - C - - C
761400	C - - C C - - C	763300	- - C - - - - C
761500	C - - C - - - C	763400	- - - C C - - C
761600	C - - - C - - C	763500	- - - C - - - C
761700	C - - - - - - C	763600	- - - - C - - C
		763700	- - - - - - - C

'-' = open, 'C' = closed

Table 3-1: Starting Address Switch Settings for the VMZ/32

3.6 MANDATORY SWITCH SETTINGS

Certain switches must be set to specific positions for normal operation of the VMZ/32. Refer to Figure 3-2 and set the switches as follows:

Switch 1, position 1 OPEN
Switch 1, position 7 OPEN
Switch 1, position 8 OPEN
OTHERS IN S1 ARE NOT USED

For maintenance purposes, three specific switch positions are required. Refer to Figure 3-2 and set the switches as follows:

Switch 5, position 1 CLOSED
Switch 5, position 2 OPEN
Switch 6, position 1 OPEN

3.7 HOW TO SET THE DEVICE ADDRESS SELECTION SWITCHES

Device addresses are set using switch S2 on the VMZ/32 module (10184). Refer to Figure 3-1 for the location of switch S2. Figure 3-2 shows each switch position.

NOTE

An open switch is accomplished by depressing the side of the switch marked "OPEN".

3.8 HARDWARE OUTPUT FLOW-CONTROL

3.8.1 XON/XOFF Flow-Control

Many devices, such as serial line printers, require flow-control to prevent loss of data. Digital Equipment Corporation standards specify the use of XON/XOFF in-stream flow-control to achieve this type of device synchronization. The VMZ/32 implements this type of flow-control under microcode control. With proper programming, system software overhead related to control character detection is eliminated.

3.8.2 EIA Level Flow Control

Some device manufacturers have adopted an alternate implementation of flow-control that uses an EIA signal such as Clear-to-Send (CB). The VMZ/32 accomodates this implementation in a manner transparent to system software. Wire-wrap posts have been included to allow selection of this option on a per-line basis. Installation of one of the jumpers listed in Table 3-2 will enable the feature for the selection line. To complete the arrangement, the EIA signal cable connected to the device may require a jumper to present the flow-control signal to the VMZ/32 on the EIA Ring (CE) signal line.

NOTE

Any line that is configured for EIA level flow-control will produce unpredictable errors if armed for modem-status change interrupts by system software.

Line	From	To
0	E28	E29
1	E30	E31
2	E32	E33
3	E34	E35
4	E36	E37
5	E38	E39
6	E40	E41
7	E42	E43
8	E44	E45
9	E46	E47
10	E48	E49
11	E50	E51
12	*E54	E55
13	E56	E57
14	E58	E59
15	E60	E61

*Note: E52 and E53 are used elsewhere

Table 3-2: Output Flow-Control Jumpers

3.9 HOW TO WIRE INTERRUPT PRIORITIES

The VMZ/32 is strapped to request the Unibus on the BR5 priority request line. If you wish to change the interrupt level, use the strapping chart in Appendix E.

3.10 PREPARING YOUR SYSTEM FOR THE VMZ/32

To prepare your system for installation of the VMZ/32, remove power from the system. Use either the front panel switch or the expansion cabinet breaker switch. We suggest that both switches be turned off.

Once power is removed from the system, locate a vacant hex SPC slot that can accommodate the VMZ/32. Normally, this will be slots two or three in a DD11-C four-slot backplane, or slots two through eight of a DD11-D nine-slot backplane. Remove any previously installed bus grant continuity cards. Remove the NPG jumper between pins CA1 and CB1 of the selected slot on the backplane to configure the slot for DMA operation.

3.11 HOW TO INSTALL THE VMZ/32 INTO YOUR SYSTEM

Prior to installing the VMZ/32, verify that address switches are set appropriately. Insert the VMZ/32 into the selected slot using the card guides to ensure that it is properly positioned. The two card extractor devices on the VMZ/32 can be used to securely seat the module in the SPC connector blocks.

3.12 INSTALLATION VERIFICATION

Once the VMZ/32 has been installed power may be applied. During the power-up sequence, the VMZ/32 performs a micro-diagnostic to verify its internal operation.

By monitoring the four LEDs near the top of the board, proper internal operation of the VMZ/32 can be verified. Figure 3-1 shows the location of the LEDs. When power is applied, all four LEDs should light briefly. Any LED that remains lit indicates a malfunction and requires investigation. Chapter 4 contains troubleshooting tips to aid in this investigation.

If all four LEDs are off after power has been applied to the system the VMZ/32 is ready for an operational test.

3.13 OPERATIONAL VERIFICATION

3.13.1 VAX/VMS Systems

In systems in which VAX/VMS is used the operational verification procedure contained in Appendix D should be performed. Should any part of that procedure fail, refer to Chapter 4 for troubleshooting tips.

3.13.2 Other Systems

In systems without the VAX/VMS, it is necessary to perform an operational test which ensures that the VMZ/32 installed correctly and is operational. Such a test must test DMA and non-DMA output capability. All tests should be performed on both DMF32-unit emulations to ensure that both have been properly configured.

CHAPTER 4

What to Do if The VMZ/32 Does Not Work

4.1 HOW TO CARE FOR THE VMZ/32

ABLE products are designed to provide years of service with a minimum of care. Here are a few tips to help you avoid problems.

* If a printed circuit board is frequently inserted and removed, it tends to build up a gum-like residue on the contacts. Clean this off using alcohol or freon. Use of a pencil eraser can remove some of the gold on the contacts, so if you choose to use one, go easy.

* Every six months remove each printed circuit board and clean off any accumulated dust. Dust can impede air flow. While the board is out, inspect it for any visual evidence of a potential problem such as damaged components, loose connections, loose-socketed ICs, etc.

* Schematics for your VMZ/32 can be ordered from the ABLE factory. The document order number is:

10103003

4.2 TROUBLESHOOTING TIPS

4.2.1 LEDs On

When the ERR LED remains lit, a failure in the micro-diagnostics is indicated. We suggest that you run the power-up sequence a few times to verify consistency of the failure.

If either of the following conditions occurs, switch S6 position 1 may be closed and should not be. Check this and all other switch settings.

* The ERR LED is off, but other LEDs are lit.

* The ERR LED is lit, LED 2 is lit, LED 3 is off, and LED 1 is in either state.

If these conditions persist, your VMZ/32 can be considered faulty. If so, contact the ABLE Product Support Center as outlined in Section 4.3.

4.2.2 Verify Configuration and Installation

Experience has shown that the greatest number of problems with VMZ/32 involve configuration or installation errors. An address, vector, or priority level assignment may be inconsistent with system requirements.

1. Using Sections 3.5, 3.6 and 3.7 verify that address assignments and switch settings are correct.

2. Using Section 3.9, check that interrupt priority jumpers are correctly placed and are making contact.

3. Use a voltmeter to verify that the +5V, +15V, and -15V are within 5% of their nominal value. If not, adjust the associated power supplies. See Table 4-1 for the backplane pins at which these voltages appear.

Voltage	Backplane Pins
+5V	AA2, BA2, CA2, DA2, EA2, FA2
+15V	CU1
-15V	CB2, DB2, EB2, FB2
Ground	AC2, BC2, CC2, DC2, EC2, FC2

Table 4-1: Voltage Sources on Backplane

4.3 CUSTOMER SERVICE

ABLE Computer's goal is to provide each customer with a product that works well in his system. We design and build our products to provide high reliability and to minimize problems. When a problem does arise, it is our intent to do everything in our power to quickly and efficiently solve it.

4.3.1 Who to Call for Service Within the United States

If your VMZ/32 does not function properly and you are within the United States, contact our Product Support Center before sending it for repair. Have serial numbers available when calling.

ABLE Computer
1732 Reynolds Avenue
Irvine, California 92714
(714) 979-7030
TWX 910-595-1729

If your product requires repair, we prefer that you return it to the factory. Use the original container or a corregated cardboard carton with at least one inch of cushioning material on all sides. Include a description of the problem and a hard copy of the failure mode or system dump when available. Be sure to include your name, address, and telephone number. Ship it to the above address.

4.3.2 Who to Call for Service Outside the United States

If your VMZ/32 does not function properly, contact your local distributor or telex ABLE Computer for the name and address of your local distributor:

TWX 910-595-1729

In Europe, telex our London office at:

Telex 848715 ABLE G

Or, our Haar by Munich office at:

Telex 5213883 ABLE D

CHAPTER 5

How To Use the VMZ/32

[TO BE SUPPLIED]

CHAPTER 6

How to Program the VMZ/32

[TO BE SUPPLIED]

CHAPTER 7

How The VMZ/32 Controller Works

7.1 VMZ/32 CONTROLLER ARCHITECTURE

The VMZ/32 Controller is organized around an 8-bit internal data bus (DB00-DB07). The use of an 8-bit microprocessor and an 8-bit internal data bus holds etch density at a reasonable level, enhancing reliability. Figure 7-1 is a functional block diagram of the VMZ/32.

The 1024-byte buffer and 2901 microprocessor can be either read or written from the internal bus via bidirectional ports. Every other element that interfaces with the bus is limited to either input access or output access. Data can be transferred over the bus from any element having output access to any element having input access.

7.2 UNIBUS DATA INTERFACE

The interface between the internal data bus and the Unibus involves four byte-wide registers.

Words received on the Unibus are loaded into the data-input low-byte and data-input high-byte registers. The two bytes of the word are transferred separately over the internal data bus.

The two bytes of a word to be transferred from the VMZ/32 to the Unibus are written into the data-output low-byte and data-output high-byte registers. These registers are gated simultaneously onto the Unibus during a word transfer request.

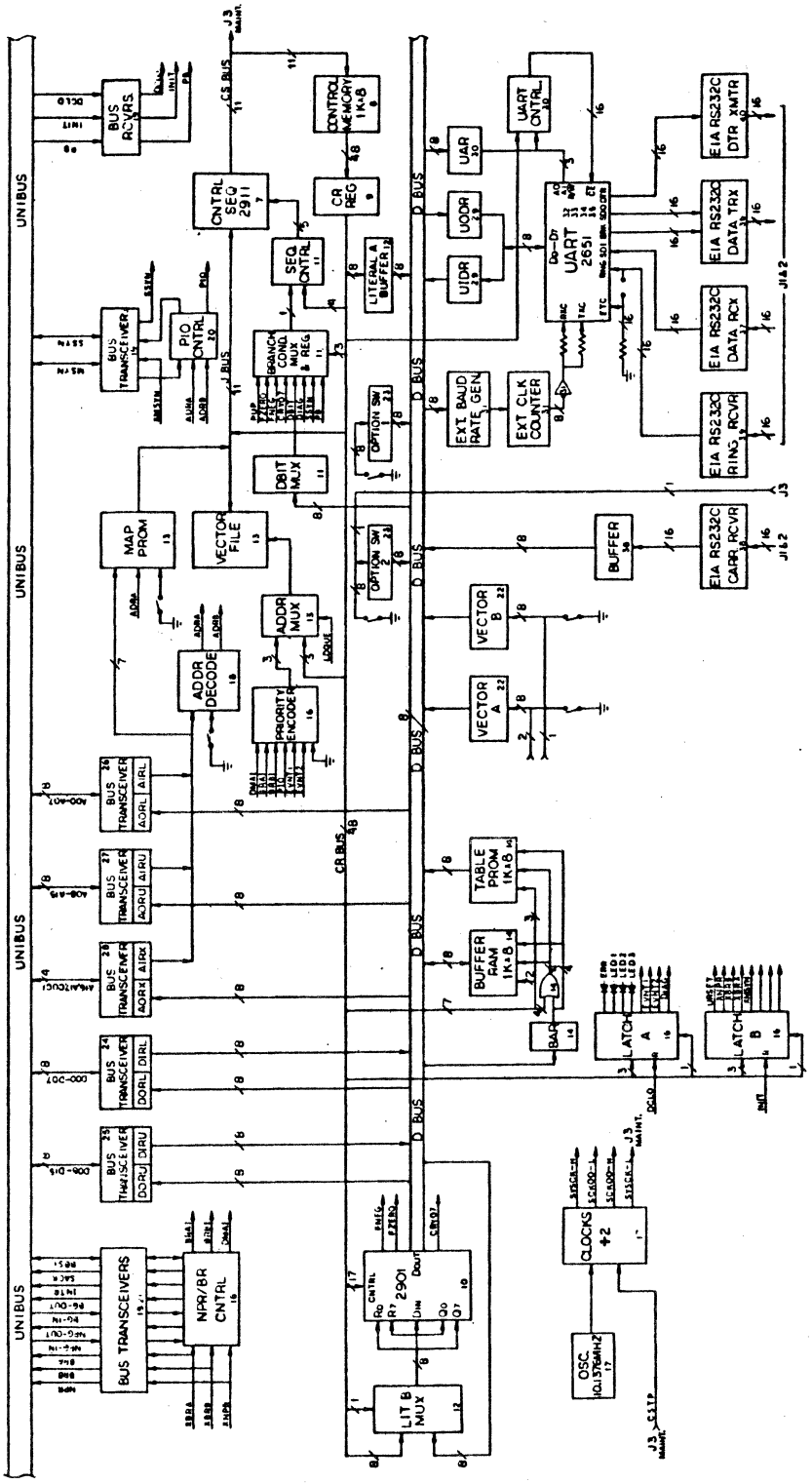

Figure 7-1: VMZ/32 Functional Block Diagram

7.3 ASYNCHRONOUS SERIAL LINE INTERFACES

A Universal Asynchronous Receiver-Transmitter (UART) module is provided for each of the 16 asynchronous serial lines. The UART modules make the conversions between the parallel bytes supplied and accepted by the Unibus and asynchronous serial characters exhibiting the appropriate format. The character format and the receive-transmit rate for each line are controlled by information written into the line parameter register for the line by system software. The line parameter register for each line is maintained in mode registers of the UART module assigned to the line.

Registers in the UART modules are read and written via an 8-bit UART data bus (UB00 through UB07). This bus interfaces with the internal data bus via two registers, one that buffers bytes directed from the internal data bus to a UART and the other that buffers bytes directed from a UART to the internal data bus.

The serial transmit-data outputs from the UART modules are applied to EIA drivers.

Receive-data signals from the 16 lines are accepted by data receivers whose outputs are applied to the UARTs.

In addition to the data signal interfaces with the asynchronous serial lines, the VMZ/32 controls one modem signal Data Terminal Ready (CD), directed to each line and monitors two modem signals Carrier (CF) and Ring (CE), received from each line. The Data Terminal Ready lines are controlled by the DTR bits in the UARTs. The Carrier signals are gated directly onto the internal data bus.

7.4 MICROPROGRAM ARCHITECTURE

The microprogram is divided into routines that service specific events. Each event is assigned a priority. When a service routine is ready to yield control, the event status is evaluated and control is passed to the routine for the highest priority event that is currently pending. The lowest priority is assigned to a default event which, by definition, is always pending. One class of events involves the reading or writing of a device register from the Unibus. In this case, control passes to a routine that services the reading or writing of the particular device register that is being addressed.

7.5 UNIBUS INTERFACE

The Unibus interface contains a set of switches for assigning the variable bits (06 through 10) of the lowest device address for the VMZ/32. This automatically assigns 32 consecutive word addresses to the VMZ/32; the lower 16 addresses apply to the device registers associated with VMZ/32 group 0 and the higher four addresses apply to the device registers associated with VMZ/32 group 1. For example, if the switches are set to assign variable address bit values 00 110 then the device register addresses are octal 760600 through 760636 for group 0 and octal 760640 through 760676 for group 1.

7.6 UNIBUS INTERRUPTS

The VMZ/32 Controller initiates interrupt requests on the Unibus via the bus request interface section of the VMZ/32. The Unibus request interface section implements the protocol required to obtain Unibus mastery. A grant of Unibus mastery appears as an event that causes control to be passed to a servicing routine. This routine places the correct vector in the data output registers and gates it to the Unibus lines.

The vector for a group is assigned by writing into the configuration register for that group.

7.7 BUFFER RAM, TABLE PROM, AND ASSOCIATED ELEMENTS

The 1024-byte buffer RAM can be read and written from the internal data bus. This memory is used to contain the input and output silos, some of the registers accessible from the Unibus, and various registers used by the emulation firmware.

The 1024-byte table PROM can be read from the internal data bus. This table memory is used to perform functions that would otherwise take an excessive number of micro-instructions.

The Buffer Address register, writeable from the internal data bus, is used to address these two memories in conjunction with eight micro-instruction bits in a fixed base, variable offset format.

7.8 UART ADDRESS REGISTER AND ASSOCIATED ELEMENTS

One of the elements that can be written from the internal data bus is the UART address register. During a transaction with a UART, this stored address determines the particular UART selected for the transaction.

7.9 DIAGNOSTIC LIGHT-EMITTING DIODES

When power is applied to the VMZ/32, a diagnostic program is run before the emulation program is entered. Associated with this program are four light-emitting diodes (LEDs) identified by silk-screening as ERR, 1, 2, and 3. At power turn-on, all four of these indicators are turned on by the hardware. As the diagnostic runs, the states of LEDs 1 through 3 change to display binary values indicating different sections of the diagnostic program as these sections are executed. If the diagnostic runs successfully, all four of the LEDs are turned off at the time that the emulation is entered and remain off until another power turn-on. Thus, if the ERR indicator remains lit, a problem is indicated. The number displayed on LEDs 1 through 3 then provides information about the nature of the problem. In general, any error prevents the entrance to the emulation microprogram. This causes the VMZ/32 to not respond to software. Section 3.7 describes a switch setting to override this condition and allow the emulation program to be entered even if a problem is detected. However, if the first section of the diagnostic cannot be completed, the emulation program is not entered. In this case, all four LEDs remain lit.

Since the diagnostic program verifies most internal VMZ/32 functions, successful completion of the diagnostic provides a strong indication that any problem that is encountered arises from some external source such as an installation error.

APPENDIX A

Address Selection with VAX/VMS

To determine the address at which the VMZ32 should be installed, perform the following procedure:

1. Locate the VAX/VMS System Management and Operations Guide and read carefully the sections referring to the Sysgen Utility "CONFIGURE" and "SHOW/CONFIGURATION" commands.

2. Perform a "SHOW/CONFIGURATION" command on the existing system to record the pre-installation Unibus configuration. Refer to Figure A-1 for an example.

```
Username: SYSTEM
Password:
        Welcome to VAX/VMS version V3.0

$ RUN SYS$SYSTEM:SYSGEN
SYSGEN>  SHOW /CONFIGURATION

        System CSR and Vectors on 22-SEP-1982 15:19:15.76

 Name: DMA  Units: 2  Nexus:8  (UBA) CSR: 777440  Vector1: 210  Vector2: 000
 Name: LPA  Units: 1  Nexus:8  (UBA) CSR: 777514  Vector1: 200  Vector2: 000
 Name: MSA  Units: 1  Nexus:8  (UBA) CSR: 772520  Vector1: 224  Vector2: 000
 Name: TTA  Units: 8  Nexus:8  (UBA) CSR: 760100  Vector1: 300  Vector2: 304
 Name: TTB  Units: 8  Nexus:8  (UBA) CSR: 760110  Vector1: 310  Vector2: 314
 Name: TTC  Units: 8  Nexus:8  (UBA) CSR: 760120  Vector1: 320  Vector2: 324
 Name: TTD  Units: 8  Nexus:8  (UBA) CSR: 760130  Vector1: 330  Vector2: 334


SYSGEN>  EXIT
$
```

Figure A-1: Example of Sysgen Utility "SHOW/CONFIGURATION" Command

3. From the result of the previous step, make a list of the existing devices installed on the Unibus to which the VMZ/32 will be added.

4. Perform a "CONFIGURE" command to determine the address at which the Sysgen Utility expects to locate the new device, as shown in Figure A-2.

```
Username: SYSTEM
Password:
        Welcome to VAX/VMS version V3.0

$ RUN SYS$SYSTEM:SYSGEN
SYSGEN>  CONFIG
DEVICE> DZ11,4
DEVICE> DMF32,2
DEVICE> ^Z
Device: DZ11     Name: TTA       CSR: 760100*    Vector: 300*   Support: yes
Device: DZ11     Name: TTB       CSR: 760110*    Vector: 310*   Support: yes
Device: DZ11     Name: TTC       CSR: 760120*    Vector: 320*   Support: yes
Device: DZ11     Name: TTD       CSR: 760130*    Vector: 330*   Support: yes
Device: DMF32    Name: COMB      CSR: 760400*    Vector: 340*   Support: yes
Device: DMF32    Name: COMB      CSR: 760440*    Vector: 400*   Support: yes
SYSGEN>  EXIT
$
```

Figure A-2: Example Sysgen Utility "CONFIGURE" Command

5. If the address displayed for the new device is available in Table 3-1, the VMZ/32 should be set and installed at that address.

6. If the address displayed is not available in Table 3-1, refer to Appendix C for information on non-standard device addressing.

APPENDIX B

Address Selection without VAX/VMS

To determine the address at which the VMZ/32 should be installed, perform the following procedure:

1. If the Unibus already contains a DMF32-type device, calculate the first free Unibus address following the existing unit with the highest address and skip to Step 10 below.

2. Locate the rank of the VMZ/32 in Table B-1.

Rank	Device	Name
1	YJA	DJ11
2	YHA	DH11
3	XQA	DQ11
4	XUA	DU11
5	XWA	DUP11
6	OGA	LK11
7	XMA	DMC11
8	TTA	DZ11, VX/DZ
9	XKA	KMC11
10	OHA	LPP11
11	OIA	VMV21
12	OJA	VMV31
13	OKA	DWR70
14	DLB	RL11 (2nd Device)
15	LAB	LPA11

-Continued on Next Page-

Rank	Device	Name
16	OLA	KW11C
17	RSVA	RSV
18	DYB	RX211
19	XAA	DR11W
20	XBC	DR11B
21	XDA	DMP11
22	ONA	DPV11
23	ISA	ISB11
24	OOA	DMV11
25	UNA	UNA
26	PUB	UDA
27	TXA, XGA, LCA, XIA	DMF32, VMZ/32
28	XSA	KMS11

Table B-1: Device Ranks for Floating Address Assignment

3. Scan backwards through the table and locate the next lower ranked device type that is present on the Unibus to which the VMZ/32 will be added. If no lower ranked device is present, refer to Appendix C for information on non-standard device addressing.

4. Determine the Unibus address of the lower ranked device.

5. Determine the number of bytes of Unibus address space used by the lower ranked device (A DZ11 requires 10 octal bytes).

6. Calculate the first unused Unibus address following the lower ranked device.

7. Add 10 octal to this calculated address.

8. Scan forward in Table B-1 from the lower ranked device, adding 10 octal to the calculated address for each device encountered in the table; stopping after the VMZ/32. (Alternately, subtract the rank of the lower ranked device from 27, convert to octal, multiply by 10 octal, and add the result to the calculated address).

9. Round up the calculated address to a 40 octal boundary (e.g., 760320 to 760340, 760360 to 760400, 760500 to 760500).

10. If the calculated address is available in Table 3-1 (Chapter 3), the VMZ/32 should be set and installed at that address.

11. If the calculated address is not available in Table 3-1, refer to Appendix C for information on non-standard device addressing.

APPENDIX C

Non-Standard Device Addressing

In certain system configurations, it may be necessary to select a non-standard device address for the VMZ/32. Any address contained in Table 3-1 (Chapter 3) which does not interfere with existing Unibus devices may be selected. We recommend addresses beginning at 762000 octal. Non-standard configurations also require that the VMZ/32 interrupt vector addresses be selected. Any address in the range (300-777) which does not interfere with existing Unibus devices may be selected. We recommend addresses beginning at 500 octal. The VMZ/32 requires 10 octal bytes of vector space to contain two interrupt vector pairs. Having selected a device address, the VMZ/32 should be prepared for installation as described in Section 3.6. The selected interrupt vector addresses should be recorded in the system log or other permanent location for use later.

APPENDIX D

VAX/VMS Operational Verification

To verify operation of the VMZ/32 in a VAX/VMS system, perform the following procedure:

1. Perform a Sysgen Utility "AUTOCONFIGURE" command, if this is part of your normal startup procedure, and one has not already been executed as a result of the system boot.

2. If the VMZ/32 was configured at a Unibus address selected by the Sysgen Utility (i.e., one which allows automatic configuration), skip to step 5 below.

3. Examine the device list with the DCL "SHOW DEVICE" command to determine that it remains unchanged, despite the addition of the VMZ/32. If the addition of VMZ/32 has caused some other device to appear offline, disappear from the list, or cease to operate, the non-standard address selected during installation is incorrect or the VMZ/32 address switches are incorrect. Correct this before continuing.

4. Using a text editor, create a Sysgen Utility command procedure to connect the "YCDRIVER" port of the terminal driver to the VMZ/32. Execute this procedure. Refer to Figure D-1 for an example.

```
$ RUN SYS$SYSTEM:SYSGEN
CONNECT TXA0 /ADAPTER=UBO/CSR=%O162014/VECTOR=%O500/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXA1 /ADAPTER=UBO/CSR=%O162014/VECTOR=%O500/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXA2 /ADAPTER=UBO/CSR=%O162014/VECTOR=%O500/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXA3 /ADAPTER=UBO/CSR=%O162014/VECTOR=%O500/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXA4 /ADAPTER=UBO/CSR=%O162014/VECTOR=%O500/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXA5 /ADAPTER=UBO/CSR=%O162014/VECTOR=%O500/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXA6 /ADAPTER=UBO/CSR=%O162014/VECTOR=%O500/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXA7 /ADAPTER=UBO/CSR=%O162014/VECTOR=%O500/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXB0 /ADAPTER=UBO/CSR=%O162054/VECTOR=%O510/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXB1 /ADAPTER=UBO/CSR=%O162054/VECTOR=%O510/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXB2 /ADAPTER=UBO/CSR=%O162054/VECTOR=%O510/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXB3 /ADAPTER=UBO/CSR=%O162054/VECTOR=%O510/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXB4 /ADAPTER=UBO/CSR=%O162054/VECTOR=%O510/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXB5 /ADAPTER=UBO/CSR=%O162054/VECTOR=%O510/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXB6 /ADAPTER=UBO/CSR=%O162054/VECTOR=%O510/NUMVEC=2/DRIVER=YCDRIVER
CONNECT TXB7 /ADAPTER=UBO/CSR=%O162054/VECTOR=%O510/NUMVEC=2/DRIVER=YCDRIVER
EXIT
$ EXIT
$
```

Figure D-1: Example of Sysgen Utility "CONNECT" Commands

NOTE

The Sysgen Utility expects the CSR address to be specified in the format shown, with the leading digit changed from a seven to a one. The address specified is determined by the hardware configuration plus 14 octal.

5. Execute a DCL 'SHOW DEVICE" command as shown in Figure D-2. The VMZ/32 units should be displayed. If their status is offline, the VMZ/32 has been improperly addressed. Correct before continuing.

```
$ SHOW DEVICE TX
  List of Devices                    on      22-SEP-1982 15:22:07.76
  Device    Device      Device          Err.     Volume          Free  Trans Mount
  Name      Status  Characteristics     Count    Label           Blocks Count Count
  TXA0:     on line                     0
  TXA1:     on line                     0
  TXA2:     on line                     0
  TXA3:     on line                     0
  TXA4:     on line                     0
  TXA5:     on line                     0
  TXA6:     on line                     0
  TXA7:     on line                     0
  TXB0:     on line                     0
  TXB1:     on line                     0
  TXB2:     on line                     0
  TXB3:     on line                     0
  TXB4:     on line                     0
  TXB5:     on line                     0
  TXB6:     on line                     0
  TXB7:     on line                     0
$
```

Figure D-2: Example of DCL "SHOW DEVICE" Command Specifying TX

6. As a quick verification of the VMZ/32, cause characters to be transmitted, as shown in Figure D-3. Device offline and device timeout messages here indicate that the VMZ/32 has been improperly addressed. Correct before continuing.

```
$ COPY TT: TXA4:
QWERTYUIOPASDFGHJKL;1234567890ZXCVBNM,
WERTYUIOPDFGHJKLCVBNM,.
^Z
$
$ COPY TT: TXB6:
wertyuiopsdfghjklxcvbnm,.234567890-
rtyuiopdfghjkl;xcvbnm,.234567890
^Z
$
```

Random Characters, Random Lengths

Figure D-3: Quick Verification of VMZ/32 Output Operation

7. If the User Environmental Test Package (UETP) has been maintained on the system and is known to be operational, a more elaborate verification of the VMZ/32 may be performed, as shown in Figure D-4.

```
Username: SYSTEST
Password:
        Welcome to VAX/VMS version V3.0

$ @UETP


        Welcome to VAX/VMS UETP Version V3.0

%UETP-I-ABORTC, UETINIT00 to abort this test, type ^C

You are running on an 11/750 CPU with 2048 pages of memory.
Your system disk is __DMA0:[SYS0.].
Run 'ALL' UETP phases or just 'ONE' [ALL]? ALL
How many passes of UETP do you wish to run [1]? 1
How many simulated user loads do you want [5]? 5
Do you want Long or Short report format [Long]? LONG
UETP starting at 22-SEP-1982 15:28:00.01 with parameters:
ALL phases, 1 pass, 5 loads, long report.


*** NOTE ***
No DECnet software available. No DECnet testing being done.

%UETP-S-BEGIN, UETINIT01 beginning at 22-SEP-1982 15:28:03.25
%UETP-I-ABORTC, UETINIT01 to abort this test, type ^C
%UETP-S-BEGIN, UETDISK00_DMA beginning at 22-SEP-1982 15:28:04.83
%UETP-S-ENDED, UETDISK00_DMA ended at 22-SEP-1982 15:28:06.31
%UETP-W-DENOSU, UETINIT01 device OPA0000 is not supported
%UETP-W-DENOSU, UETINIT01 device MBA0000 is not supported
%UETP-W-DENOSU, UETINIT01 device NLA0000 is not supported
%UETP-S-BEGIN, UETTTYS00_LPA beginning at 22-SEP-1982 15:28:08.87
%UETP-W-ERBOX,
**********************
* Error count =  1 *
**********************
-UETP-W-TEXT, Unable to test LPA00000 because it is spooled.
%UETP-S-ENDED, UETTTYS00_LPA ended at 22-SEP-1982 15:28:09.30
%UETP-S-BEGIN, UETTAPE00_MSA beginning at 22-SEP-1982 15:28:11.98
%UETP-E-ERBOX,
**********************
* Error count =  1 *
**********************
-UETP-E-TEXT, Error while mounting MSA00000 .
-MOUNT-F-MEDOFL, medium is offline
%UETP-E-ENDED, UETTAPE00_MSA ended at 22-SEP-1982 15:28:12.86
```

-Continued on Next Page-

```
%UETP-S-BEGIN, UETTTYS00_TTA beginning at 22-SEP-1982 15:28:15.50
%UETP-S-ENDED, UETTTYS00_TTA ended at 22-SEP-1982 15:28:16.63
%UETP-S-BEGIN, UETTTYS00_TTB beginning at 22-SEP-1982 15:28:23.38
%UETP-S-ENDED, UETTTYS00_TTB ended at 22-SEP-1982 15:28:24.52
%UETP-S-BEGIN, UETTTYS00_TTC beginning at 22-SEP-1982 15:28:26.40
%UETP-S-ENDED, UETTTYS00_TTC ended at 22-SEP-1982 15:28:27.58
%UETP-S-BEGIN, UETTTYS00_TTD beginning at 22-SEP-1982 15:28:29.43
%UETP-S-ENDED, UETTTYS00_TTD ended at 22-SEP-1982 15:28:30.59
%UETP-S-BEGIN, UETTTYS00_TXA beginning at 22-SEP-1982 15:28:32.50
%UETP-S-ENDED, UETTTYS00_TXA ended at 22-SEP-1982 15:28:33.68
%UETP-S-BEGIN, UETTTYS00_TXB beginning at 22-SEP-1982 15:28:35.50
%UETP-S-ENDED, UETTTYS00_TXB ended at 22-SEP-1982 15:28:36.73

 *** Summary of testable and untestable devices. ***

DMA:        testable     0, 1

LPA:        testable     none
            untestable   0

MSA:        testable     none
            untestable   0

TTA:        testable     0, 1, 2, 3, 4, 5, 6, 7

TTB:        testable     0, 1, 2, 3, 4, 5, 6, 7

TTC:        testable     0, 1, 2, 3, 4, 5, 6, 7

TTD:        testable     0, 1, 2, 3, 4, 5, 6, 7

TXA:        testable     0, 1, 2, 3, 4, 5, 6, 7

TXB:        testable     0, 1, 2, 3, 4, 5, 6, 7

%UETP-S-ENDED, UETINIT01 ended at 22-SEP-1982 15:28:40.31
Previous logical name assignment replaced
%UETP-I-BEGIN, UETPDEV00 beginning at 22-SEP-1982 15:28:43.66
%UETP-I-BEGIN, UETDISK00_0000 beginning at 22-SEP-1982 15:28:44.01
%UETP-I-BEGIN, UETTTYS00_0001 beginning at 22-SEP-1982 15:28:44.36
%UETP-I-BEGIN, UETTTYS00_0002 beginning at 22-SEP-1982 15:28:44.83
%UETP-I-BEGIN, UETTTYS00_0003 beginning at 22-SEP-1982 15:28:45.17
%UETP-I-BEGIN, UETTTYS00_0004 beginning at 22-SEP-1982 15:28:45.52
%UETP-I-ENDED, UETDISK00_0000 ended at 22-SEP-1982 15:31:49.49
%UETP-I-BEGIN, UETTTYS00_0005 beginning at 22-SEP-1982 15:31:50.23
%UETP-I-ENDED, UETTTYS00_0002 ended at 22-SEP-1982 15:32:05.86
%UETP-I-BEGIN, UETTTYS00_0006 beginning at 22-SEP-1982 15:32:06.61
%UETP-I-ENDED, UETTTYS00_0001 ended at 22-SEP-1982 15:32:07.59
%UETP-I-ENDED, UETTTYS00_0003 ended at 22-SEP-1982 15:32:12.21
%UETP-I-ENDED, UETTTYS00_0004 ended at 22-SEP-1982 15:32:19.44
%UETP-I-ENDED, UETTTYS00_0005 ended at 22-SEP-1982 15:35:13.07
%UETP-I-ENDED, UETTTYS00_0006 ended at 22-SEP-1982 15:35:30.24
%UETP-I-ENDED, UETPDEV00 ended at 22-SEP-1982 15:35:30.93
```

Figure D-4: Example of Successful UETP Run

8. Test the input capabilities of the VMZ/32 by attaching a properly configured local terminal through a null modem cable.

APPENDIX E

Unibus Priority Strapping

The VMZ/32 is strapped to request the Unibus on the BR5 priority request line. This setting conforms with the setting required by all known system software. Should it become necessary to select another BR-level, the tables below contain the required wiring changes. Corresponding software changes are the responsibility of the user.

Unibus Priority Level 4

From	To
E1	E2
E3	E5
E4	E7
E6	E8
E9	E10
E11	E12
E13	E14
E14	E15

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Unibus Priority Level 5	
From	To
E1	E6
E2	E4
E3	E5
E7	E8
E9	E10
E11	E12
E13	E16
E15	E16

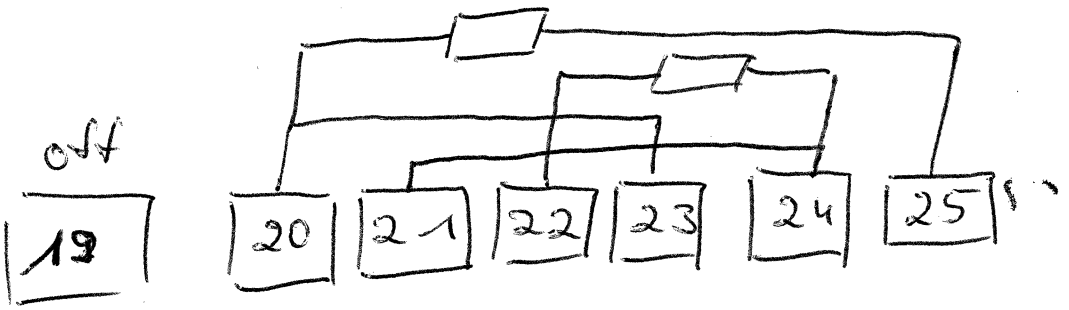
Unibus Priority Level 6	
From	To
E1	E10
E2	E4
E3	E5
E6	E8
E7	E9
E11	E12
E13	E17
E15	E17

Table E-1: Priority Strapping

APPENDIX F

List of Materials

This appendix contains a list of materials that comprise the VMZ/32 module. Vendor names and part numbers are included.



UM2 20mA

20 - 23
20 - R - 25

21 - 24
22 - R - 24

23 - 20

DESCRIPTION	VENDOR PART NO.	ABLE PART NO.	QTY.	REF. DESIGNATION	VENDOR
SCHEM - 16 CH ASYNC. DMA CDM CNTRLR		10103003	REF		
RESISTOR 5% 1/4W 1K	RC07GF102J	310-012-102	6	R1, 2, 3, 10. 11. 15	
RESISTOR 5% 1/4W 220	RC07GF221J	310-012-221	1	R5	
RESISTOR 5% 1/4W 33K	RC07GF333J	310-012-333	6	R4, 6, 7, 8, 12, 13	
RESISTOR 5% 1/4W 4. 7K	RC07GF472J	310-012-472	4	R9, 14, 16, 17	
RESISTOR MODULE, 8 PIN, SIP, 5%, 180	MSP08A01-181J	311-181-002	1	RM9	DALE
RESISTOR MODULE, 8 PIN, SIP, 5%, 470	MSP08A01-471J	311-471-002	2	RM1, 6	DALE
RESISTOR MODULE, 8 PIN, SIP, 5%, 1K	MSP08A01-102J	311-102-002	2	RM15, 25	DALE
RESISTOR MODULE, 8 PIN, SIP, 5%, 33K	MSP08A01-333J	311-333-002	6	RM5, 7, 1C, 16, 22, 23	DALE
RESISTOR MODULE, 8 PIN, SIP, 5%, 4. 7K	MSP08A01-472J	311-472-002	8	RM2, 3, 4, 14, 18, 19, 24, 28	DALE
RESISTOR MODULE, 8 PIN, SIP, 5%, 4. 7K	MSP08A03-472J	311-472-003	8	RM11, 12, 13, 17, 20, 21, 26, 27	DALE
RESISTOR MODULE, 8 PIN, SIP, 5%, 180/390	764-5-R180/390	312-121-002	1	RM8	BECKMAN
CAPACITOR, SILVER MICA, 5%, HV, 200PF	CD15FD201J03	320-029-201	1	C40	CORNELL
CAPACITOR, SILVER MICA, 5%, HV, 47DPF	CD15FD471J03	320-029-471	2	C41, 46	CORNELL
CAPACITOR, CERAMIC, AXIAL, 10%, 50V .01MF	CK12BX103K	322-226-103	35	C7-39, 42, 43	CORNING
CAPACITOR, TANTALUM, 20%, 20V, 4. 7MF	CCM-020-475-20	322-244-475	8	C1-6, 44, 45	CORNING
CAPACITOR MODULE 8 PIN SIP 470PF	460CH471X9PD	321-637-471	2	CM1, 2	SPRAUGE
OPTICS LED QUAD	555-4003	331-204-001	1	CR1	DIALIGHT
DIODE ZENER 3. 3V 1W	IN4728A	341-303-302	2	CR2, 3	FAIRCHILD
I. C. -INTERFACE QUAD DRIVER	1488	345-001-488	8	U88, 95, 101, 108, 114, 122, 126, 134	MOTOROLA
I. C. -INTERFACE QUAD RECEIVER	1489	345-001-489	12	U58, 64, 76, 77, 82, 83, 98, 111, 121, 125, 133, 137	MOTOROLA
I. C. -INTERFACE QUAD RECEIVER O. C.	8640	345-008-640	1	U74	NATIONAL
I. C. -INTERFACE QUAD BUS XCEIVER O. C.	8641	345-008-641	3	U9, 63, 68	NATIONAL
I. C. -INTERFACE QUAD BUS XCEIVER W/LOGIC	2908	345-029-008	10	U32, 33, 39, 45, 51, 81, 87, 94, 97, 120	AMD
INTERFACE OCTAL INVTR/LINE DRVR 3ST.	74LS240	345-274-240	7	U52, 70, 100, 110, 112, 124, 132	T. I.
INTERFACE OCTAL BUFF. /LINE DRVR 3ST.	74LS244	345-274-244	1	U18	T. I
RAM 64X4 O. C.	74S189	347-174-189	2	U24, 28	T. I
RAM 4K 1024X4 TRI-ST.	2148	347-421-480	2	U34, 40	INTEL
HEX INVERTER	7404	349-074-004	1	U80	T. I.
QUAD 2 IN NAND BUFFER O. C.	7438	349-079-038	2	U69, 75	T. I.
8 TO 3 PRIORITY ENCODER	74148	349-074-148	1	U48	T. I
QUAD 2 IN NAND	74S00	349-174-000	3	U62, 71, 73	T. I.
HEX INVERTER	74S04	349-174-004	2	U60, 67	T. I.
QUAD 2 IN AND	74S08	349-174-008	2	U43, 78	T. I.
TRIPLE 3 IN NAND	74S10	349-174-010	2	U49, 55	T. I.
TRIPLE 3 IN AND	74S11	349-174-011	1	U61	T. I.
QUAD 2 IN OR	74S32	349-174-032	1	U29	T. I.
DUAL D FLIP FLOP	74S74	349-174-074	2	U93, 96	T. I.
I. C. -QUAD 2 IN XOR	74S86	349-174-086	1	U65	T. I.
I. C. -DUAL J-K FLIP FLOP	74S112	349-174-112	1	U109	T. I.
13 INPUT NAND	74S133	349-174-133	1	U57	T. I.
3 TO 8 DECODER	74S138	349-174-138	3	U26, 31, 106	T. I.
DUAL 2 TO 4 DECODER	74S139	349-174-139	2	U37, 59	T. I.

Continued on Next Page

3 TO 8 DECODER	74LS138	349-274-138	2	U84,85	T.I
8 TO 1 MUX	74S151	349-174-151	1	V30	T.I.
QUAD 2 TO 1 MUX	74S157	349-174-157	2	U25,46	T.I.
HEX D FLIP FLOP	74S174	349-174-174	1	U42	T.I
QUAD 2 TO 1 MUX	74LS157	349-274-157	2	V20,21	T.I
MICROPROCESSOR	2901B	349-229-001	2	U22,23	AMD
MICROPROGRAM SEQUENCER	2911	349-229-011	3	U1,12,13	AMD
DUAL D FLIP FLOP	74LS74	349-274-074	1	U72	T.I.
8 BIT ADDRESSABLE LATCH	74LS259	349-274-259	2	U47,53	T.I.
8 BIT LATCH TRISTATE	74LS373	349-274-373	1	U79	T.I.
OCTAL D FLIP FLOP TRI-STATE	74LS374	349-274-374	8	U10,11,14,15,17,19, 119,123	T.I.
OCTAL D FLIP FLOP W/ENABLE	74LS377	349-274-377	5	U35,36,66,86,131	T.I.
4 BIT SYNC COUNTER	74LS161	349-274-161	2	U135,138	T.I.
USART	2651	349-402-651	16	U89-92,102-105,115-118, 127-130	SIGNETICS
8 TO 1 MUX	74LS151	349-274-151	1	U16	
8 BIT COMPARATOR	25LS2521	349-252-521	2	U38,44	AMD
OSCILLATOR, 10.1376Mhz	K1114A	391-013-771	1	U99	MOTOROLA
SOCKET PIN PC MOUNT	LSG-1AG2-1	570-400-101	4	(U99)	AUGAT
SWITCH 8 POS DIP	76SB08	412-081-101	4	S1,2,5,6	GRAYHILL
SWITCH 10 POS DIP	76SB10	412-101-101	2	S3,4	GRAYHILL
SOCKET IC 20 PIN	520-AG-11D	575-402-001	2	(U27,54)	AUGAT
SOCKET IC 24 PIN	524-AG-11D	575-402-401	7	(U2-4,6-8,41)	AUGAT
HANDLE PC EXTRACTOR, LEFT	111-10-1	630-100-004	1		CALMARK
HANDLE PC EXTRACTOR, RIGHT	111-10-2	630-100-005	1		CALMARK

T.I. = Texas Instruments, AMD = Advanced Micro Devices

Table F-1: List of Materials