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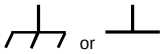
Safety Symbols



Instruction manual symbol affixed to product. Indicates that the user must refer to the manual for specific WARNING or CAUTION information to avoid personal injury or damage to the product.



Indicates the field wiring terminal that must be connected to earth ground before operating the equipment—protects against electrical shock in case of fault.



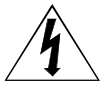
Frame or chassis ground terminal—typically connects to the equipment's metal frame.



Alternating current (AC).



Direct current (DC).



Indicates hazardous voltages.

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Product Name: VXIbus Extender

Model Number: HP E1482B

Product Options: All

conforms to the following Product Specifications:

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CSA C22.2 #1010.1 (1992)
UL 1244

EMC: CISPR 11:1990/EN55011 (1991): Group 1 Class A
IEC 801-2:1991/EN50082-1 (1992): 4 kVCD, 8 kVAD
IEC 801-3:1984/EN50082-1 (1992): 3 V/m
IEC 801-4:1988/EN50082-1 (1992): 1 kV Power Line
0.5 kV Signal Lines

Supplementary Information: The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (inclusive 93/68/EEC) and carries the "CE" marking accordingly.

Tested in a typical configuration in a C-size VXI mainframe.



February 15, 1995 **Jim White, QA Manager**

European contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department HQ-TRE, Herrenberger Straße 130, D-71034 Böblingen, Germany (FAX +49-7031-143143).

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About This Manual

Manual Content

This manual contains information on the applications of the HP E1482B VXI-MXI Bus Extender Module. It is part of a manual set that includes the C-Size VXIbus Systems "Installation and Getting Started Guide" and various plug-in module user's manuals.

Chapter 1: Product Overview — This chapter contains a functional, electrical, and physical description of the HP E1482B VXI-MXI Bus Extender Module

Chapter 2: Configuring/Installing the VXI-MXI Module — This chapter provides configuring and installation information for installing your VXI-MXI modules in C-size mainframes. It provides the system set-up procedure for a default system configuration including the address windows.

Chapter 3: Switch/Jumper Configuration Reference — This chapter provides reference information you can use to change the default configuration settings of the VXI-MXI module. Switches and jumpers discussed in this chapter do not need to be changed to set up a working system. They can be changed to meet special requirements of your test system.

Chapter 4: Theory of Operation — This chapter discusses the major elements of the VXI-MXI in detail.

Appendix A: Specifications — This appendix contains a list of the VXI-MXI Bus Extender Module's operating specifications.

Appendix B: Error Messages — This appendix lists the error messages associated with the Command Module and their possible causes.

Appendix C: Register Definitions — This appendix contains a detailed description of the operational characteristics and programming requirements for the VXI-MXI Bus Extender Module's registers.

Appendix D: INTX/MXI Connector Pinouts — This appendix contains the pinouts for the INTX and MXI connectors for reference purposes only.

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Chapter 1

Product Overview

About this Chapter

This chapter describes the VXI-MXI features, lists the contents of your VXI-MXI kit, and explains how to unpack the VXI-MXI kit.

- VXI-MXI Functional Description 13
- Features 16
- VMEbus Support Signals 17
- VXI-MXI Physical Description 17

VXI-MXI Functional Description

The VXI-MXI is a C-size extended class VXIbus extender device that interfaces the VXIbus to the MXIbus. The VXI-MXI interface module uses address mapping to transparently translate bus cycles on the VXIbus system bus (VMEbus) to the MXIbus and vice versa.

In simplest terms, the VXI-MXI can be thought of as a bus translator that converts VXIbus signals into appropriate MXIbus signals. Expressed in MXIbus terminology, the VXI-MXI implements a MXIbus interface to communicate with other MXIbus devices. Expressed in VMEbus terminology, the VXI-MXI is an interface to the outside world.

A functional block diagram of the VXI-MXI is shown in Figure 1-1. The major components of the VXI-MXI are discussed in greater detail in Chapter 4, "Theory of Operation."

The VXI-MXI is an extended class register-based VXIbus device with optional Slot 0 capability so that it can reside in any slot in a C-size or D-size VXIbus chassis. The VXI-MXI converts` A32, A24, A16, D32, D16, and D08(EO) VXIbus cycles into MXIbus cycles and vice versa. The VXI-MXI has four address windows that map into and out of the VXIbus mainframe. These four windows represent the three VMEbus address spaces (A32, A24, and A16) plus a dedicated window for mapping the VXIbus configuration space (the upper 16 kilobytes of A16 space).

The MXIbus is a multidrop system bus that connects multiple devices at the hardware bus level in a software-transparent manner. Multiple VXIbus mainframes with VXI-MXI interfaces can be connected to form a single multiframe VXIbus system.

Multiple MXIbus devices are tightly coupled by mapping together portions of each device’s address space and interlocking the internal hardware bus cycles across the MXIbus. The window address circuitry on each MXIbus device monitors internal local bus cycles to detect bus cycles that map across the MXIbus. Similarly, external MXIbus cycles are monitored to detect MXIbus cycles that map into the VXIbus system. MXIbus devices can operate in parallel at full speed over their local system bus and need to synchronize operation with another device only when addressing or being addressed by a resource located on another MXIbus device. The

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MXIbus device originating the transaction must gain ownership of the MXIbus and of the local bus in the target MXIbus device. All hardware bus cycles are then interlocked across the MXIbus and local buses to complete the transfer.

The VXI-MXI INTX daughter card contains three registers which reside in the VXI-MXI Configuration Space. The INTX Interrupt Configuration Register, the INTX Trigger Configuration Register, and the INTX Reset Configuration Register configure the mapping of the VMEbus interrupt lines, the VXIbus trigger lines, and the SYSRESET, SYSFAIL, and ACFAIL lines to and from the INTX connector.

The interrupt logic maps the VMEbus interrupt lines to and from the corresponding INTX interrupt lines. In conjunction with the VXI-MXI circuitry, the interrupt requests routed between VXIbus mainframes through the INTX connector can be transparently serviced by interrupt handlers in VXIbus mainframes other than the mainframe from which the request was generated. This process takes advantage of transparent MXIbus interrupt acknowledge cycles.

When an interrupt request received from across the INTX is driven on the corresponding VMEbus interrupt line, and an interrupt handler in the receiving VXIbus mainframe generates an interrupt acknowledge cycle for that interrupt request, the interrupt acknowledge cycle is transparently converted to a MXIbus interrupt acknowledge cycle for that interrupt request level. Similarly, when a VMEbus interrupt line is driven out of the VXIbus mainframe across the INTX connection, an interrupt handler in another VXIbus mainframe can generate an interrupt acknowledge cycle to handle that interrupt. The VXI-MXI in the requesting mainframe will recognize that the MXIbus interrupt acknowledge cycle is for the request it is driving, and will convert the cycle into a VMEbus interrupt acknowledge cycle which can service the VMEbus interrupt request.

The trigger control logic maps the VXIbus trigger lines to and from the corresponding INTX trigger lines. When mapping high speed trigger signals across the INTX connection, total cable length in the connection should be limited to 12 meters.

The system reset control circuitry maps the VMEbus signals SYSRESET, SYSFAIL, and ACFAIL to the corresponding signals on the INTX connection.

The CLK10 Control circuitry routs the VMEbus 10MHz signal to and from the INTX connection. The configuration of the CLK10 mapping is controlled by three switches on the INTX daughter card. In order to maintain the 10MHz signal, the INTX CLK10 signal must be limited to a total of 12 meters of cable.

The INTX connector is a shielded 44-pin connector. Cables can be connected point-to-point or daisy-chained between devices.

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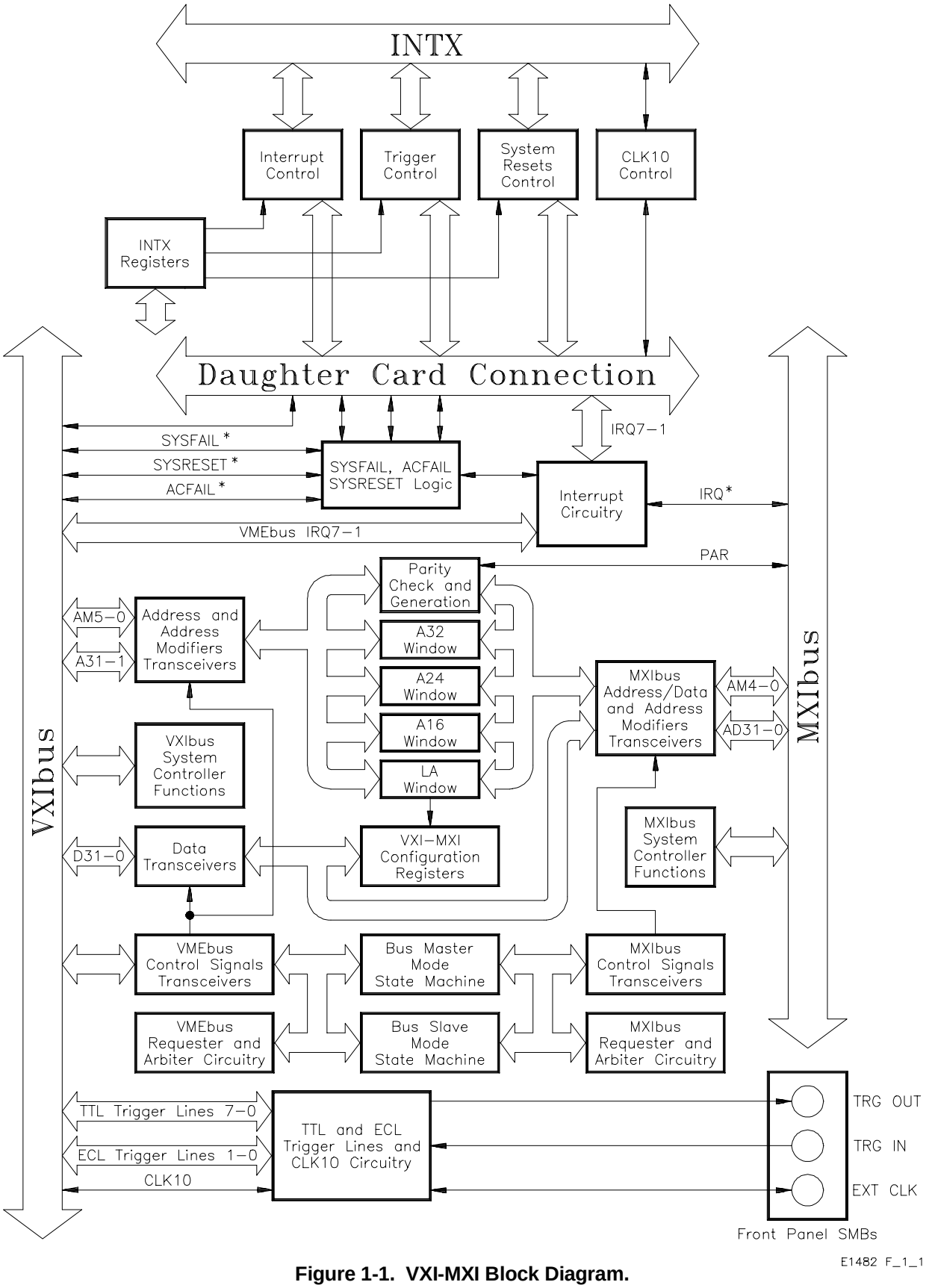


Figure 1-1. VXI-MXI Block Diagram.

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The interrupt and reset signals are extended with standard MXIbus tranceivers. These tranceivers are open collector devices that generate precise trapezoidal waveforms with typical risetimes of nine nanoseconds. The trapezoidal shape reduces crosstalk between adjacent signals. The receivers have built-in low pass filters to remove noise, and a high speed comparator that recognizes the trapezoidal shaped signal from noise. MXIbus specifies a maximum of 8 devices on one link with total cable lengths up to 20 meters and data rates up to 20Mbytes/sec.

The high speed signals are extended by the INTX daughter card with RS-485 tranceivers. RS-485 is differential and permits data rates up to 10Mbaud at distances up to 12 meters. It is also multi-point, meaning that there can be multiple (up to 32) drivers and receivers on a signal line.

Features

The VXI-MXI has the following features:

- Interfaces the VXIbus to the MXIbus (32-bit Multisystem Extension Interface bus)
- Extends VXIbus to multiple mainframes, external MXIbus-equipped instruments, and external MXIbus-equipped personal computers (PCs)
- Multiple VXIbus mainframes appear as a single VXIbus system
- Integrated block mode for high-performance data transfers
- Supports dynamic configuration of VXIbus devices
- Interlocked bus operation for prevention of deadlock conditions
- Daughter-card connector scheme gives additional functionality
- Fully compatible with VXIbus and MXIbus specifications
- No restrictions on Commander/Servant hierarchy or physical location of devices.
- Extends the seven VMEbus IRQ interrupts with MXIbus (trapezoidal) tranceivers.
- Extends the VMEbus signals SYSRESET, SYSFAIL, and ACFAIL with MXIbus tranceivers.
- Extends the eight VXIbus trigger lines with RS-485 tranceivers.
- Extends the VXIbus CLK10 signal with RS-485 tranceivers.
- Supports transparent interrupt acknowledge cycles for interrupt lines driven and received across the INTX connection.

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VMEbus Support Signals

The VXI-MXI generates all the support signals required by the VMEbus:

- VMEbus controller functions:
  - 16-MHz system clock driver
  - VME bus timeout (BTO)
  - Data transfer bus arbiter (PRI ARBITER)
  - Interrupt acknowledge daisy-chain driver
  - Pushbutton system reset switch
- VMEbus master capabilities:
  - Access to A16, A24, and A32 address space
  - D8(EO), D16, and D32 accesses
  - Release-on-Request bus requester (jumper-selectable arbitration level)
- VMEbus slave accesses:
  - A16, A24, and A32 address space
  - D8(EO), D16, and D32 accesses
- VXIbus Slot 0 functions:
  - 10-MHz clock
  - MODID register
  - TTL and ECL Trigger line support

VXI-MXI Physical Description

The VXI-MXI occupies one C-Size mainframe slot. The module's faceplate has annunciators, clock and trigger connectors and interface ports which are described below and illustrated in Figure 1-2.

Faceplate Annunciator

There are three annunciators on the VXI-MXI faceplate which indicate the following:

- *FAILED* LED indicates that the VMEbus SYSFAIL line is asserted.
- *VME ACCESS* LED indicates when the VXI-MXI is accessed from the VXIbus.
- *MXI ACCESS* LED indicates when the VXI-MXI is accessed from the MXIbus.

MXIbus Connector

This connector lets you connect the MXI-VXI to another MXI-VXI in your system.

INTX Connector

This connector lets you connect the expanded interrupt functions of the MXI-VXI to another MXI-VXI in your system.

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SMB connectors

The three SMB Connectors provide trigger input and output, and external clock input and output as required. The external clock SMB connector is configurable for either input or output.

- External clock input or output (configurable)
- Trigger output
- Trigger input

System Reset Button

The *System Reset* button lets you return the MXI-VXI to its power-on state.

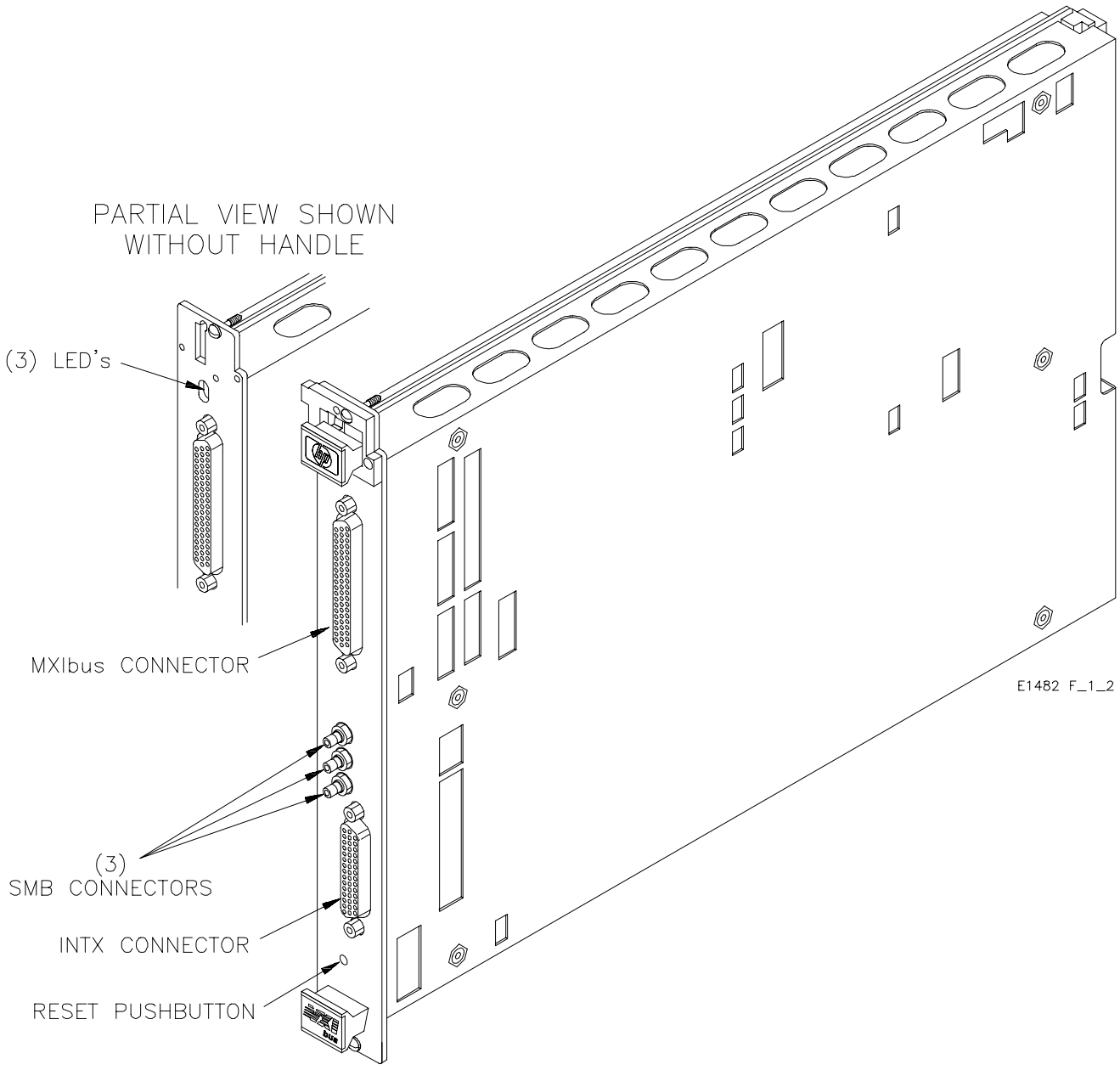


Figure 1-2. VXI-MXI Faceplate Layout.

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Chapter 2

Configuring/Installing the VXI-MXI Module

About this Chapter

This chapter describes the configuration and installation of VXI-MXI modules. The module is shipped from the factory configured for installation in slot 0 of an extender mainframe. You must reconfigure the VXI-MXI module used in the root mainframe.

Initial Installation Tasks

Before installing the VXI-MXI in the VXIbus mainframe, the following items must be configured properly:

- **VXIbus Slot 0** (switches S1 and S8 must be set correctly for each module or damage can result - see Steps 1 and 2 of the installation procedure).
- **MXIbus and INTX Terminating Networks** (you must remove these if the module is in the middle of the MXIbus daisy chain - see Step 3).
- **VXIbus Logical Address** (factory setting on each module is logical address 1; you must set all VXI-MXI module addresses and other VXI module addresses in the system correctly - see Step 4).

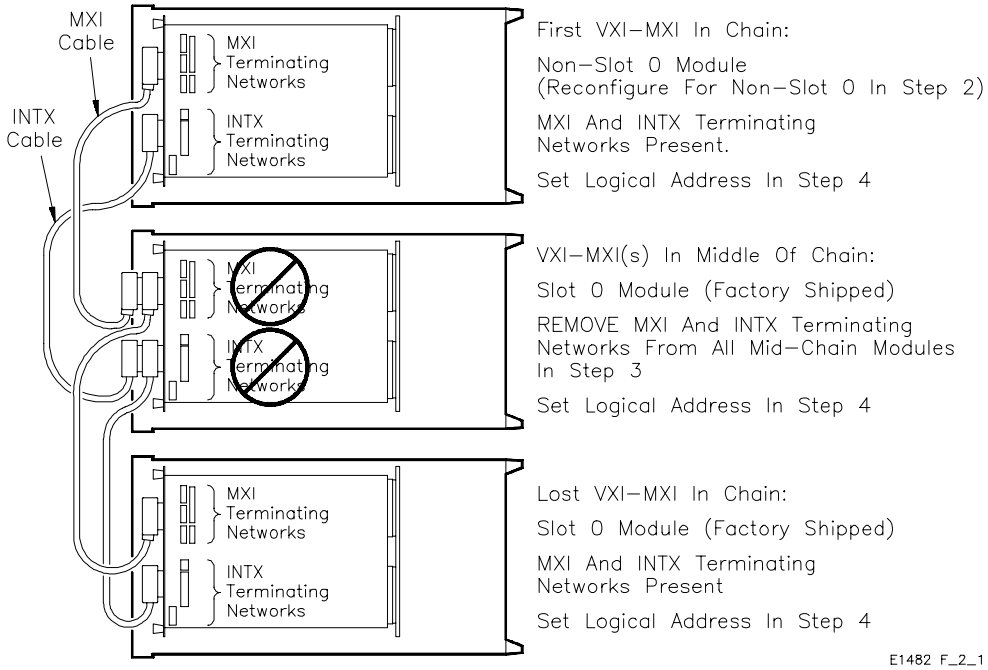


Figure 2-1. Initial Installation Tasks.

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NOTE: Advanced Configuration

There are many configuration switches and jumpers that we do not recommend you change until you have verified system operation using the factory default settings. The purpose for this is to establish the address windows properly for all mainframes and to verify that the resource manager can configure the system before too many configuration changes are made. You can troubleshoot from the verified default configuration should you encounter operational problems after reconfiguring any of the following items.

Refer to Chapter 3 for additional configuration information. In most cases, these items do not need to be changed from their factory default settings.

- VMEbus Request Level (jumpers W1, W2, W3, W4, and W5)
- VMEbus Timeout Level (jumper W8)
- VMEbus Timeout Chain Position (jumper W7)
- Interlocked Arbitration (slide switch S3)
- MXIbus System Controller (slide switch S4)
- MXIbus System Controller Timeout Level (jumper W6)
- MXIbus Fairness (slide switch S2)
- CLK10 Source (jumpers W9 and W10 - accessible through the connector edge of the VXI-MXI module)
- CLK10 Mapping (slide switches W1, W2, and W3 on the daughter board)
- EXT CLK SMB Input/Output (slide switch S6)
- Trigger Input Termination (slide switch S5)
- Front Panel Pushbutton System Reset (slide switch S7)

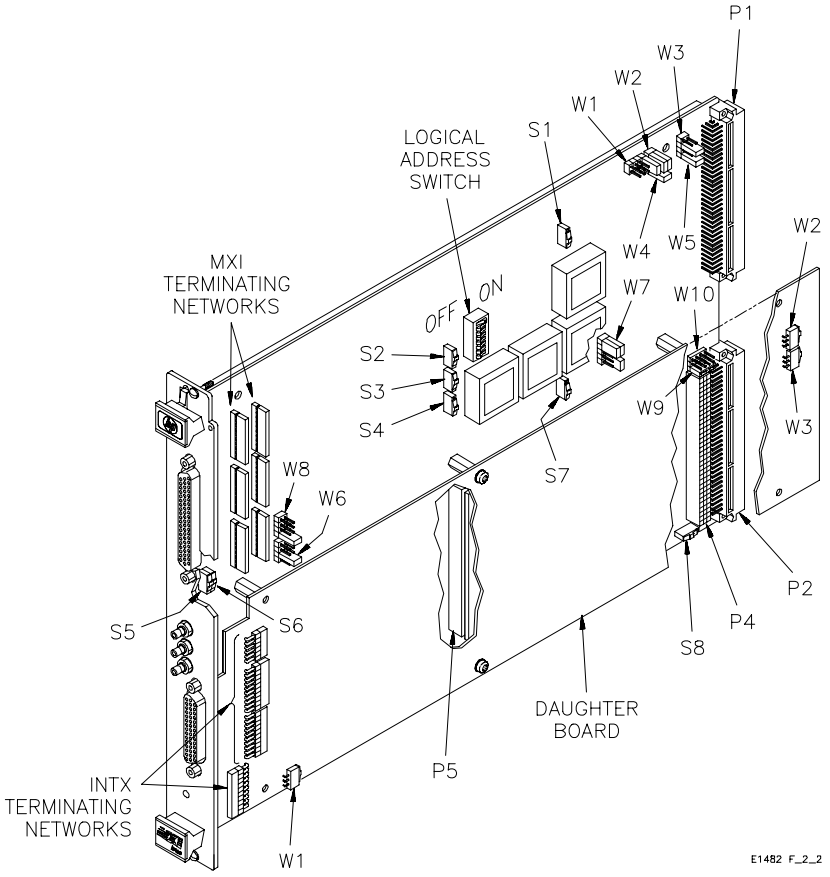


Figure 2-2. VXI-MXI Parts Locator Diagram.

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CAUTION

The VXI-MXI is shipped from the factory configured to be installed into Slot 0 of your VXIbus mainframe. Installing your VXI-MXI into any slot other than Slot 0 without reconfiguring the VXI-MXI for non-slot 0 (switches S1 and S8) can damage the VXI-MXI, the VXIbus backplane, or both. See Figure 2-6 for S1 and S8 non-slot 0 switch settings.

Multiframe System Design

Before you begin configuring the VXI-MXI modules, you must determine what your multiframe system will look like. With this informtion you know which VXI-MXI modules are slot 0 modules and which module is non-slot 0 and you can begin configuration. Figure 2-3 illustrates a VXI-MXI system using a command module as resource manager.

NOTE

Hewlett-Packard does not recommend using more than one level of extensions below the root level because of the complexity of multi-level VXI-MXI installation and the decrease in system performance in a multi-level system.

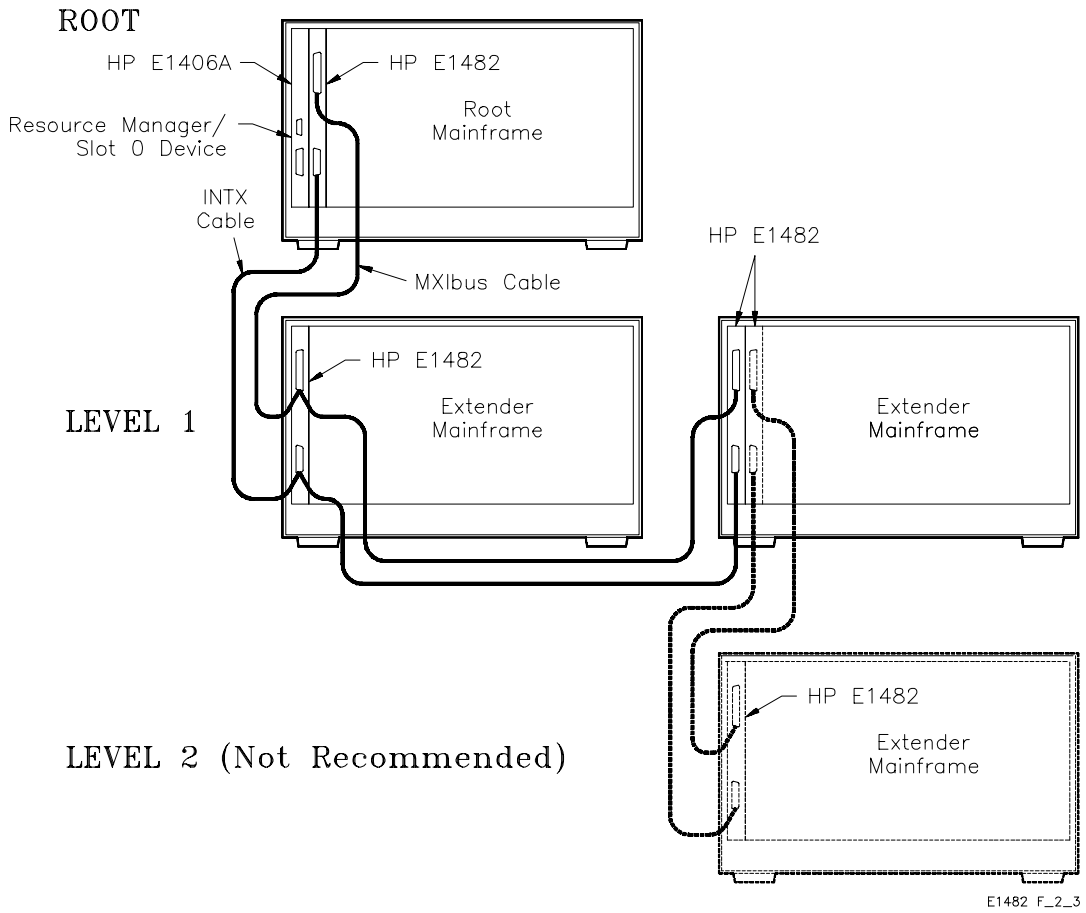


Figure 2-3. VXI-MXI System with VXIbus Multiframe RM.

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Factory Default Configuration Settings

Table 2-1 shows switch settings on the VXI-MXI Module for operation when the resource manager is in another mainframe (Extender Mainframe column - these are default settings shipped from the factory - see Figure 2-4). The table also shows (shaded) what switches/jumpers to change to configure the module for a mainframe where there is an embedded controller or a slot 0 Command Module provided as resource manager (Root Mainframe columns - see Figure 2-5). Also shaded in the extender mainframe column is a note reminding you to remove all MXIbus and INTX terminating resistor networks for mid-frame modules in a system that is three mainframes or larger.

Table 2-1. VXI-MXI Module Configuration Settings.

	Extender Mainframe (Factory Default Settings) NOTE: VXI-MXI Module is Configured for an Extender Mainframe from the factory. (VXI-MXI in slot 0)		**Root Mainframe Resource Manager: a) E1405B/1406A Cmd Module in slot 0 (see Figures 2-9 and 2-16) b) V/382 Embedded Controller in slots 0 and 1 (see Figure 2-13) (Non-Slot 0 VXI-MXI)**		**Root Mainframe Resource Manager: HP RADI-EPC7 Embedded Controller in slots 1 and 2 (see Figure 2-15) (VXI-MXI in slot 0)**	
Switch or Jumper	**Figure**	**Description**	**Figure**	**Description**	**Figure**	**Description**
Switches S1, S8 (VXIbus Slot 0)	2-6a	Slot 0	2-6b	Non-slot 0	2-6a	Slot 0
MXIbus Terminating Networks	2-1 & 2-7	All Networks Installed (in first and last VXI-MXI modules in the daisy chain)	2-1 & 2-7	MXIbus Networks Installed	2-1 & 2-7	MXIbus Networks Installed
and INTX Terminating Networks		NOTE: Remove all MXI and INTX networks from mid-frame modules (see Step 3).	2-1 & 2-7	INTX Networks Installed	2-1 & 2-7	INTX Networks Installed
Jumpers W1, W2, W3, W4, W5 (VMEbus Request Level)	3-1a	Level 3 requester				
Jumper W6 (VME BTO Level)	3-2a	VME timeout =100µsec	3-2b	VME timeout 200µsec	3-2b	VME timeout =200µsec
Jumper W7 (VME BTO Chain Position)	3-3a	1 extender, slot 0	3-3b	1 extender, non-slot 0	3-3a	1 extender, slot 0
Switch S3 (Interlocked Arbitration)	3-6b	Interlocked				
Switch S4 (MXIbus System Controller)	3-7a	Not MXI bus controller	3-7b	MXI bus controller	3-7b	MXI bus controller
Jumper W8 (MXI Controller Timeout Level)	3-8d	MXI bus timeout disabled	3-8a	MXI bus timeout 100µsec	3-8a	MXI bus timeout 100µsec
Switch S2 (MXIbus Fairness)	3-9a	Fairness enabled				
Jumpers W9, W10 (CLK10 Source)	3-10a	On-board 10MHz VXI-MXI installed in slot 0	3-10c	Do not source CLK10	3-10a	On-board 10MHz VXI-MXI installed in slot 0
Switches W1, W2, W3 (CLK10 Mapping)	3-11a	CLK10 mapping disabled				
Switch S6 (Ext Clk SMB)	3-12a	Output external clock				
Switch S5 (Trigger Input Termination)	3-13a	Trigger 50Ω terminated				
Switch S7 (Front Panel Pushbutton)	3-14a	SYSRESET* asserted				

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STEP 1. Set up all Extender Mainframe VXI-MXI Modules.

For extender (remote) mainframe VXI-MXI modules (slot 0 modules), leave the default switch and jumper settings as shipped by the factory (except for setting the logical address which is described later). After verifying MXIbus operation you can change settings from the default to match your system requirements (more on this later).

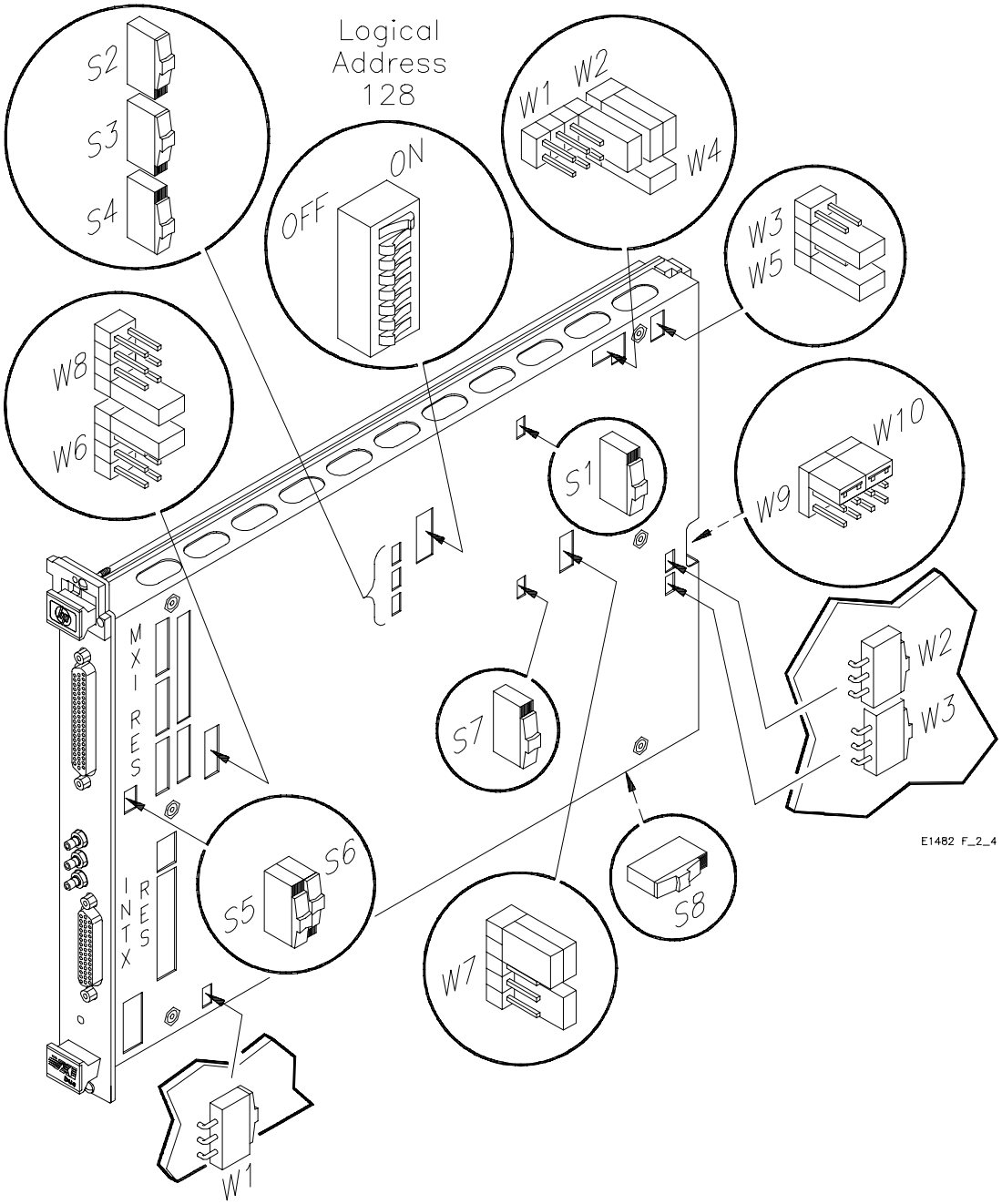


Figure 2-4. Extender VXI-MXI Settings (DEFAULT).

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Step 2. Set up the Root Mainframe VXI-MXI Module.

The " Root" mainframe has the resource manager in slot 0 (exceptions are if you are using the EPC-7 embedded controller or an external controller with an EISA-MXI card - see Step 4 Quick Set-Up figures). Change only the shaded switches/jumpers to configure the VXI-MXI Module to be used in the root mainframe (non-slot 0). You must change switches S1 and S8 to configure for non-slot 0 use or damage can occur. The following section provides more information on slot 0 and non-slot 0 modules.

NOTE: If you are using an external controller (e.g. Series 700 workstation or PC with an EISA-MXI card), all VXI-MXI modules are set up for extender mainframes (see Step 4 External Controller Quick Set-Up figures for 2-frame and 3-frame systems). Set up all VXI-MXI modules as described in Step 1.

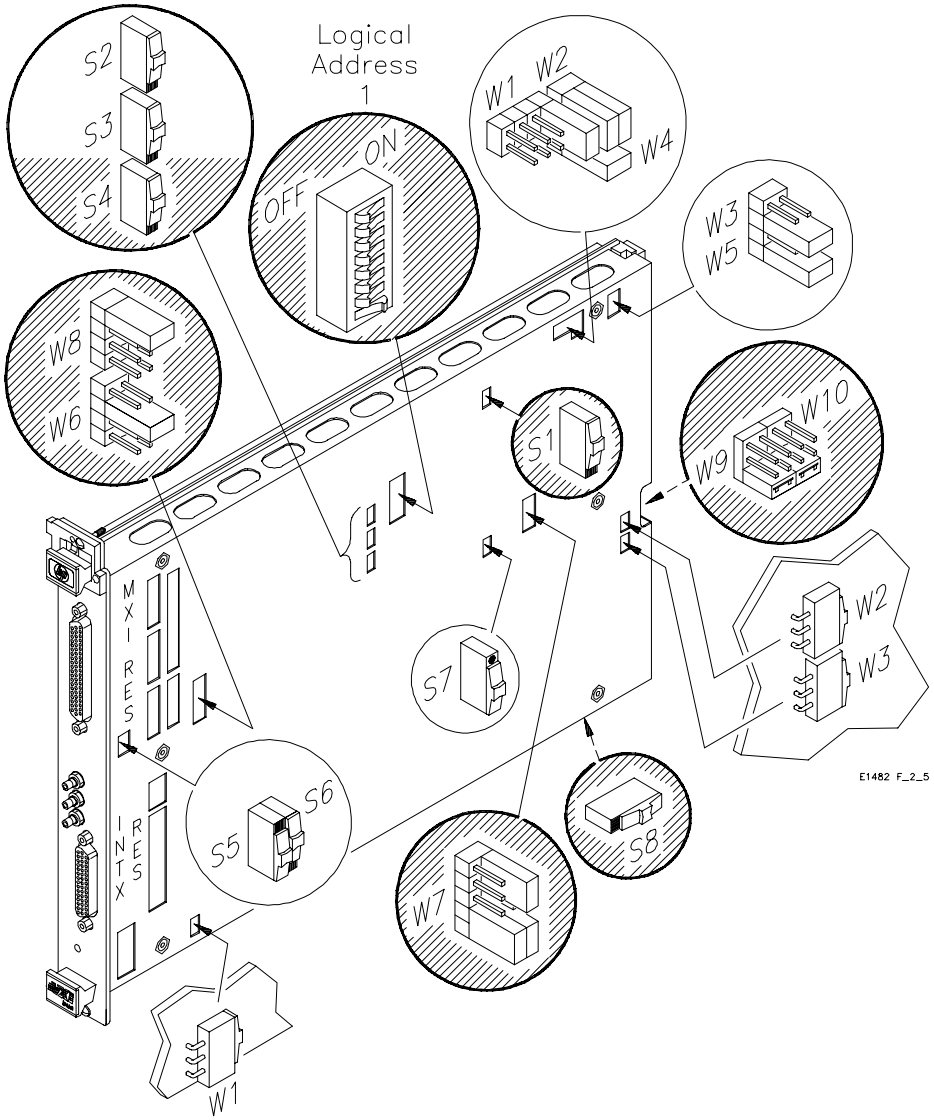


Figure 2-5. Root (Local) VXI-MXI Settings.

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CAUTION **Do not install a module configured for Slot 0 into another slot without reconfiguring it for Non-Slot 0 use (e.g. Local mainframe). Doing so can result in damage to the module, the VXIbus backplane, or both.**

VXIbus Slot 0

The VXI-MXI is shipped from the factory configured to be installed in Slot 0 of a VXIbus extender mainframe. If another module is already in Slot 0, you must decide which module will be the Slot 0 device and reconfigure the other module for Non-Slot 0 use.

It is recommended you use the interlocked arbitration bus mode for both slot 0 and non-slot 0 VXI-MXI modules. Refer to the *Interlocked Arbitration Mode* section in Chapter 3 for a description of the optional normal bus mode. Figure -6(a) shows the default configuration settings for the VXI-MXI installed as the Slot 0 device. To configure the VXI-MXI as a Non-Slot 0 device, change slide switches S1 and S8 as depicted in Figure 2-6(b).

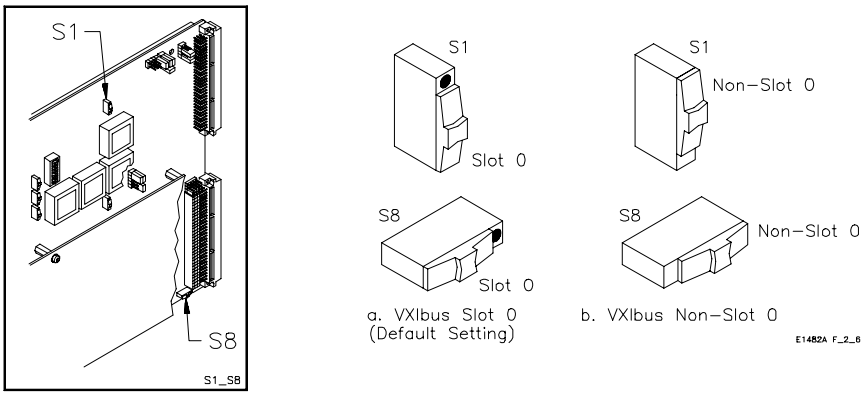


Figure 2-6. VXIbus Slot 0 Selection

When the VXI-MXI is installed in Slot 0, it becomes the VMEbus System Controller, meaning that it has VMEbus Data Transfer Bus Arbiter capability (PRI ARBITER) and that it drives the 16-MHz VMEbus system clock. The VMEbus Data Transfer Bus Arbiter circuitry accepts bus requests on all four VMEbus request levels, prioritizes the requests, and grants the bus to the highest priority requester. The VMEbus system clock is driven by an onboard 16-MHz oscillator with a 50%±5% duty cycle.

The VXIbus specification defines several additional functions for devices installed in the Slot 0 position. A Slot 0 device must implement a 16-bit MODID register to control and monitor the VXIbus MODID lines. Slot 0 cards must also have 16.9 k pull-up resistors on each VXIbus MODID line. If the card is not in Slot 0, the MODID0 line on that card must be pulled down to ground with a 825 Ω resistor.

The VXIbus Resource Manager (RM) can identify whether the VXI-MXI is located in Slot 0 by reading the VXIbus Model Code in the Device Type Register. If the VXIbus Model Code for the VXI-MXI is hex 0FE, the module is in Slot 0; if the code is hex 8FE, the module is not in Slot 0.

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Step 3. Remove MXI and INTX Terminating Networks from modules in the middle of the MXIbus daisy chain.

For systems with more than two mainframes, remove the MXI and INTX terminating networks from the module(s) that will be installed in the middle mainframe(s) of the daisy chain.

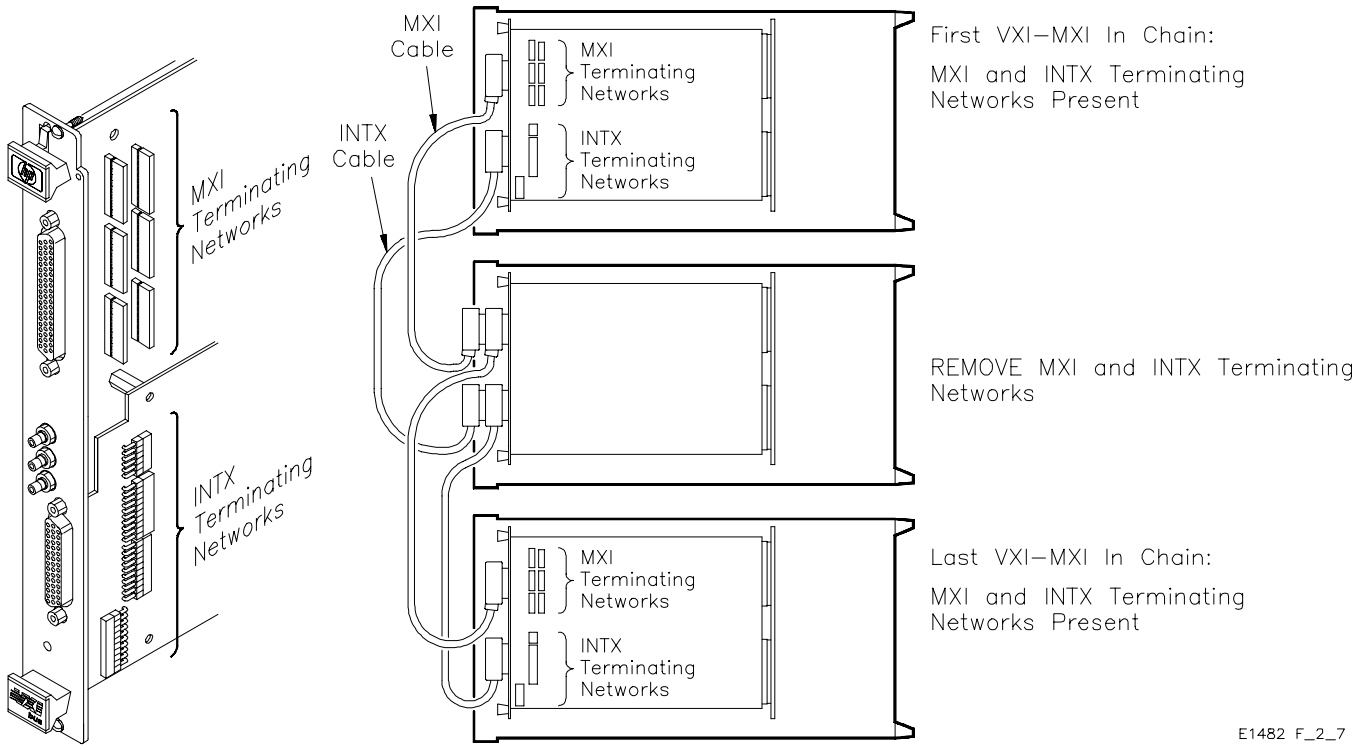


Figure 2-7. MXIbus and INTX Daisy Chain

MXIbus Terminating Resistor Networks

The MXIbus is a matched impedance bus and requires termination networks at the first and last device in the MXIbus daisy-chain. These internal plug-in resistor packages minimize reflections caused by impedance discontinuities at the ends of the cables and therefore, are located at the MXIbus connectors.

The VXI-MXI is shipped from the factory with terminating SIP resistor networks installed. If the VXI-MXI will be the first or last device in the MXIbus daisy-chain, you should leave these internal terminators in place. If the VXI-MXI is not going to be an end device, remove the terminating resistor networks from their sockets and store them in a safe place in case the MXIbus system changes. All six MXIbus networks must be either installed or removed.

INTX Terminating Resistor Networks

Like the MXIbus, the INTX cables have matched impedance and require termination networks at the first and last devices in the INTX chain. These terminations minimize the reflections caused by impedance discontinuities at the ends of the cable. The INTX daughter board comes with terminating resistors installed. If the daughter board is not going to be an end device, remove the terminating resistor networks and store them with the MXI networks.

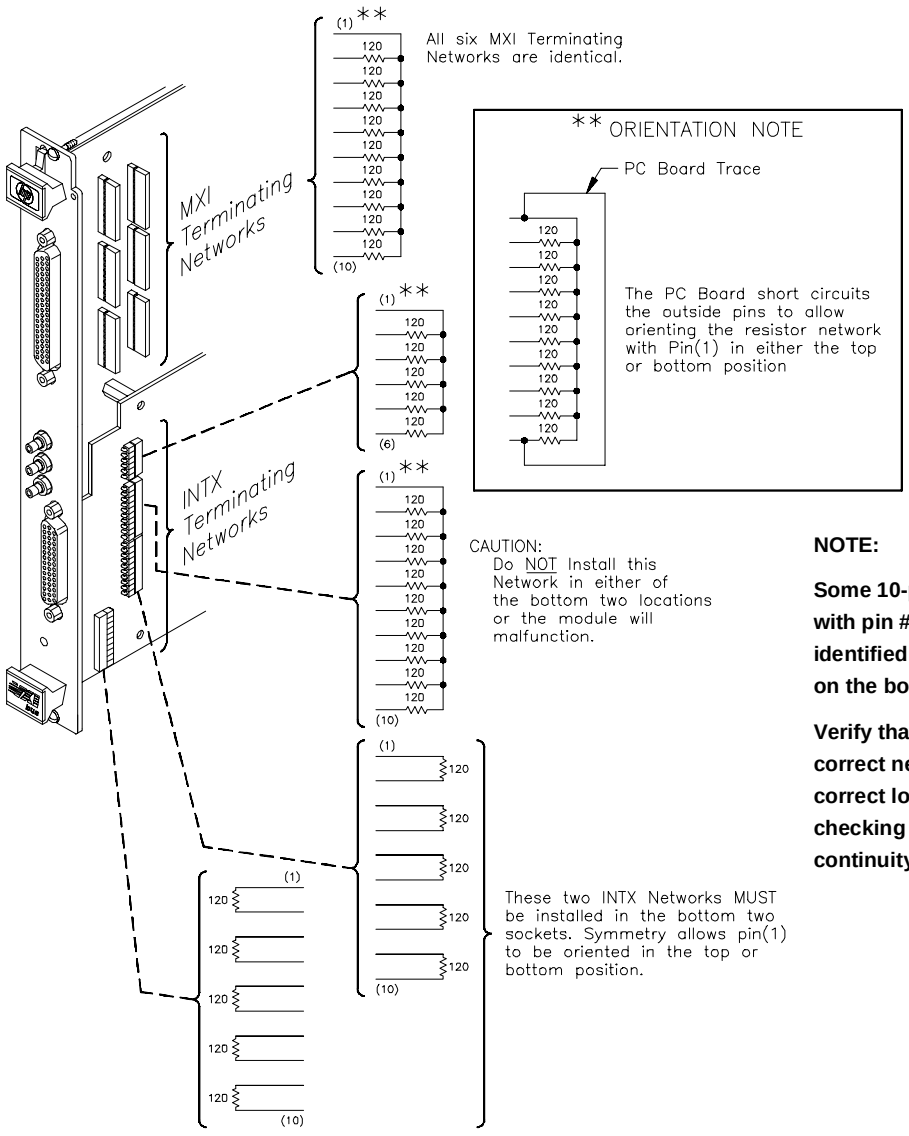
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Installing MXI and INTX Terminating Networks.

MXIbus and INTX Terminating Networks are shipped installed. They are removed if required by Step 3. Use this information to install the networks correctly and assure proper module operation.

NOTE

MXI and INTX Terminating Networks must be installed in their correct locations for thre modfule to operate properly. Pin #1 orientation is not critical (see (ORIENTATION NOTE) but location is.



NOTE:

Some 10-pin INTX networks with pin #1 common may be identified by a black stripe on the body.

Verify that you have the correct networks in the correct location by checking the resistor continuity before installing.

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Step 4. Set the addresses for the VXI-MXI Modules, the Resource Manager and other modules of your system.

You must set addresses that allow the resource manager to configure the system according the VXI rules. This step contains QUICK START sections that show you how to address 2-frame and 3-frame systems. These sections are divided into examples that show setups for systems using a command module, an embedded controller (both an HP E1499 V/382 and an HP RADI-EPC7) and external controllers with MXIbus modules.

VXIbus Logical Address

Each device in a VXIbus/MXIbus system is assigned a unique number between 0 and 255. This 8-bit number, called the *logical address*, defines the base address for the configuration registers located on the device. With unique logical addresses, each VXIbus device in the system is assigned 64 bytes of configuration space in the upper 16 kilobytes of A16 space.

Some VXIbus devices have dynamically configurable logical addresses. These devices have an initial logical address of 255, which indicates that they can be dynamically configured. While the VXI-MXI does support dynamic configuration of VXIbus devices within its mainframe, it cannot itself be dynamically configured. Therefore, do not set the logical address for the VXI-MXI to 255.

The VXIbus RM has Logical Address 0 by definition. The VXI-MXI does not have VXIbus RM capability, so do not set the logical address for the VXI-MXI to 0. See the following section "Getting Started With MXIbus Addressing" for configuring addresses for a multiple mainframe VXIbus/MXIbus system.

An 8-bit DIP switch at position U46 selects the logical address for the VXI-MXI. Refer to Figure 2-2 to find the location of this DIP switch. The metal enclosure surrounding the VXI-MXI has a cut-out for this switch, so you do not need to remove the metal enclosure to change this switch setting. The ON position on the DIP switch corresponds to a logic value of 0, and the OFF position corresponds to a logic value of 1. This switch is set at the factory to a default logical address of 128. Verify that the logical address assigned to the VXI-MXI is not used by any other statically configured VXIbus device in your system. Remember that logical addresses 0 and 255 are not allowed for the VXI-MXI. Figure 2-8 shows switch settings for logical address decimal 1 and 192 (hex 1 and hex C0).

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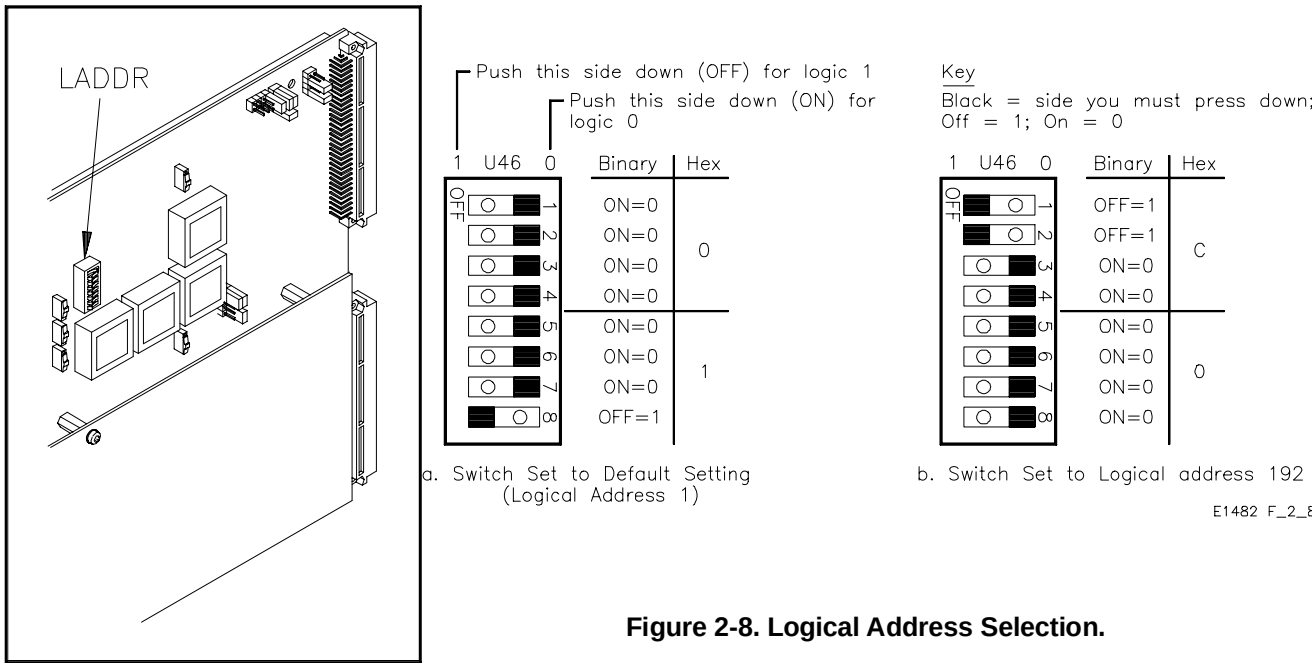


Figure 2-8. Logical Address Selection.

Getting Started With MXIbus Addressing

NOTE

You must structure your system and set the addresses such that the system resource manager (RM) can configure the address window according to VXI rules. If you set addresses that violate VXI rules, the RM cannot configure the system. It is the user's responsiblilty to set addresses that comply with VXI rules. Addressing rules are discussed in this chapter following the Quick Set-Up sections.

Before you begin setting the logical addresses of the devices in your VXIbus/MXIbus system, you must determine the tree configuration of your system. The basic configuration for a MXIbus multiframe system is shown in Figure 2-3. The location of the multiframe RM constitutes the root of the system tree. MXIbus links connected to the root mainframe form level 1 of the tree.

A second VXI-MXI module in a level 1 mainframe with a MXIbus link connected to another mainframe forms level 2. Hewlett-Packard does not recommend using more than one level of extensions below the root level because of the complexity of multi-level VXI-MXI installation and the decrease in system performance in a multi-level system.

Addressing VXI Modules

C-SCPI Users (with register-based drivers): You can set VXI modules to any address when using an embedded controller (e.g. HP V/382 or HP RADI-EPC7) or an external controller with a MXI interface (e.g. HP series 700 workstationwith E1489I MXIbus). They are able to recognize a module as an instrument regardless of its address.

HP-IB Users: A system using an HP-IB controller and an HP E1405/E1406 Command Module as the resource manager requires instrument identifier addresses (address divisible by 8). The command module identifies instruments when it encounters an address divisible by 8. You should set an instrument to addresses that are boundaries of 8 when the HP E1405 or E1406 is used as the resource manager.

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Quick Set-Up Address Examples: 2-Frame and 3-Frame VXI-MXI Systems

There are a number of rules that govern the definition of address windows. If you are using two or three mainframes, this section provides information that will help you set up the address windows for most 2-frame or 3-frame VXI-MXIbus systems without having to learn all the rules and how they apply. You may want to review the reference information describing these rules at the back of this chapter to understand why the addresses are set as they are.

Quick Set-Up For 2-Frame Systems

This section provides information on setting up a basic 2-frame VXI-MXI system. Table 2-2 and Figure 2-24 illustrate the boudaries allowed for address windows. Allocate the address range 0 - 127 to the root mainframe (i.e. set addresses for modules in the root mainframe to addresses in this range). Allocate the address range 128 - 255 to the extended mainframe.

Command Module (HP E1405B or E1406A) Installation and Use in a 2-Frame System.

NOTE

A system using a command module as the resource manager identifies instruments by an instrument identifier address. Instrument identifier addresses are those divisible by 8 and must be used if you are using an HP E1405 or E1406 Command Module as the resource manager.

- **ROOT MAINFRAME:** Set the VXI-MXI module to address 2. Set other VXI modules in the root mainframe to addresses below 128. Note: The resource manager must be at address 0.
- **EXTENDED MAINFRAME:** Set the VXI-MXI module address to address 128.

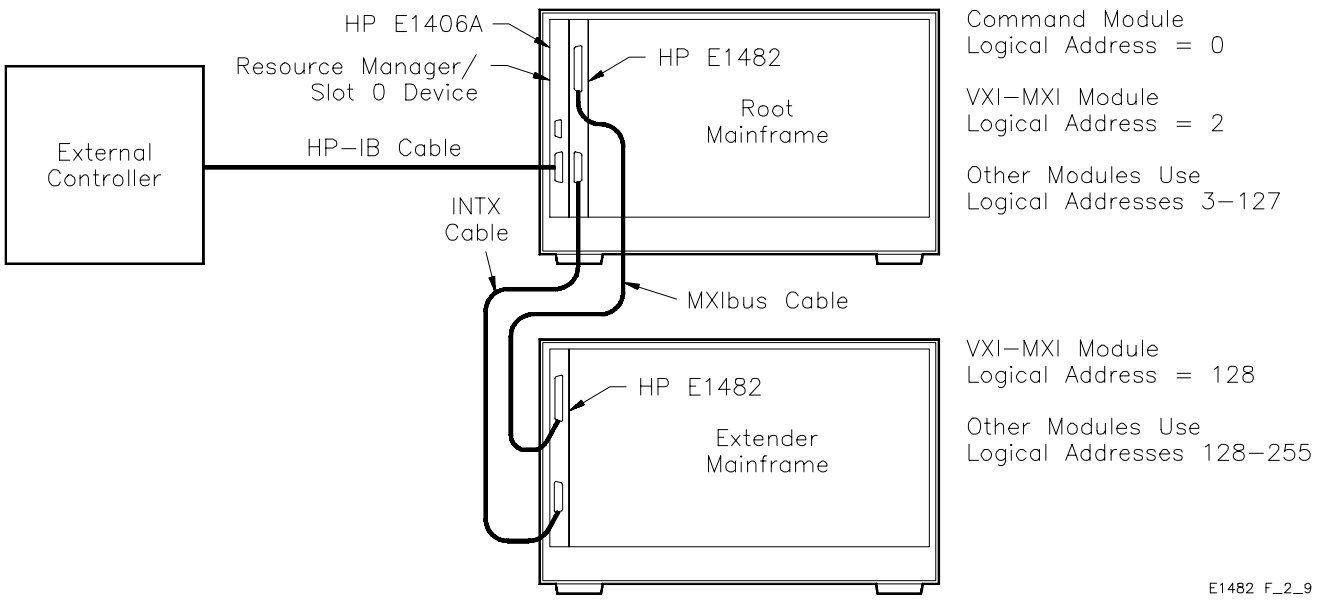


Figure 2-9. Command Module System, 2-Frame.

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External Controller (Workstation or PC) Installation and Use in a 2-Frame System.

For systems using an EXTERNAL controller (e.g. workstation or PC) in place of a command module, set the VXI-MXI module that interfaces to the workstation/computer to logical address 1 (the workstation/computer must be at logical address 0). This is illustrated in the 1-frame connection to the EISA-MXI card in Figure 2-10.

- A 2-frame system using an external controller is illustrated in the lower part of Figure 2-10. This system splits the addresses into two parts. For the root mainframe, the workstation or PC is at logical address 0, the VXI-MXI module is at logical address 1. All other modules in the root mainframe use logical addresses 64 to 127.
- The VXI-MXI module in the extended mainframe is at logical address 128; all other modules in the extended mainframe use logical addresses 129 to 255. The NOTE on the following page also applies to external controllers.

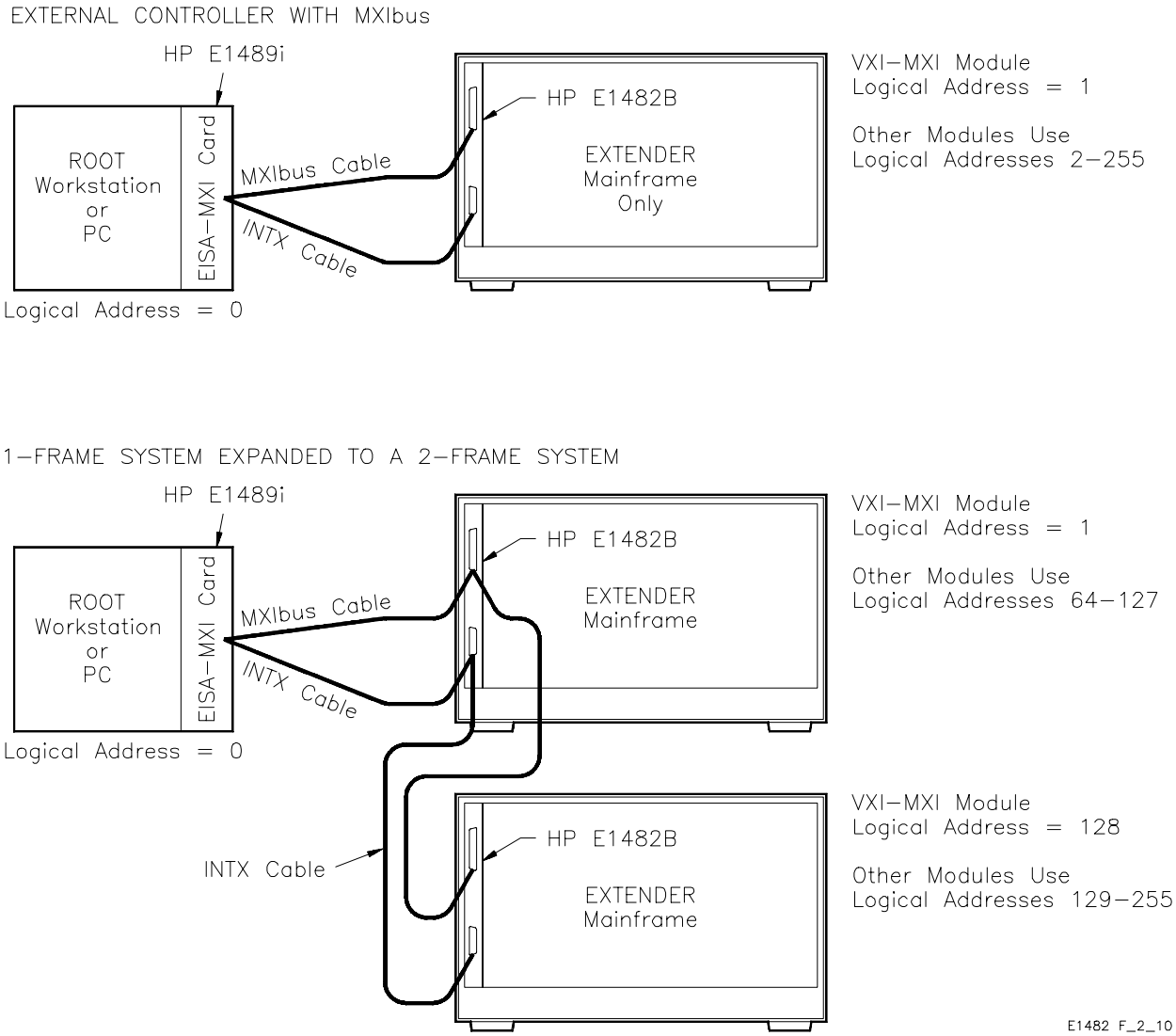


Figure 2-10. External Controller System, 2-Frame.

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The following shows a 1-frame MXIbus system connected to a Series 700 workstation. This diagram depicts the system shown in the top of figure 2-10.

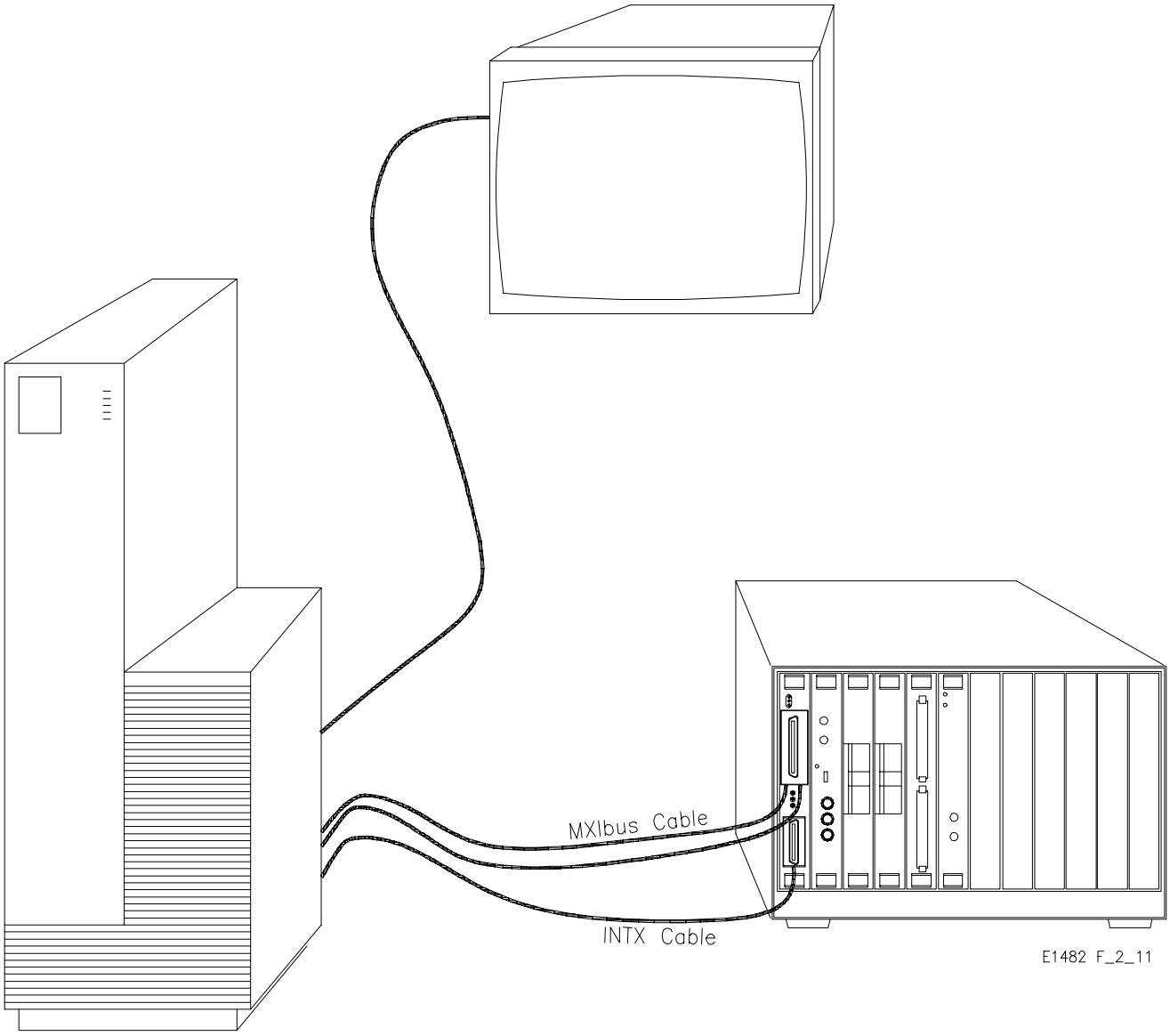


Figure 2-11. Series 700 Workstation/MXI Installation.

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Embedded Controller HP E1499A (V/382) Installation and Use in a 2-Frame System.

For systems using an HP E1499A (V/382) EMBEDDED controller as the resource manager in place of an HP E1405/E1406 Command Module, the root mainframe is the same as shown in Figure 2-9 except you replace the HP E1406 Command Module with the embedded controller (the embedded controller may require two slots). The embedded controller becomes the slot 0 device and system controller (at address 0) and the address windows can be divided as shown in Figure 2-12. This illustration shows an HP E1499 embedded computer and the addresses the modules are set to for MXIbus operation. The next page shows a pictorial of this installation.

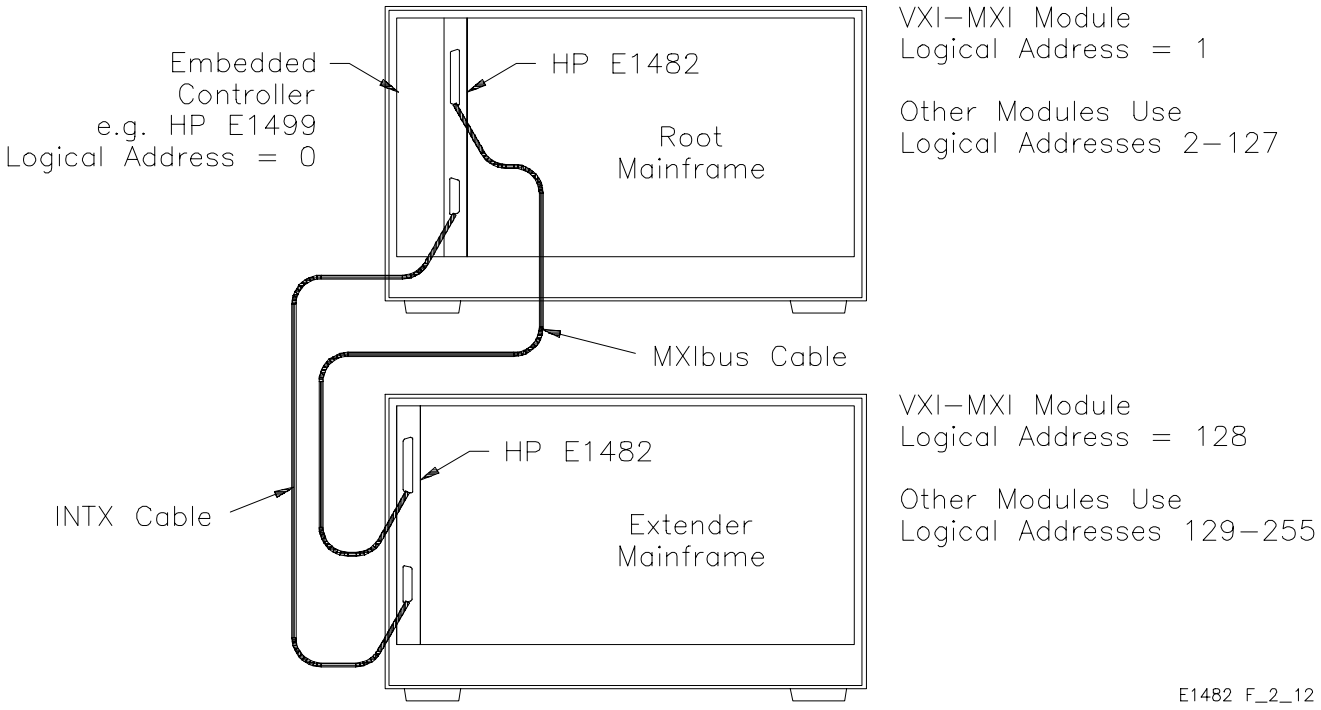


Figure 2-12. Embedded Controller System, 2-Frame.

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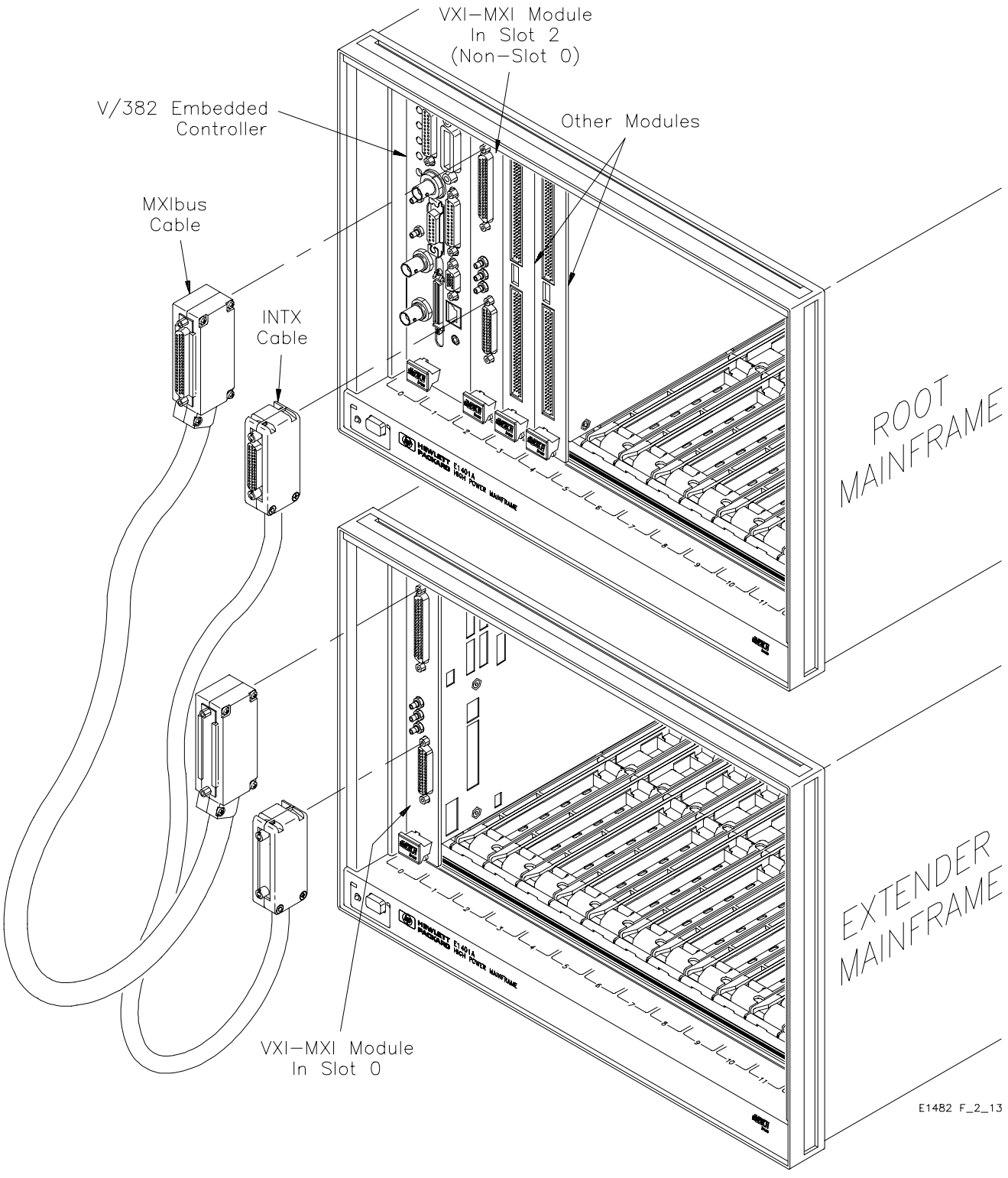


Figure 2-13. Installation of the V/382.

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Embedded Controller (HP RADI-EPC7) Installation and Use in a 2-Frame System.

For systems using an HP RADI-EPC7 EMBEDDED controller as the resource manager in place of an HP E1405/E1406 Command Module, the root mainframe differs from Figure 2-9. You replace the HP E1406 Command Module with the embedded controller (the embedded controller requires two slots) but you must install the VXI-MXI module in slot 0 which becomes the slot 0 device at address 1. The system controller (at address 0) is the EPC7. The address windows can be divided as shown in Figure 2-14. This illustration shows an HP RADI-EPC7 embedded computer and the addresses the modules are set to for MXIbus operation. The next page shows a pictorial of this installation.

NOTE The EPC7 Start Up Resource Manager does not allow statically configured devices to be located at address 255. Therefore, a MXI window with the EPC7 cannot include address 255 and should use 191 as its largest address (see below).

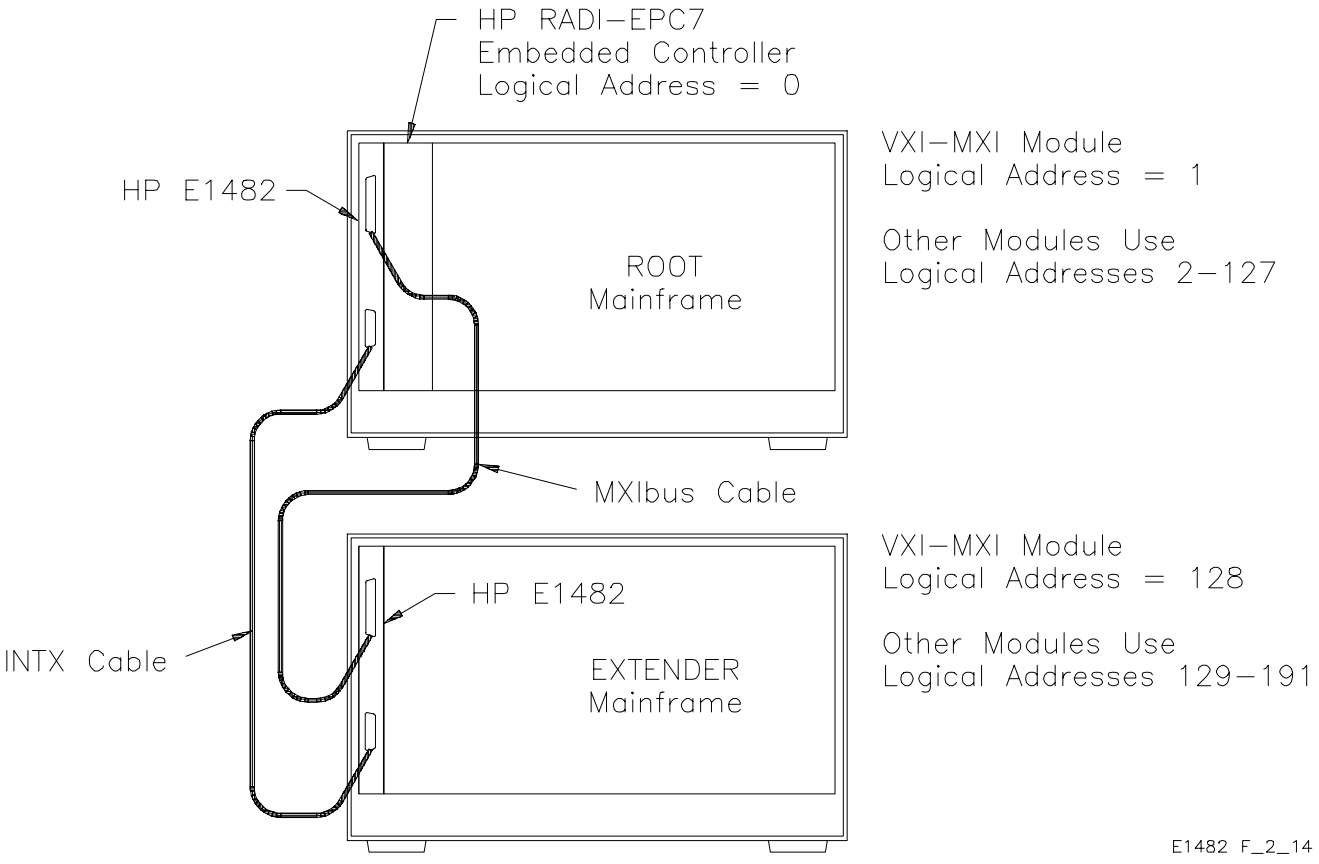


Figure 2-14. Embedded (EPC7) System, 2-Frame.

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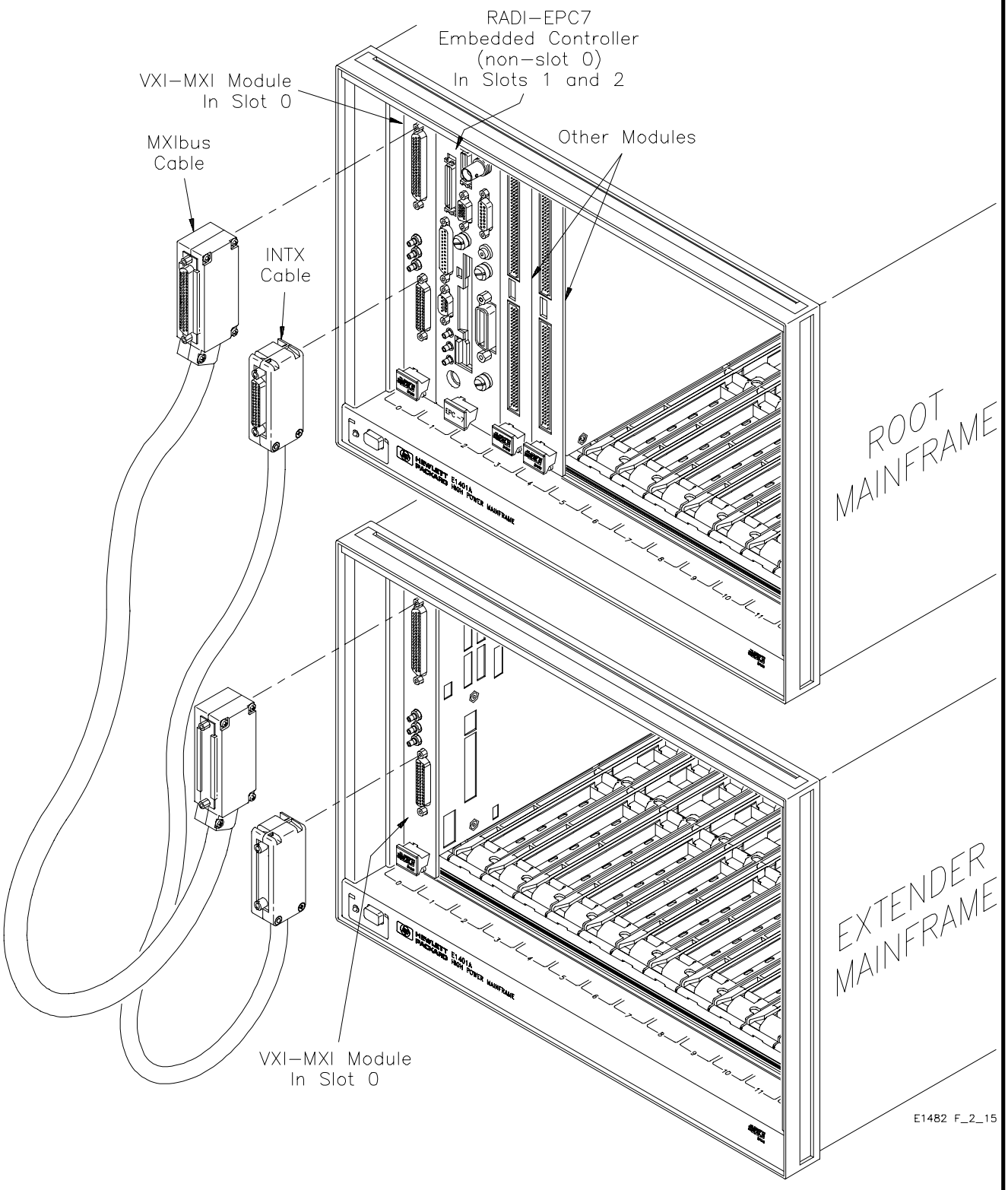


Figure 2-15. EPC7 and VXI-MXI Module Installation.

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Quick Set-Up For 3-Frame Systems

This section provides information on setting up a basic 3-frame VXI-MXI system. The most straight forward approach for three frames is to divide the address space into three sections. It is not possible to divide the address space into three equal segments because of the critical boundary at address 128 (see Table 2-2 and Figures 2-16 and 2-24).

Command Module (HP E1405B or E1406A) Installation and Use in a 3-Frame System.

- **ROOT MAINFRAME:** Set the VXI-MXI module to address 2. It does not have to be an instrument identifier address (e.g. divisible by 8; instrument identifiers are important only if you are using an E1405 or E1406 Command Module as the resource manager). Set other VXI modules in the root mainframe to addresses below 128. Note: the resource manager must be at address 0.
- **FIRST EXTENDED MAINFRAME:** Set the VXI-MXI module address to address 128. You can reserve address 128 as an instrument identifier for another VXI module in the first extended mainframe (see note below). Set all other VXI modules to addresses between 128 and 191 (do not duplicate the VXI-MXI address). The upper half of the address space is divided into two address windows of 64 addresses each (one for the first extended mainframe and one for the second extended mainframe).

NOTE

Note that a window size of 64 provides you with only eight (8) instrument identifiers for use with the E1405/E1406.

- For the first extended mainframe whose window is 128 - 191, this includes address 128 as one of the eight.
- For the second extended mainframe whose window is 192 - 255, this includes address 192 as one of the eight.

The address does not have to be the first address of the window but in general, it is easier to set the VXI-MXI module address to the first address of the window. If you want to reserve address 128 or 192 as an instrument identifier in either window, set the VXI-MXI module to address 129 and 193 respectively.

- **SECOND EXTENDED MAINFRAME:** Set the VXI-MXI module address to 192. You can reserve address 192 as an instrument identifier for another VXI module in the second extended mainframe (see the above note). Set all other VXI modules to addresses between 192 and 255 (do not duplicate the VXI-MXI address). Note that a window size of 64 provides you with only eight (8) instrument identifiers for use when an HP E1405/E1406 is used as the resource manager.

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Command Module (HP E1405B or E1406A) Installation and Use in a 3-Frame System.

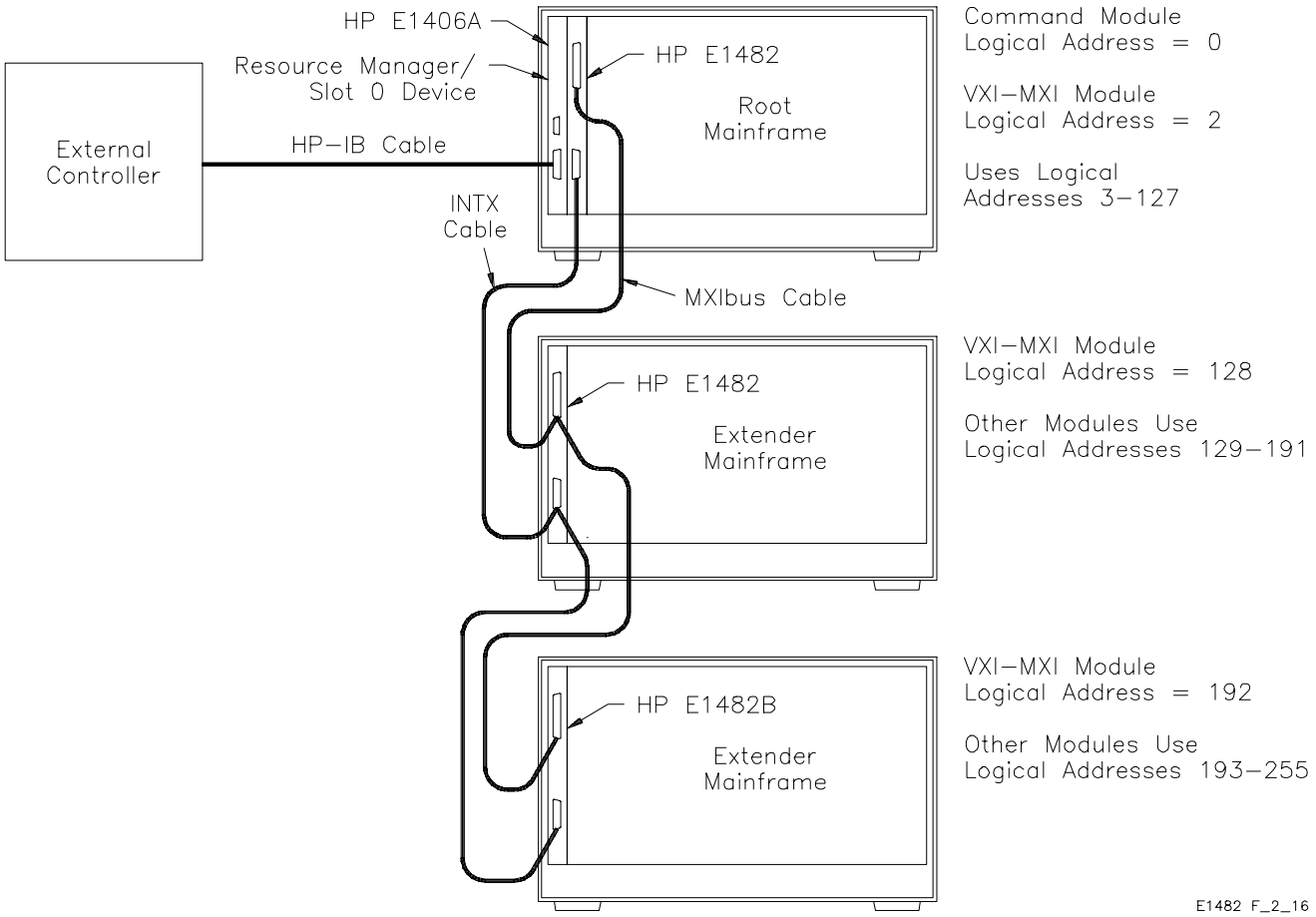


Figure 2-16. Command Module System, 3-Frame.

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External Controller (Workstation or PC) Installation and Use in a 3-Frame System.

For systems using an EXTERNAL controller (e.g. workstation or PC), always set the VXI-MXI module that interfaces to the workstation/computer to logical address 2 (the workstation/computer must be at logical address 0). This is illustrated in the connection to the EISA-MXI card Figure 2-17. Also see Figure 2-11.

- This system splits the addresses into three address windows of 64 addresses each. For the root mainframe, the workstation or PC is at logical address 0, the VXI-MXI module is at logical address 2. All other modules in the root mainframe use logical addresses 64 to 127. The VXI-MXI module in the first extended mainframe is at logical address 128; all other modules in the first extended mainframe use logical addresses 129 to 191. The VXI-MXI module in the second extended mainframe is at logical address 192; all other modules in the second extended mainframe use logical addresses 193 to 255.

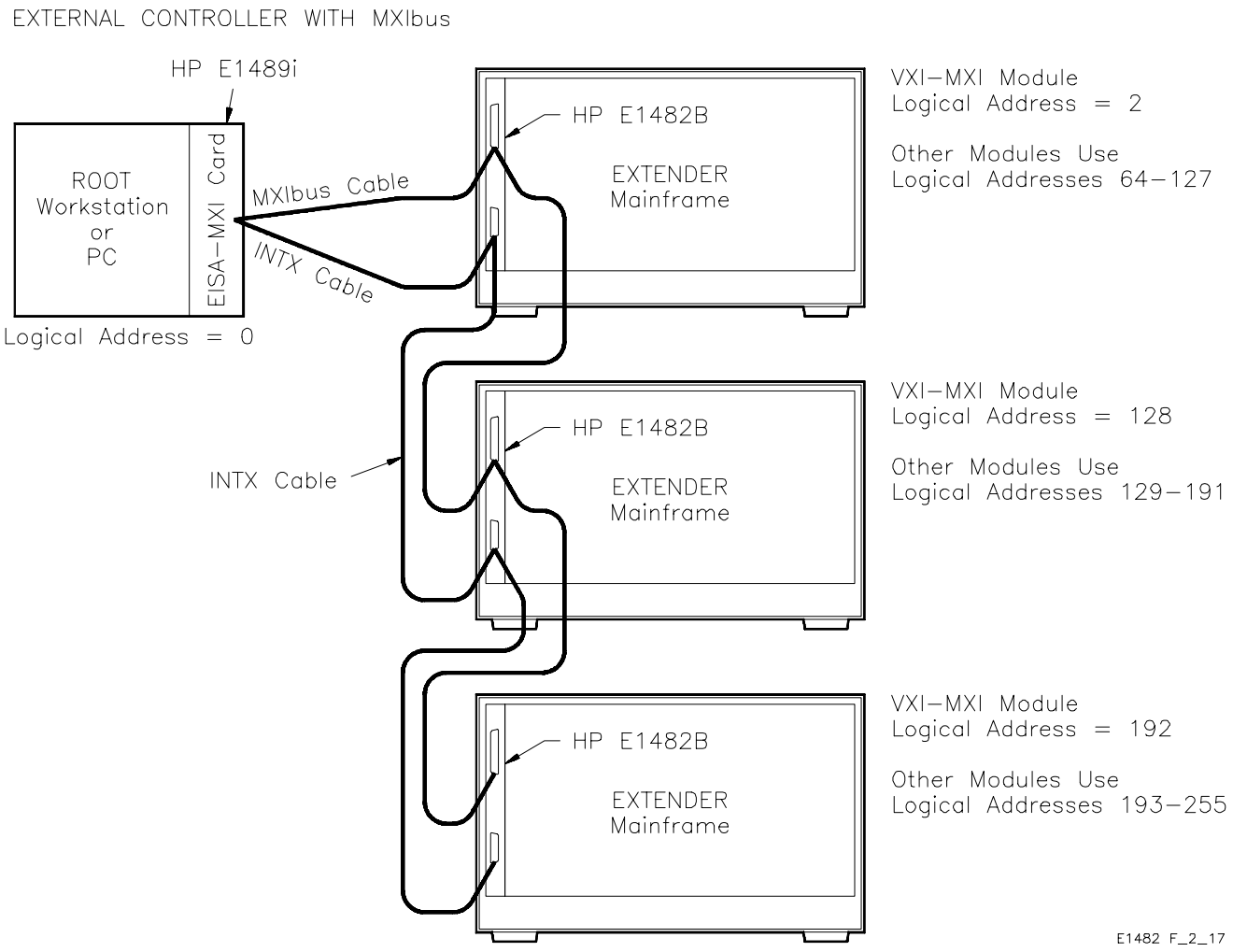


Figure 2-17. External Controller System, 3-Frame.

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Embedded Controller (HP E1499A V/382) Installation and Use in a 3-Frame System.

For systems using a V/382 EMBEDDED controller in place of an HP E1405/E1406 Command Module, the root mainframe shown in Figure 2-18 replaces the HP E1406 Command Module with the embedded controller (the embedded controller may require two slots). The embedded controller becomes the slot 0 device and system controller (at address 0) and the address windows can be divided as shown in Figure 2-18. This illustration shows an HP E1499 embedded computer and the addresses the modules are set to for MXIbus operation. Also see Figure 2-13.

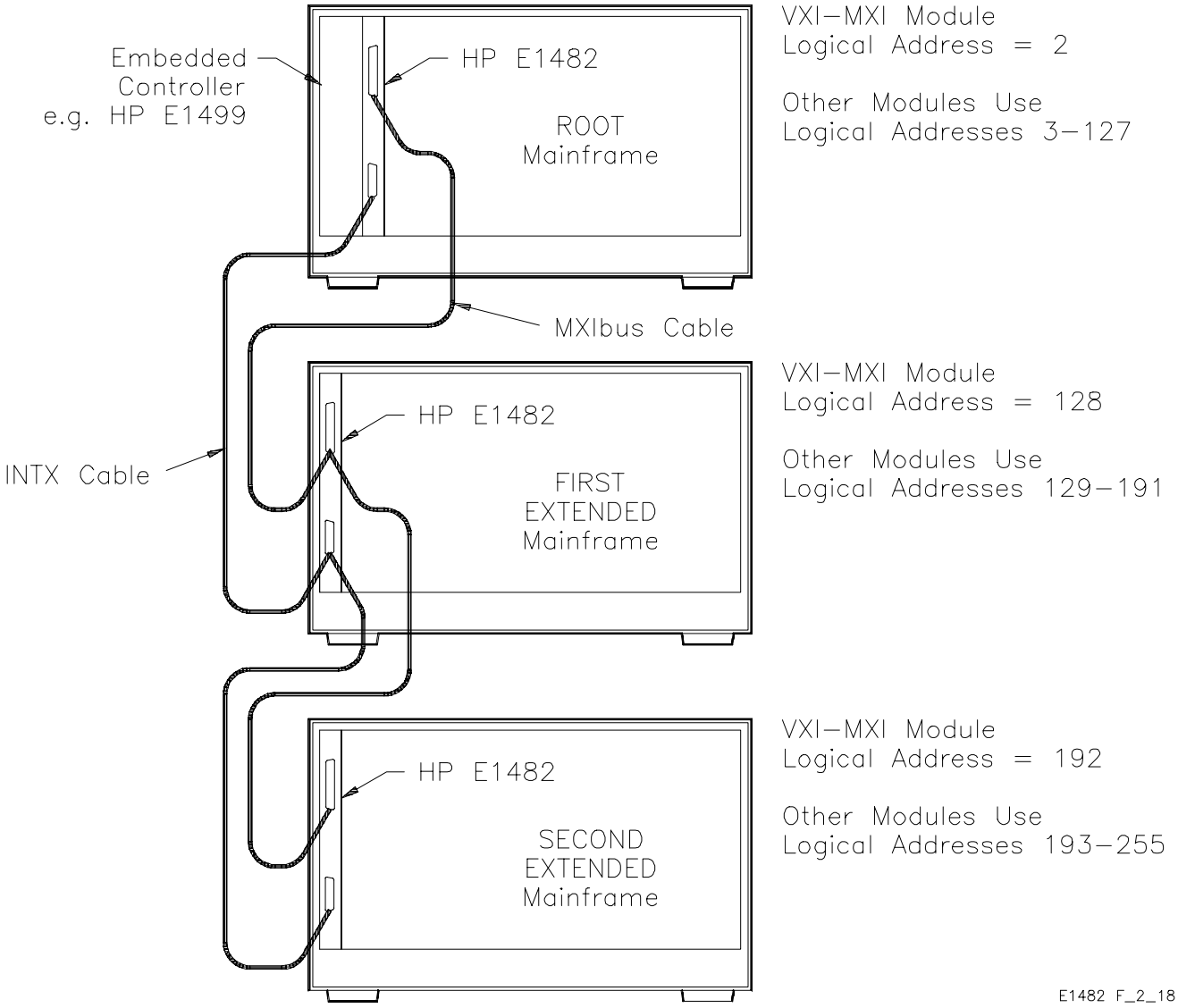


Figure 2-18. Embedded Controller System, 3-Frame.

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Embedded Controller (HP RADI-EPC7) Installation and Use in a 3-Frame System.

For systems using a RADI-EPC7 EMBEDDED controller in place of an HP E1405/E1406 Command Module, the root mainframe shown in Figure 2-19 replaces the HP E1406 Command Module with the embedded controller (the embedded controller may require two slots). The embedded controller becomes the slot 0 device and system controller (at address 0) and the address windows can be divided as shown in Figure 2-19. This illustration shows an EPC7 embedded computer and the addresses the modules are set to for MXIbus operation. You must install the EPC7 and the VXI-MXI module in the root mainframe as shown in Figure 2-15. You must make the EPC7 a non-slot 0 module and disable the VMEbus Timeout which is done in the following step (Step 5).

NOTE The EPC7 Start Up Resource Manager does not allow statically configured devices to be located at address 255. Therefore, a MXI window with the EPC7 cannot include address 255 and should use 191 as its largest address (see below).

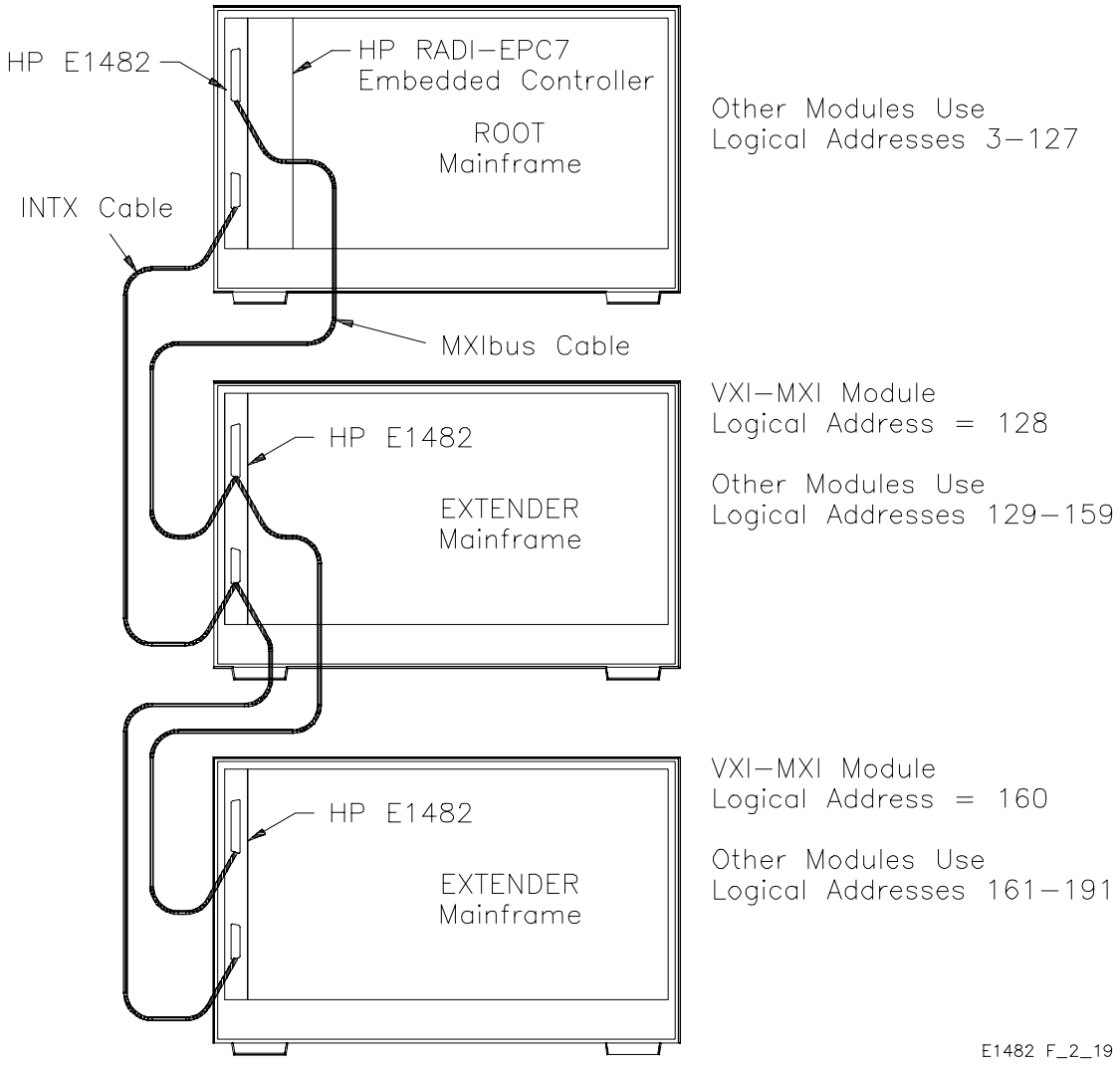


Figure 2-19. Embedded (EPC7) System, 3-Frame.

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Step 5. Disable the VMEbus Timeout (VME BTO) on the Resource Manager (command module or embedded controller).

The VXI-MXI module must do the VMEbus timeout on all mainframes. You MUST disable the VME BTO on the HP E1405B or E1406A Command Module or HP E1499 V/382 or HP RADI-EPC7 embedded controller serving as resource manager. This step is divided into three parts that show how to disable VME BTO on the EPC7 (Figure 2-20), the V/382 (Figure 2-21) and command modules (Figure 2-22).

NOTE: You must disable the VMEbus timeout on any VXI module used in the VXI-MXI system. Any module with the VME BTO enabled will not allow the system to be configurable. Only the VXI-MXI module in each mainframe can have the VME BTO enabled.

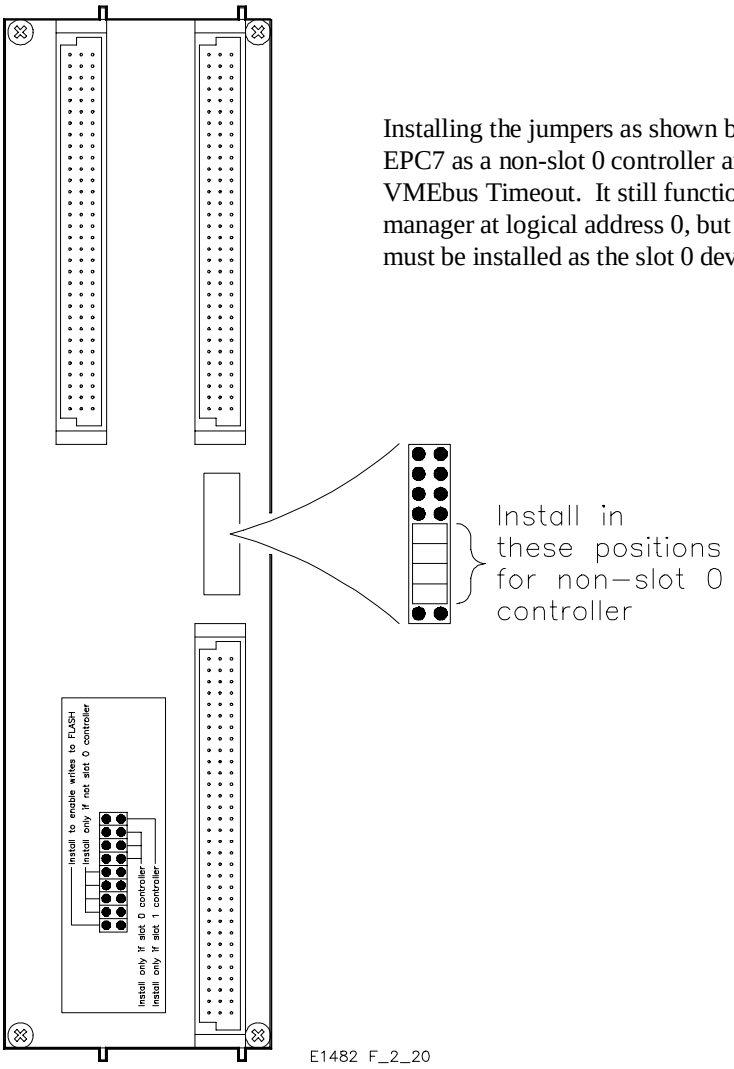


Figure 2-20. Disable VME BTO on the RADI-EPC7.

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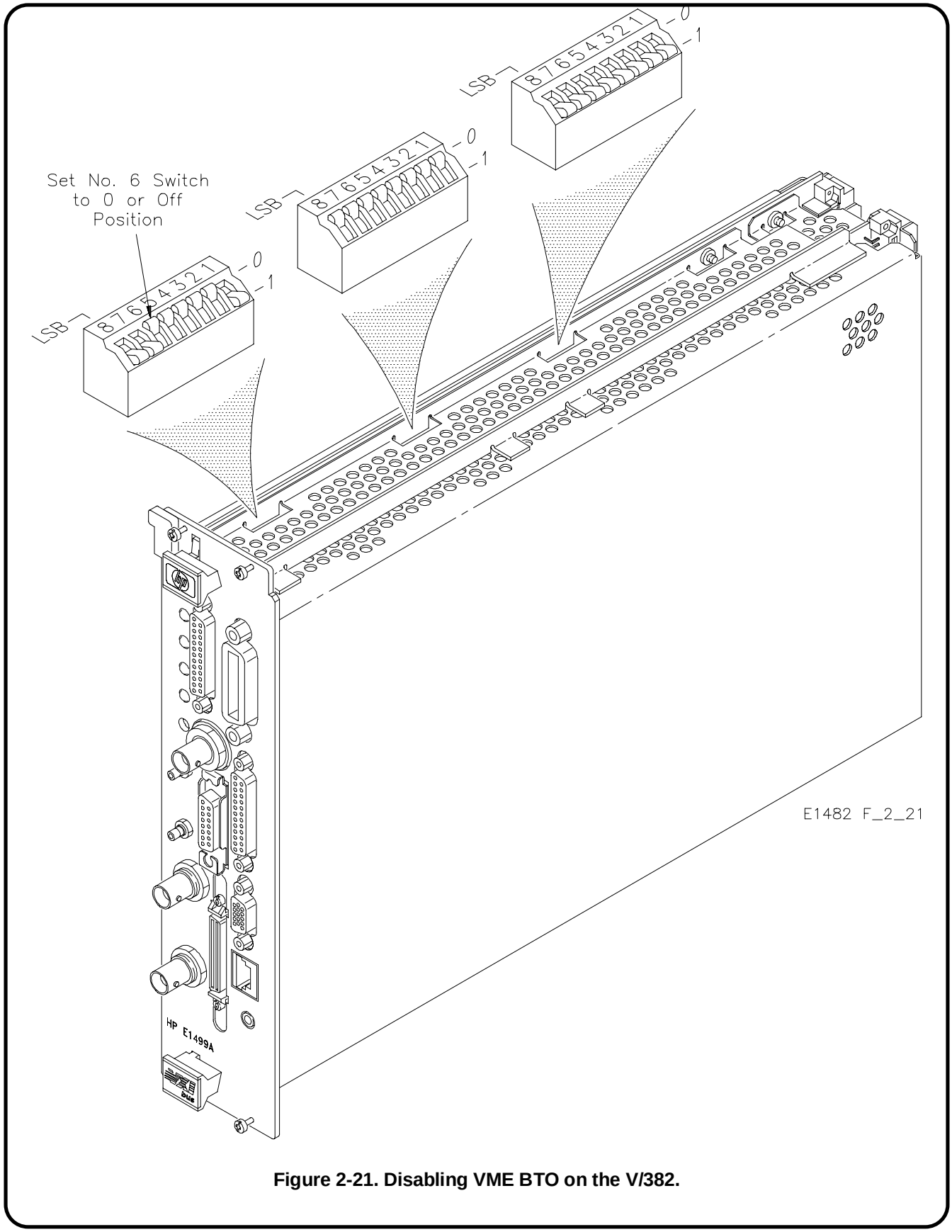


Figure 2-21. Disabling VME BTO on the V/382.

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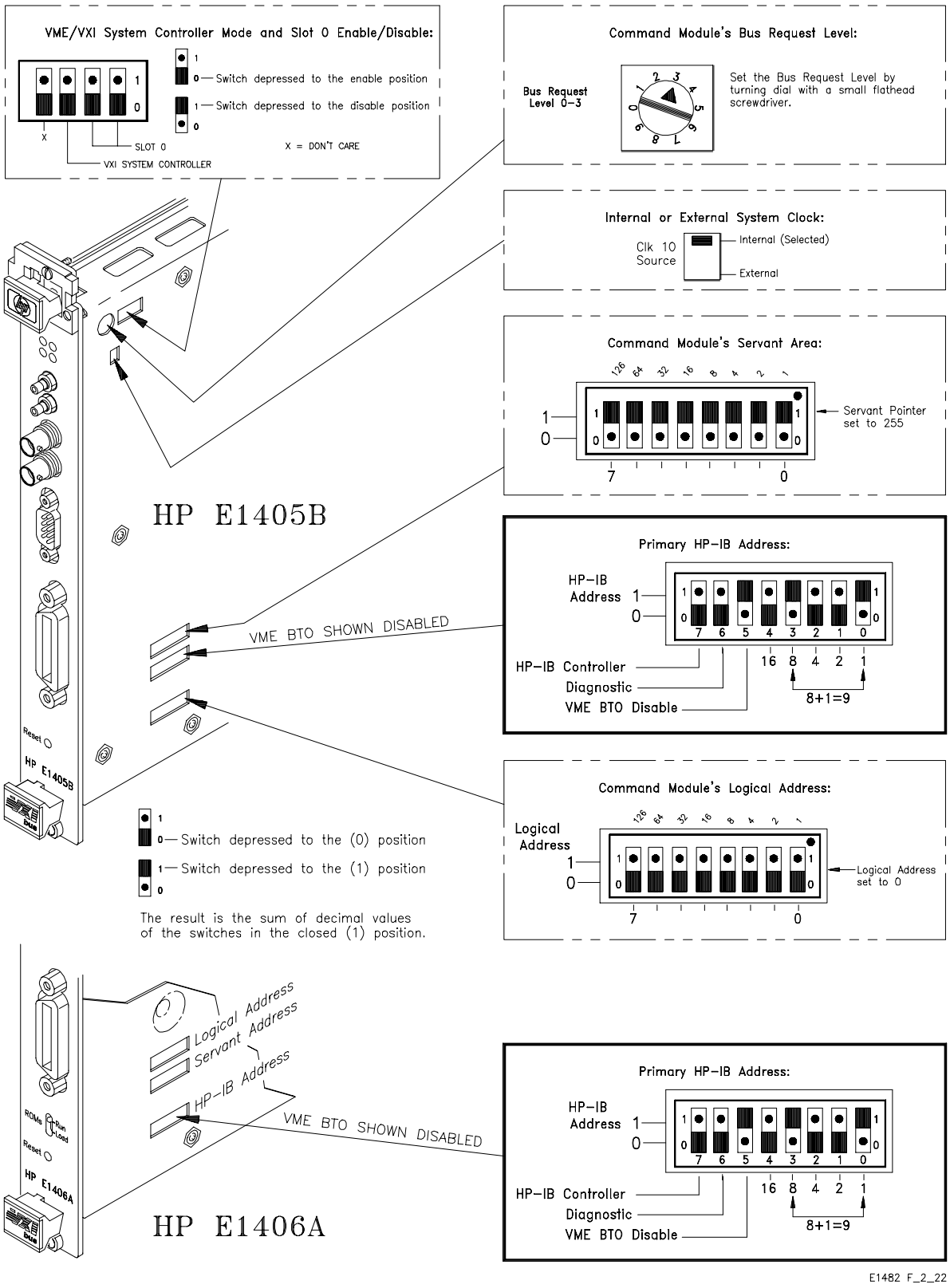


Figure 2-22. Disabling VME BTO on Command Modules.

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Step 6. Install the Resource Manager and VXI-MXI Modules in your system. Install only one other module in each mainframe (refer to the Quick Start figures if needed).

In this step you establish that you have a functional MXIbus system. You determine that the resource manager can configure this minimum system with the VXI-MXI modules having default settings as shipped by the factory. The one additional VXI module in each mainframe causes the resource manager to open address windows for each mainframe.

Installing the VXI-MXI Module

Verify the following before installing a VXI-MXI module:

- If installing the VXI-MXI in a slot other than Slot 0, verify that you have changed the settings of the VXIbus Slot 0 slide switches (S1 and S8), the VME BTO level jumper (W6), VMEbus chain position jumper (W7), the MXI Controller Timeout jumper (W8) and the CLK10 Source Select jumpers (W9 and W10). The VXI-MXI must be installed in slot 0 except in the root mainframe.
- If interlocked mode is used, all the VXI-MXIs must be the highest priority VMEbus requesters in that mainframe. However, one mainframe (and only one mainframe) in the MXIbus link can have a higher priority VMEbus requester than its VXI-MXIs.
- The first and last MXIbus devices in the MXIbus daisy chain must have the terminating networks installed for the MXIbus and INTX bus (modules come with these in place - see Step 3).
- No two devices in your VXIbus/MXIbus system can have the same logical address (see Step 4 and the Quick Set-Up examples).

You are now ready to install the VXI-MXI. Following are general instructions for installing your VXI-MXI in your VXIbus mainframe. Consult the user manual or technical reference manual of your VXIbus mainframe for specific instructions and warnings.

1. Remove power from the mainframe.
2. Remove or open any doors or covers blocking access to the mainframe slots.
3. If the VXI-MXI will be installed in a D-size mainframe, install a support designed for installing C-size cards in D-size mainframes.
4. Insert the VXI-MXI into the slot of the mainframe by aligning the top and bottom of the card with the card guides inside the mainframe. Slowly push the VXI-MXI straight into the slot until it seats in the backplane receptacles. The front panel of the VXI-MXI should be even with the front panel of the mainframe.

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5. Tighten the retaining screws on the top and bottom edges of the front panel.

6. Check installation.

7. Connect MXIbus and SMB cables as required.

8. Replace or close any doors or covers to the mainframe, and restore power to the mainframe.

Connecting the MXIbus Cable

MXIbus devices are daisy-chained together with MXIbus cables. The VXI-MXI uses a shielded 62-pin high-density D-subminiature device connector specified in the MXIbus specification. When properly configured, MXIbus cables will dress down and away from the VXIbus mainframe. Ensure that the proper cable ends are connected to the intended devices. See Figure 2-1 and 2-23.

Start by connecting the end of the cable with the single connector to the MXIbus System Controller and the end of the cable with dual-ended connectors to the next device in the MXIbus link. Continue adding cables, connecting the end of the cable with the single connectorto the device in the link closest to the MXIbus System Controller, and the end of the cable with the dual-ended. Figure 2-23 shows a VXI/MXI cable with connectors.

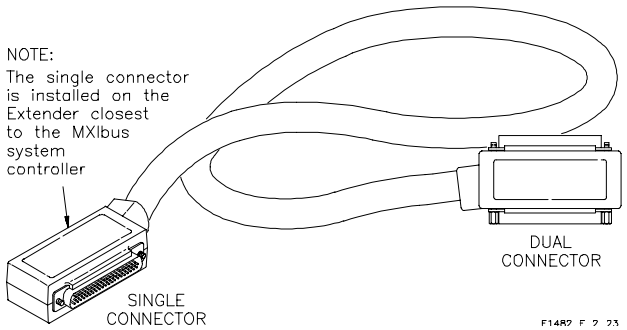


Figure 2-23. MXIbus Cable Configuration.

Secure the MXIbus cable(s) on the back of the MXIbus connector using the captive screw elements to ensure that the cable(s) will not accidently become disconnected. The VXI-MXI is connected to a MXIbus system by daisy-chaining its MXIbus cable(s) to other MXIbus devices. If two cables are attached to a MXIbus device, the connectors should be attached in a back-to-back fashion similar to the IEEE-488.

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NOTE If multiple MXIbus devices are daisy-chained together, the total cable distance must not exceed 20 meters, and the maximum number of MXIbus devices allowed in the link is eight.

NOTE In a properly configured MXIbus system, the first and last devices in the daisy-chain have only one MXIbus cable connected to the MXIbus connector. MXIbus devices that are neither the first or last device in the daisy-chain have two (and only two) MXIbus cables attached to their device connector. The same note is true for the INTX cable and connectors.

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Step 7. Power up the system and verify that the resource manager is able to configure the system.

When the MXIbus cables in the system are properly connected, power-up all mainframes except the mainframe containing the VXIbus Resource Manager. Apply power to that mainframe last. This step confirms that all addresses and all switches are properly set and the resource manager can configure the system by establishing address windows and communication with modules.

NOTE

Always turn on the mainframe with the VXIbus Resource Manager last so that all devices will be powered on and ready to respond if the resource manager attempts to access the MXIbus devices as soon as it is started up. If this is not possible, manually rerun the resource manager after all mainframes are powered up (on Command Modules, press the "Reset" button).

Connecting a Display Terminal to View Configuration Sequence

It is recommened that you have an RS-232 terminal connected to the Command Module RS-232 port. When you turn on the root mainframe, the resource manager configures the system and will print the power-on and configuration sequence to the terminal screen. If you are using an embedded controller as your resource manager, connect a video monitor to the controller as described in your controller's documentation.

Optional Printout of Configuration Sequence

If you do not have a display terminal, you can connect an RS-232 printer to the Command Module's RS-232 port and obtain a hard-copy printout of the power-on and configuration sequence.

Verification Without a Terminal or Printer

On Command Modules, check that the "Ready" light comes on instead of the "Failed" light after the turn-on sequence. You can also query the resource manager via HP-IB to determine proper operation is occuring.

What If Problems are Encountered?

- Verify that all VXI-MXI module switch and jumper settings are set as described in Steps 1 and 2.
- Reseat modules in the VXI mainframe; be sure you have a good connection to the backplane.
- Remove all modules except the VXI-MXI modules and reapply power. If the resource manager can now configure the system, suspect one of the removed modules has its address set in conflict with another mainframe's address window.
- Additionally, verify that all VMEbus timeouts are disabled on all modules (this includes embedded controllers) except the VXI-MXI module.

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Typical Listing of Configuration Sequence

The following is a typical power-on and configuration sequence obtained from a 2-frame VXI-MXI system using a Command Module with a VXI-MXI module in each mainframe and one other VXI module in each mainframe.

This listing is for a system containing IBASIC installed in the command module at ladd = 240 (secondary address = 30).

```
                Testing ROM
          Testing 512K Bytes RAM
                    Passed
                Testing CPU
          CPU Self Test Passed
           HPIB Address:  09
                 Talk/Listen
Command Module ladd = 0
Command Module servant area = 255
Command Module VME bus timeout -- DISABLED
Searching for static devices in mainframe 0
        SC device at ladd      0 in slot 0
        SC device at ladd      2 in slot 1  --  VXIbus extender
        SC device at ladd     24 in slot 5
Searching for static devices on interconnect bus 2
        SC device at ladd 128 in slot 0  --  VXIbus extender
Searching for static devices in mainframe 128
        SC device at ladd 152 in slot 3
Searching for dynamic devices in mainframe 128
VXIbus extender 128 Ladd window range:    152 to 153, INWARD
VXIbus extender     2 Ladd window range:    128 to 159, OUTWARD
Searching for dynamic devices in mainframe 0
Searching for pseudo devices
        ladd 240,  IBASIC
Configuring Commander / Servant hierarchy
        ladd =    0, cmdr ladd =     -1
        ladd =   24, cmdr ladd =      0
        ladd =  152, cmdr ladd =      0
        ladd =  240, cmdr ladd =      0
Validating Commander / Servant hierarchy
Mapping A24 memory
Searching for A24 memory in mainframe 128
VXIbus extender 128    A24 window range:  00000000 to 00FFFFFF, OUTWARD
VXIbus extender     2    A32 window range:  00000000 to 00FFFFFF, INWARD
Searching for A24 memory in mainframe    0
        ladd       0,    offset = 00200000H,    size = 131072 Bytes
Mapping A32 memory
Searching for A32 memory in mainframe 128
VXIbus extender 128    A32 window range:  00000000 to FFFFFFFF, OUTWARD
VXIbus extender     2    A32 window range:  00000000 to FFFFFFFF, INWARD
Searching for A32 memory in mainframe    0
Configuring VME interrupts
        VME interrupt line 1 assigned to ladd    0, handler ID 1
        VME interrupt line 2 - no handler assigned
        VME interrupt line 3 - no handler assigned
```


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```
        VME interrupt line 4 - no handler assigned
        VME interrupt line 5 - no handler assigned
        VME interrupt line 6 - no handler assigned
        VME interrupt line 7 - no handler assigned
VXIbus extender 128 interrupts:  1-OUT    2-DIS    3-DIS    4-DIS    5-DIS    6-DIS    7-DIS
VXIbus extender     2 interrupts:  1-OUT    2-DIS    3-DIS    4-DIS    5-DIS    6-DIS    7-DIS
SYSTEM INSTALLED AT SECONDARY ADDR    0
VOLTMTR INSTALLED AT SECONDARY ADDR    3
MBinstr INSTALLED AT SECONDARY ADDR 19
IBASIC INSTALLED AT SECONDARY ADDR 30
IBASIC memory:    115232
SYSTEM instrument started
File System memory:    40131
File System Started
BNO issued to ladd 152, BNO response = FFFE
Opening HP-IB/IBASIC access for message based device at sec addr 19


^^    cccSelect an instrument.
```


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Step 8. Install other modules. Reverify operation.

After you have confirmed that the resource manager can configure your VXI-MXI system in Step 7, install other VXI modules in the mainframes.

You may want to install a few modules at a time and turn on the mainframes to reverify the system can be configured. If a problem is encountered, you only have a few modules in each mainframe to work with to isolate the problem.

Continue installation/reverification until all modules have been installed in the system.

If you have a terminal to view the turn-on and configuration sequence, notice the configuration of address windows as you add more modules (and therefore more addresses) to each mainframe.

Advanced Configuration.

Use the information in Chapter 3 after operation is verified to change the configuration of your VXI-MXI modules for specific requirements of your test system. In most cases, the default settings will satisfy test system needs.

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Step 9. Review this configuration and installation reference for more detailed information.

This section provides reference information for configuring and installing a VXI-MXI system.

VMEbus Devices in VXIbus/MXIbus Systems

If you have VMEbus devices installed in your VXIbus system, pay special attention to how the A16 resources used by the VMEbus cards are configured. The VXIbus specification has reserved the upper 16 kilobytes of A16 space for configuration registers on VXIbus devices. During system initialization, the system Resource Manager scans the upper 16 kilobytes of A16 searching for VXIbus devices. Ensure that VMEbus devices are not mistaken for VXIbus devices. This is done by modifying resource configuration tables or files.

If possible, you should configure the A16 resources for your VMEbus boards in the lower 48 kilobytes (0000 through BFFF hex) of A16 space, so as to not interfere with VXIbus configuration space. The logical address window mapping window is then used for mapping configuration space for VXIbus devices, and the A16 window mapping window is used for mapping configuration space for VMEbus devices. If you must configure any of the VMEbus module's A16 resources in the upper 16 kilobytes (C000 through FFFF hex) of A16 space, you need to indicate to the system Resource Manager that there are non-VXIbus foreign devices installed. Be careful not to configure any static VXIbus logical addresses in the portions of A16 space occupied by the VMEbus devices.

Optional Equipment

The following optional MXIbus/INTX cable kits are available from Hewlett- Packard. Each cable kit includes two cables: 1) MXIbus cable and 2) INTX cable.

Description	Part Number
MXIbus/INTX Cable Kits:	
1 meter MXIbus/INTX Cable Kit	E1482-80001
4 meter MXIbus/INTX Cable Kit	E1482-80004

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Hardware Installation Rules

The following are basic rules for VXI-MXI module installation:

- Each mainframe must contain a VXI-MXI module to provide the MXIbus communication path between mainframes.

  Embedded Controller or Command Module Resource Manager: The VXI-MXI module in the "root" mainframe should be installed in the slot next to the resource manager located at slot 0 (e.g. install the VXI-MXI module in slot 1; slot 2 for the 2-slot embedded controller).

  External Controller Resource Manager: The VXI-MXI module in the "root" mainframe should be installed in slot 0.

- The VXI-MXI module in all extender mainframes (regardless of the type of resource manager used) must be installed in slot 0. All VXI-MXI modules must be configured for INTERLOCKED bus arbitration (factory setting) so there is no possibility of a bus error. Register-based device drivers do not handle bus errors.

NOTE (Disable VMEbus Timeout on non-VXI-MXI resource managers)

- The VXI-MXI module must do the VMEbus timeout on all mainframes (the VMEbus timeout **must be disabled** on all HP E1405/E1406 Command Modules and/or the HP E1499 V/382 or HP RADI-EPC7 embedded controllers).

- A multiple mainframe VXIbus system must partition the VXIbus address space (decimal 0 to 255) between mainframes. The partitioning is done by the VXIbus Resource Manager (RM) based on addresses you set. The resource manager you use must be able to support MXIbus operation.
  The Resource Manager can be:
  a) External Controller e.g. HP 700/750 Workstations
  b) Embedded Controller e.g. HP E1499 (V382) or HP RADI-EPC7
  c) Command Module e.g. HP E1405 or E1406

- It is recommended that the address of each VXI-MXI module be somewhere within the address window of the mainframe the module is installed in.

- Select logical addresses for VXI modules within each mainframe so that the logical address windows required by each mainframe do not overlap. The multi-frame RM defines the address windows based on the logical addresses encountered in each mainframe.

- The system RM performs all the VXIbus RM functions and will choose the smallest window for the mainframe that includes all logical addresses encountered within the mainframe (with the possible exception of the MXI module itself - the MXI module does not have to be in the window.

- A root mainframe must not inlude a device with logical address 128 or greater. Having the address 0 and 128 or greater in the same window would force a window of all 256 logical addresses because this is the only window that can contain these addresses (See Table 2-2 and Figure 2-24).

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Rules For Selecting Logical Addresses

You must be aware of the allowed window sizes and window boundary restrictions (the allowed starting addresses for a particular window size) when defining the VXI logical address mapping in a VXI-MXI system.

- The minimum logical address window size is 2.

Note these two Rules ! Refer to Table 2-2 and Figure 2-24 for tabulated information on window size and starting addresses.

- **The window size must be a power of two** e.g. size= 2^N, (N=1, 2, 3, . . ., 8) Therefore, a window size can be 2, 4, 8, 16, 32, 64, 128, or 256.
- **The starting address of the window must start at 0 or at an address which is a multiple of the window size being assigned.** For example, a window with 30 logical addresses requires a window size of at least 32 (32 is a power of 2; 30 is not a power of 2). The addresses of this window can start at logical address 0, 32, 64, 96, 128, 160, 192, or 224. Logical addresses in a window requiring a size of 128 must start at logical address 0 or 128 (the window is either 0 to 127 or 128 to 255).
- Inbound window. Each device must be within the address window of the mainframe it resides in. The logical addresses within a mainframe should be set to allocate as small a window as possible to allow unused address space for other mainframes (the RM will actually establish the window based on addresses you set).
- Outbound window. The logical address window for the VXI-MXI module in the root main- frame must be a valid window (valid starting address and size), and in- clude all of the modules in all of the extender mainframes connected to it.
- A VXI-MXI module does not have to be in its own "local" address window (window for the mainframe it is in). For example, if it is the VXI-MXI module in mainframe #2 and the logical address window for this mainframe is 64 to 71, the VXI-MXI module can be at an address outside of this window as long as it does not fall within a logical address window of another mainframe. The upper bound of each frame's window is determined by the highest address in that frame and power of 2 rule.

Inward and Outward Windows

Two types of windows exist: inward and outward. The outward window resides in the "root" mainframe (the mainframe with the resource manager) and must include the logical address windows for all extended mainframes.

Inward windows reside in each extended mainframe. These windows contain all addresses for the modules contained in the mainframe with the possible exception of the VXI-MXI module itself.

CAUTION

Due to the VXI-MXIbus specifications on windows, even though the number of logical addresses is small, a large window may be required to include all addresses. For example, if you set the addresses 0 and 128 in the same mainframe, this mainframe will require a window size of 256 (the entire window of 0-255) and no addresses are available for other mainframes. The resource manager will be unable to configure a multi-frame system in this case.

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Figure 2-24 and Table 2-2 both tabulate and illustrate window size and allowed starting addresses (logical address boundaries). The figure and table illustrate the rules described on the preceding page.

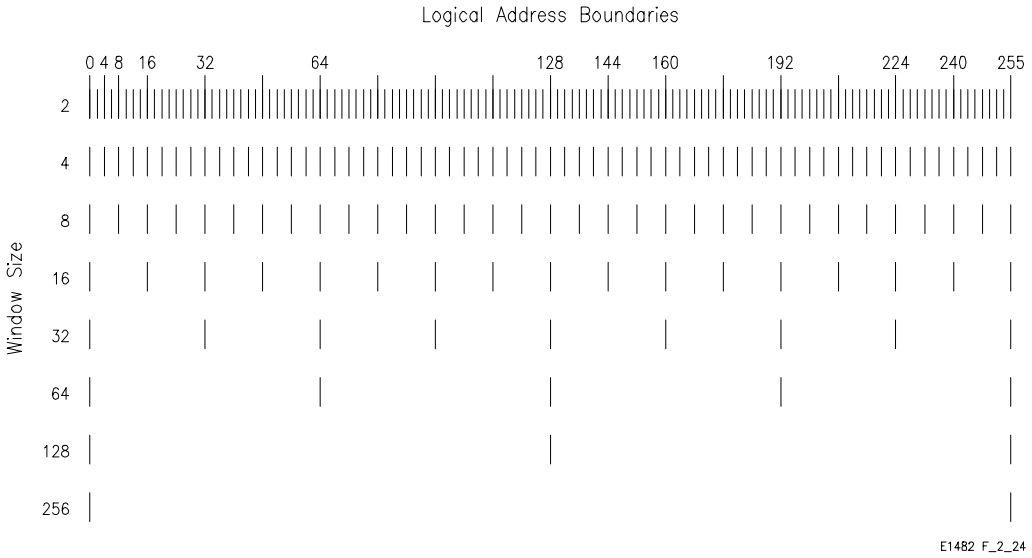


Figure 2-24. Window Size versus Starting Addresses.

Table 2-2. Window Size and Allowed Start Addresses.

Window Size (number of addresses)	Allowed Starting Addresses for the Window (Boundaries)
2	0, 2, 4, 6, 8, 10,. . ., all even numbers up to 254 inclusive.
4	0, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 88, 96, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 144, 148, 152, 156, 160, 164, 168, 172, 176, 180, 184, 188, 192, 196, 200, 204, 208, 212, 216, 220, 224, 228, 232, 236, 240, 244, 248, 252
8	0, 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112, 120, 128, 136, 144, 152, 160, 168, 176, 184, 192, 200, 208, 216, 224, 232, 240, 248
16	0, 16, 32, 48, 64, 80, 96, 112, 128, 144, 160, 176, 192, 208, 224, 240
32	0, 32, 64, 96, 128, 160, 192, 224
64	0, 64, 128, 192
128	0, 128
256	0

NOTE

It is not possible to detect duplicate logical addresses because devices are found by reading the VXIbus ID Register. If two devices share a logical address, they will both respond to an address access without any indication of an error.

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discussed

Chapter 3

Switch/Jumper Configuration Reference

About this Chapter

This chapter provides reference information you can use to change the default configuration settings (switches and jumpers) of the VXI-MXI module:

- Switch/Jumper List 57
- Individual Switch/Jumper Configurations 57

Switch/Jumper List

The following is a list of hardware jumpers, switches, and slide switches that can be changed from the default settings to match your system requirements (you should first establish system operation using the default settings - see Chapter 2):

- VMEbus Request Level (jumpers W1, W2, W3, W4, and W5)
- VMEbus Timeout Level (jumper W8)
- VMEbus Timeout Chain Position (jumper W7)
- Interlocked Arbitration (slide switch S3)
- MXIbus System Controller (slide switch S4)
- MXIbus System Controller Timeout Level (jumper W6)
- MXIbus Fairness (slide switch S2)
- CLK10 Source (jumpers W9 and W10 - accessible through the connector edge of the VXI-MXI module)
- CLK10 Mapping (slide switches W1, W2, and W3 on the daughter board)
- EXT CLK SMB Input/Output (slide switch S6)
- Trigger Input Termination (slide switch S5)
- Front Panel Pushbutton System Reset (slide switch S7)**S**

NOTE

The VXIbus Logical Address (switch U46), MXIbus Terminating Networks, INTX Terminating Networks and VXIbus Slot 0 (slide switches S1 and S8) settings are in Chapter 2. You set these configurations in the initial set-up procedure described at the beginning of Chapter 2.

WARNING

The VXI-MXI is shipped from the factory configured to be installed into Slot 0 of your VXIbus mainframe. Installing your VXI-MXI into any slot other than Slot 0 without reconfiguring the VXI-MXI for non-slot 0 (switches S1 and S8) can damage the VXI-MXI, the VXIbus backplane, or both. See Figure 2-2 (Chapter 2) for S1 and S8 switch settings.

VMEbus Request Level

The VXI-MXI uses one of the four VMEbus request levels to request use of the VMEbus Data Transfer Bus (DTB). The VXI-MXI requests use of the DTB

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whenever an external MXIbus device attempts a transfer that maps into the VXIbus mainframe.

The VXI-MXI is shipped from the factory configured to use VMEbus request level 3, as required in the VXIbus specification. Request level 3 is the highest priority request level and request level 0 is the lowest. The VXI-MXI can be changed to use any of the other three request levels by changing the jumper configuration of the pin arrays at locations W1, W2, W3 , W4, and W5. You may want to change request levels to change the priority of the VXI-MXI request signal. For more information, refer to the VMEbus specification.

To change the VMEbus request level of the VXI-MXI, rearrange the jumpers on the pin arrays as shown in Figure 3-1.

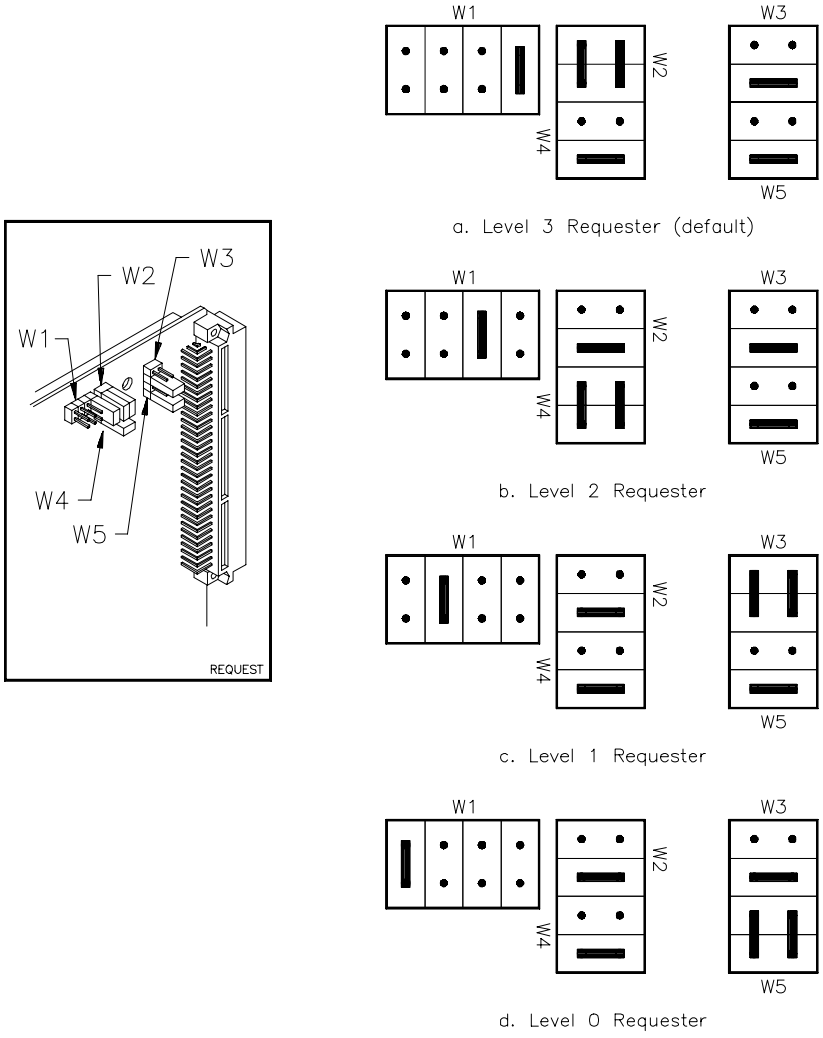


Figure 3-1. VMEbus Requester Jumper Settings.

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VMEbus Timeout Level (VME BTO Level)

When a VXI-MXI is installed in a VXIbus mainframe, the VMEbus Timeout (BTO) circuitry for the VXIbus mainframe must be enabled on the VXI-MXI. If there are multiple VXI-MXI interfaces in a mainframe, the VME BTO Level must be enabled on one of them and they must be in adjacent slots. In the case of multiple VXI-MXIs, it is recommended that the VME BTO Level be enabled on the VXI-MXI that is installed in Slot 0. The default setting for the VME BTO Level from the factory is 100 µsec.

The VME BTO Level monitors the current bus cycle and asserts the bus error (BERR) signal if a data transfer acknowledge (DTACK) or BERR is not received from the selected slave within the given amount of time after data strobe (DS1 or DS0) becomes active. Whenever a MXIbus transfer into or out of the VXI-MXI occurs, the VMEbus timeout on the VXI-MXI is disabled and the MXIbus System Controller BTO monitors the transfer. This configuration allows VXIbus transfers to have short bus timeout values and MXIbus transfers to have much longer timeout values.

- The VMEbus Timeout Level can be disabled or set to 100, 200, or 400 µsec by rearranging the jumper selection at location W6, as shown in Figure 3-2. The VMEbus timeout is disabled when a MXIbus transfer is initiated out from the mainframe. The configuration of jumper block W7 selects how the VXIbus local bus is used to disable the VMEbus timeout when outward MXIbus transfers occur. If the VXI-MXI is not installed in Slot 0, remember to enable the VMEbus BTO on the VXI-MXI and to disable the VMEbus BTO on the Slot 0 device.

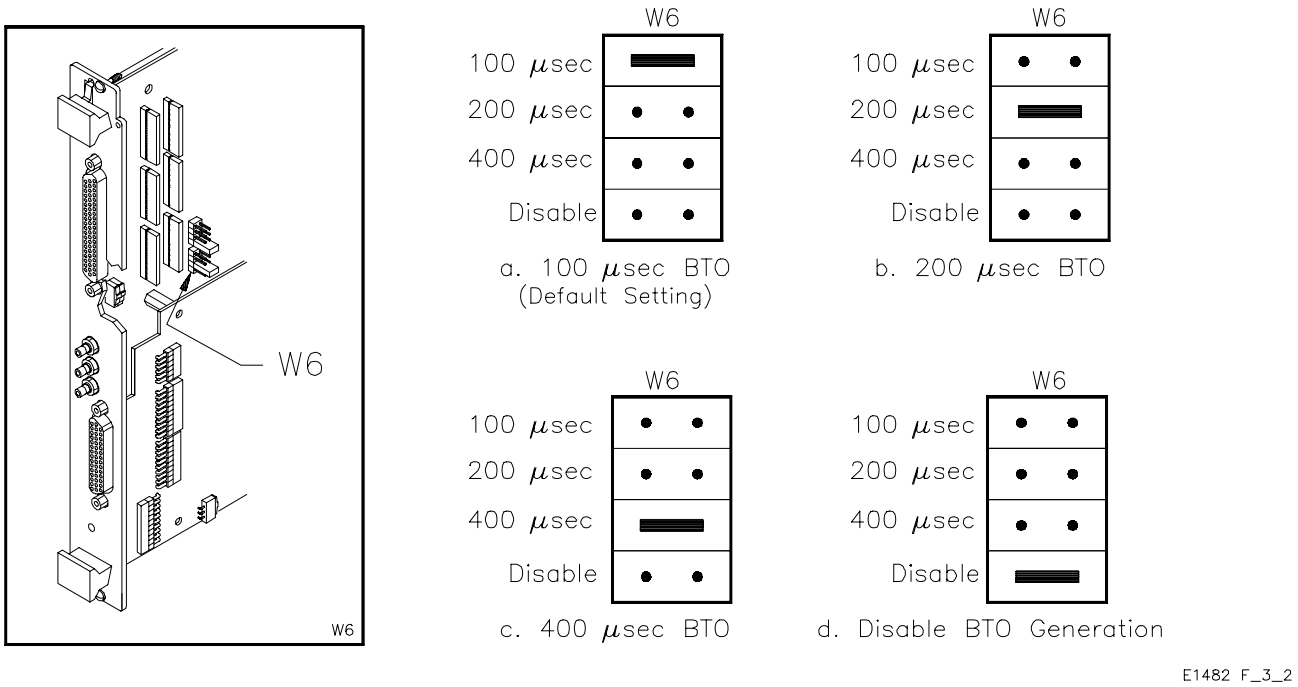


Figure 3-2. VMEbus Timeout Selection Jumpers.

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VMEbus Timeout Chain Position (VME BTO Chain Position)

The jumper block at location W7 indicates the location of the VXI-MXI interface in relation to other VXI-MXIs installed in the mainframe. If only one VXI-MXI is in the system, set the W7 jumper block to one of the configurations shown in Figure 3-3.

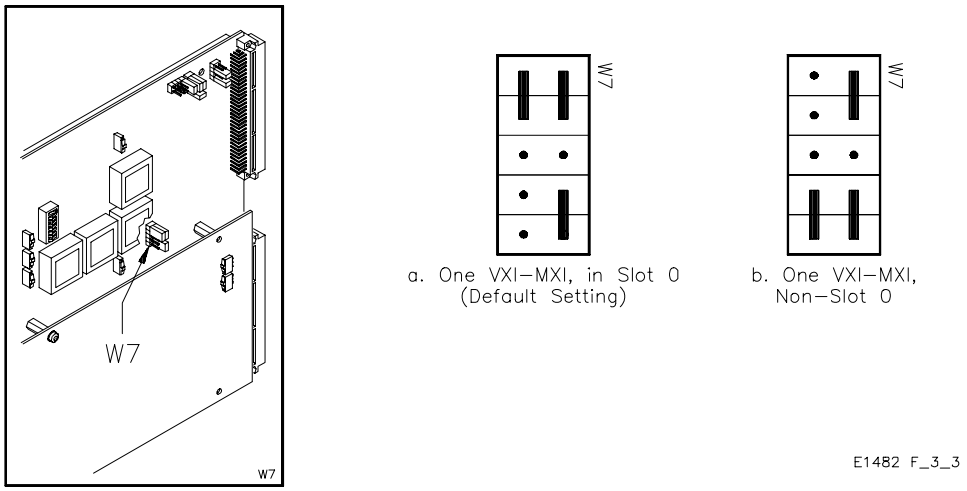


Figure 3-3. VMEbus Timeout; One VXI-MXI in Mainframe.

When multiple VXI-MXI modules are installed in adjacent slots, the VXIbus local bus is used to send a signal to the VXI-MXI with the VMEbus BTO to indicate that an outward MXIbus transfer is in progress. The following figures show how to configure jumper block W7 to select how the VXIbus local bus is used to disable the VMEbus timeout during outward MXIbus transfers. If the system contains more than one VXI-MXI, select which card will supply the VMEbus timeout, and set the W7 jumper block according to the VXI-MXI's position in relation to the adjacent VXI-MXIs. Figure 3-4 shows four possible settings.

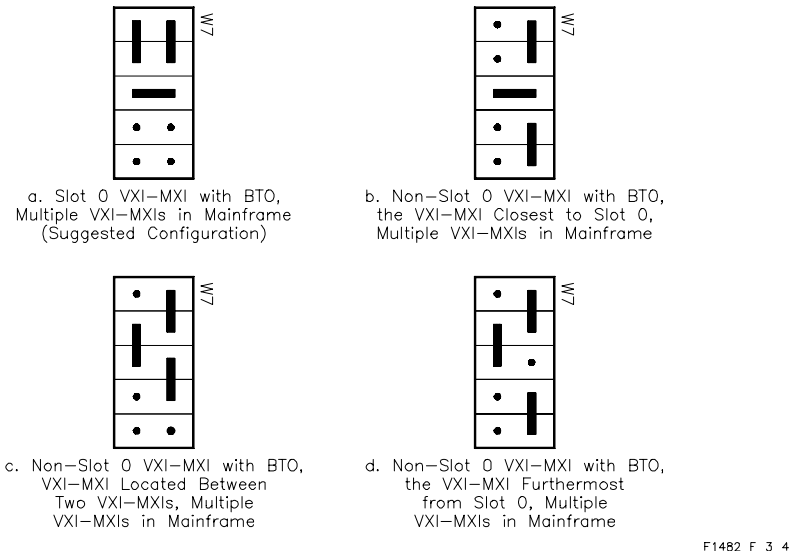


Figure 3-4. VMEbus Timeout; Multiple VXI-MXIs.

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For the VXI-MXIs that do not supply the VMEbus timeout, set the W7 jumper block to reflect each VXI-MXI's position in relationto the adjacent VXI-MXIs. See Figure 3-5.

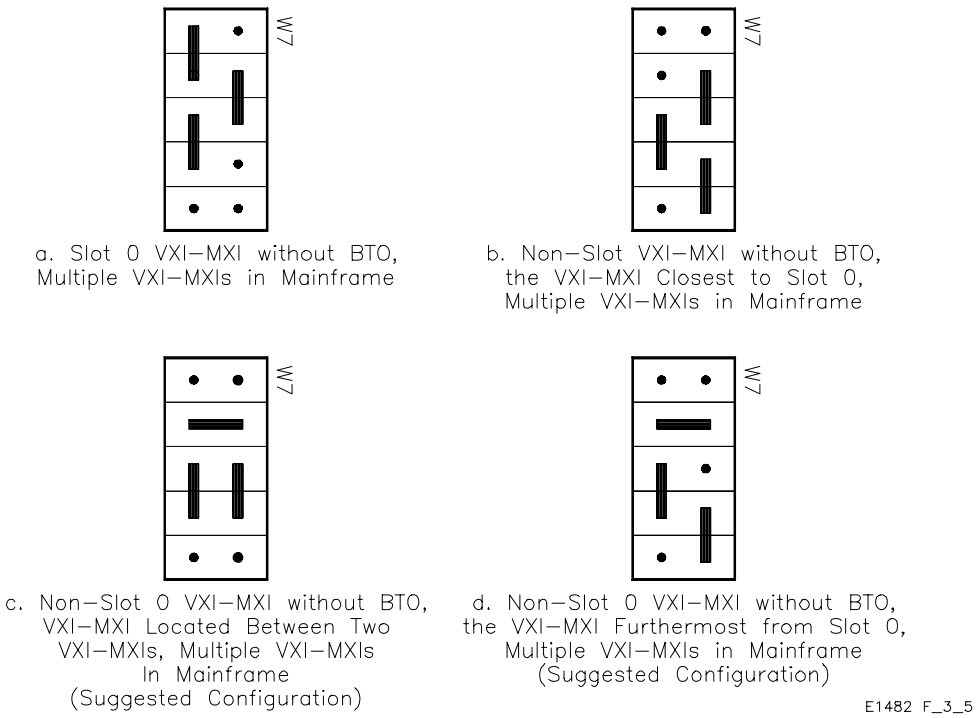


Figure 3-5. No VMEbus Timeout; Multiple VXI-MXI.

Interlocked Arbitration

Interlocked arbitration is a mode of operation in which the system performs as one large VXIbus mainframe with only one master of the entire system (VXIbus and MXIbus) at any given moment. This mode of operation prevents deadlocks by interlocking all arbitration in the VXIbus/MXIbus system. Refer to Chapter 4, "Theory of Operation," for a thorough discussion of interlocked arbitration mode.

Note: Normal operating mode does not function with a Series 700/EISA-MXI system. This controller cannot handle a bus error generated by a bus transaction that another bus master initiates.

In the normal operating mode, there can be multiple masters operating simultaneously in the VXIbus/MXIbus system. A deadlock occurs when a MXIbus master requests use of a VXIbus resource in another VXIbus mainframe while a VXIbus master in that mainframe is in the process of requesting a resource across the MXIbus. When this situation occurs, the VXIbus master must give up its bus ownership to resolve the conflict by sending a BERR signal to terminate the transfer on its VMEbus. Devices in the VXIbus mainframe must be able to detect a BERR caused by a deadlock condition so that they can retry the operation.

The VXI-MXI is shipped from the factory configured for interlocked mode. If MXIbus transfers will be occurring both into and out of the mainframe and the VXIbus modules in your system do not have the capability for handling BERR exceptions caused by deadlock conditions, you may want to configure the VXI-MXI for interlocked arbitration mode. In this mode, no changes will need to be made to software. However, parallel processing in separate VXIbus mainframes is no longer possible (as it is in the Normal mode), and system performance may be lower than in normal operating mode.

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VMEbus requesters are awarded the bus when they receive an active signal on the daisy-chained bus grant line. Requesters closest to the Slot 0 device have higher priority, therefore, than devices installed in slots further from Slot 0. For proper operation in interlocked arbitration mode, only one mainframe can have a requester at a higher priority than the VXI-MXIs in that mainframe. In all the other mainframes, the VXI-MXIs must be the highest priority requesters. In other words, the VXI-MXIs should be installed in Slot 0 and the adjacent slots with the option that one mainframe in the MXIbus link (for example, a multiframe RM) has a VMEbus requester in Slot 0. Devices in the mainframe can be configured to operate with the same or different VMEbus requester levels.

Interlocked arbitration mode has a potential for long access times. Therefore, bus timeouts should be configured for adequate times.

Interlocked arbitration mode is selected with the slide switch at location S3, as shown in Figure 3-6.

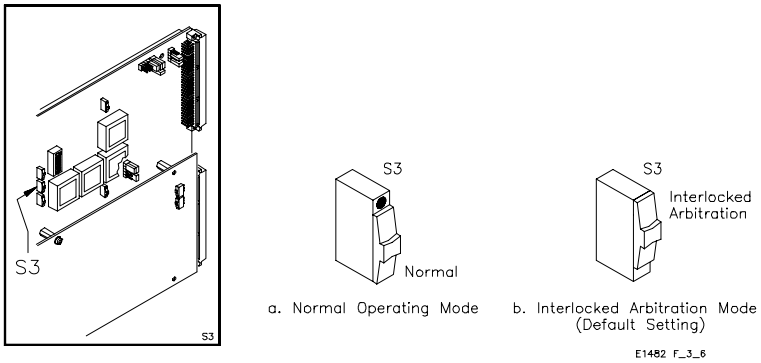


Figure 3-6. Interlocked Arbitration Mode Selection.

MXIbus System Controller

The slide switch at location S4 selects whether the VXI-MXI interface module is the MXIbus System Controller. The MXIbus System Controller is the first device in the MXIbus daisy-chain. The System Controller supplies the arbitration circuitry for MXIbus arbitration, the MXIbus interrupt acknowledge daisy-chain driver, and the MXIbus bus timeout unit. The VXI-MXI is shipped from the factory configured for non-MXIbus System Controller operation. If the VXI-MXI is the first device in the MXIbus link, change the setting of the S4 slide switch as shown in Figure 3-7 to configure the VXI-MXI as the MXIbus System Controller.

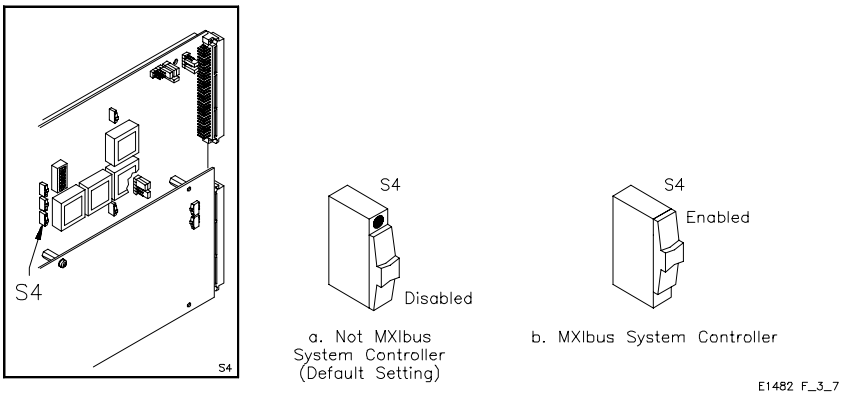


Figure 3-7. MXIbus System Controller Selection.

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MXI Controller Timeout Level

The MXIbus System Controller is also responsible for the MXIbus system timeout. The timeout period begins when a MXIbus data strobe (DS) is received and the period stops when a MXIbus DTACK or BERR is detected. If a timeout occurs, the MXIbus System Controller sends a MXIbus BERR to clear the MXIbus system. On power up, this timeout is between 100 and 400 µsec as configured by the jumper array at location W8. The timeout can be extended to a value between 100 and 400 msec by setting the LNGMXSCTO bit in the MXIbus Control Register (see Appendix B). A long MXIbus System Controller timeout is desirable in MXIbus systems with many devices or in situations where one or more MXIbus devices use a large amount of MXIbus bandwidth.

The MXI Controller Timeout Level is set with the jumper array W8, as shown in Figure 3-8. When the LNGMXSCTO bit in the MXIbus Control Register is zero, the selected timeout level is in µsec. When the LNGMXSCTO bit is one, the selected timeout level is in msec.

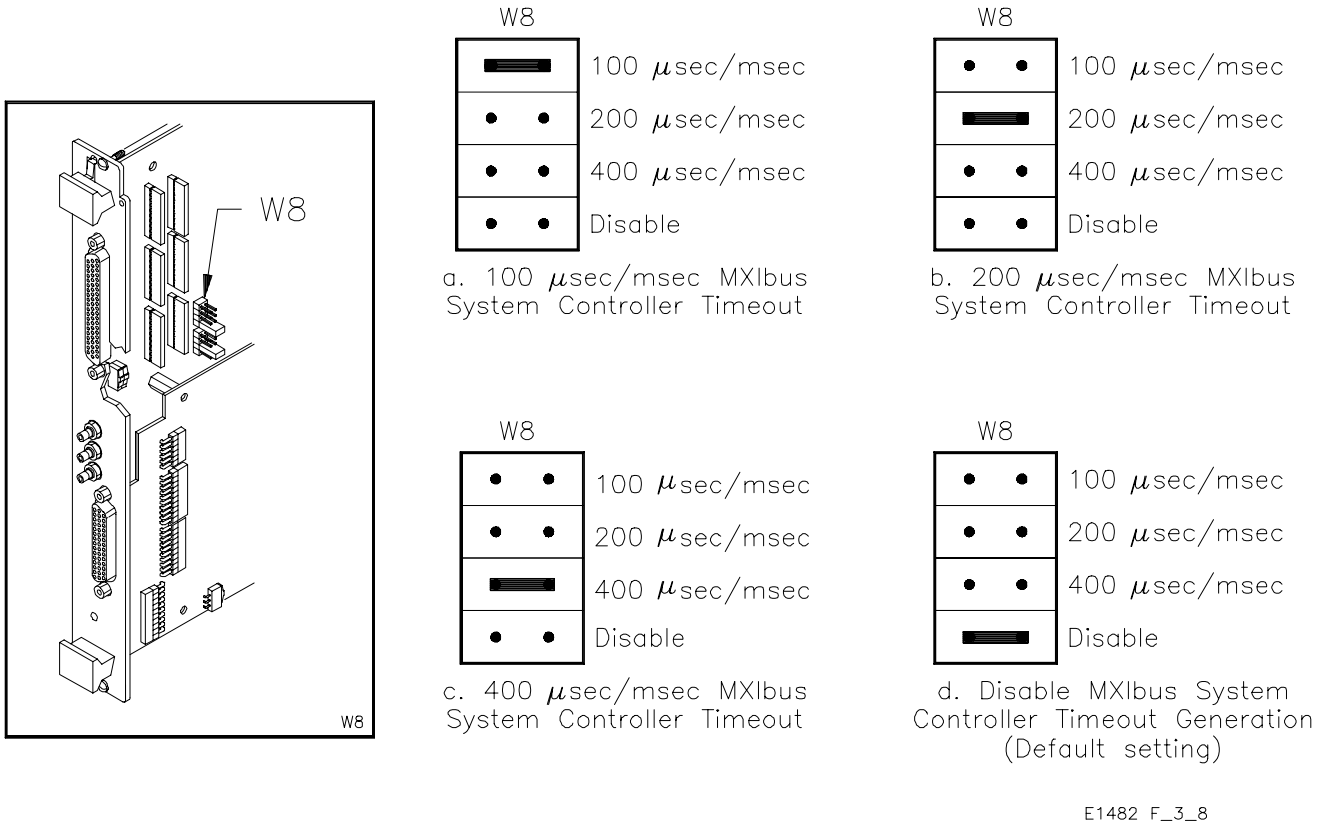


Figure 3-8. MXIbus System Controller Timeout Selection.

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MXIbus Fairness

The MXIbus fairness feature ensures that all requesting devices will be granted use of the MXIbus. This feature prevents a high priority MXIbus device from consuming all of the MXIbus bandwidth. If MXIbus fairness is enabled, a MXIbus master will refrain from driving the MXIbus bus request (BREQ*) signal active after releasing it until the master detects the MXIbus BREQ* signal inactive. MXIbus fairness ensures that all MXIbus masters have an equal opportunity to use the MXIbus. The VXI-MXI factory default setting has the MXIbus fairness feature disabled. Keep this option disabled if a device in your mainframe needs a large portion of the MXIbus bandwidth without interruptions from lower priority requesters. In an unfair system, the order in which you connect the MXIbus devices in the daisy-chain determines the priority of each device's MXIbus request. MXIbus requesters closer to the MXIbus System Controller have higher priority than those further down the MXIbus chain. The MXIbus fairness feature is enabled or disabled by the slide switch at location S2, as shown in Figure 3-9.

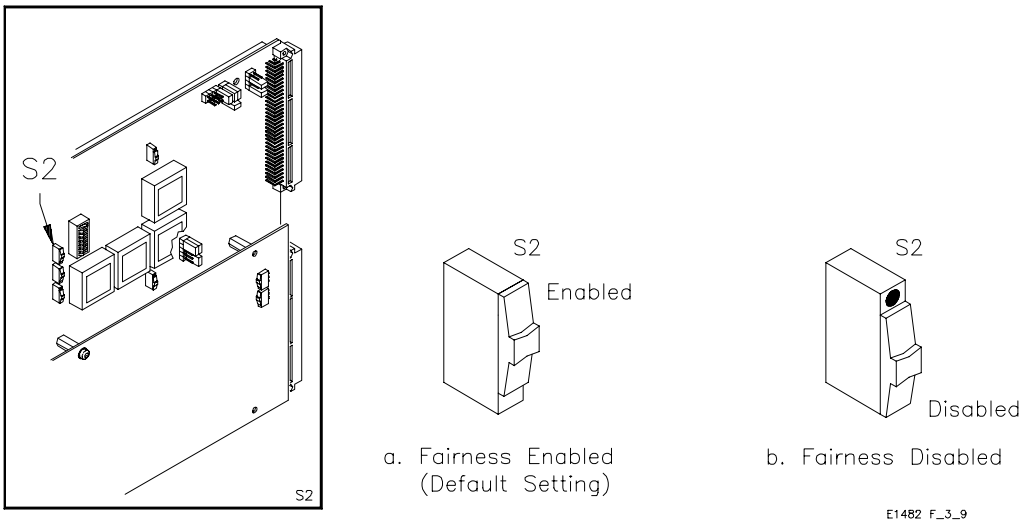


Figure 3-9. MXIbus Fairness Selection.

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CLK10 Source

The VXIbus specification requires that Slot 0 devices supply a clock signal, CLK10, on a differential ECL output. The VXI-MXI can generate the CLK10 signal from an onboard oscillator (10 MHz with a 50%±5% duty cycle), route an external clock signal from the front panel SMB connector labeled EXT CLK to the CLK10 signal, or not source the CLK10 signal at all. One of these options is chosen using the jumpers at locations W9 and W10, as shown in Figure 3-10.

The VXI-MXI is configured at the factory to be a Slot 0 device driving the CLK10 signal from the onboard oscillator. If you are installing the VXI-MXI in a slot other than Slot 0, change the W9 and W10 jumpers so that the VXI-MXI is not sourcing the CLK10 signal.

WARNING

Configuring more than one VXIbus device to drive the CLK10 lines can damage the VXIbus backplane or the CLK10 drivers on the VXIbus devices.

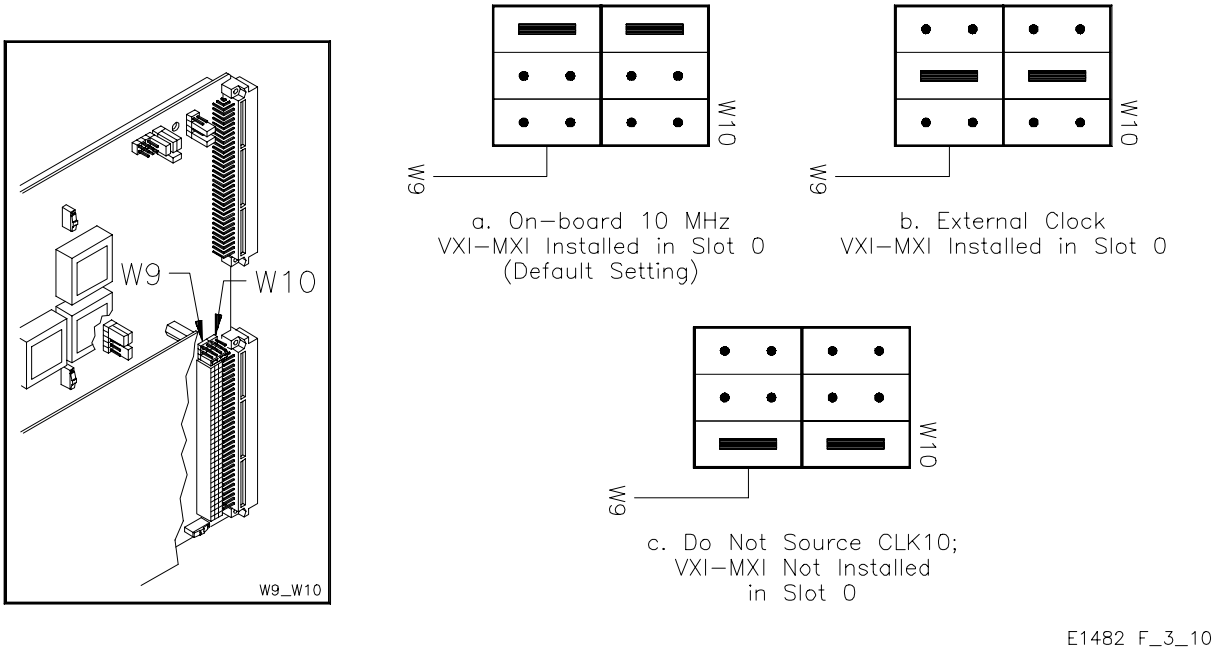


Figure 3-10. CLK10 Source Signal Options.

NOTE

You can change these jumpers without having to remove the daughter board by using a pair of needlenose pliers.

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CLK10 Mapping

CLK10 Mapping switches are located on the INTX daughter board. The daughter board is shipped from the factory with the CLK10 Mapping function disabled. The three jumper settings on the INTX daughter board are used to configure the CLK10 mapping. Figure 3-11 shows how to set the jumpers to disable CLK10 mapping, enable CLK10 to map out of (**Drive**) the mainframe, and enable CLK10 to map into (**Receive**) the VXIbus CLK10 signal.

The VXI-MXI must be installed in slot zero if you want to route the CLK10 signal to the VXIbus CLK10 signal. The CLK10 jumpers on the VXI-MXI must also be set so that the VXI-MXI is not sourcing the CLK10 signal, since the INTX signal will now be sourcing the clock signal. Figure 3-11 shows how the CLK10 Source options are set on the main circuit board.

The VXI-MXI can be installed in any slot when it is enabled to map out the CLK10 signal (Drive).

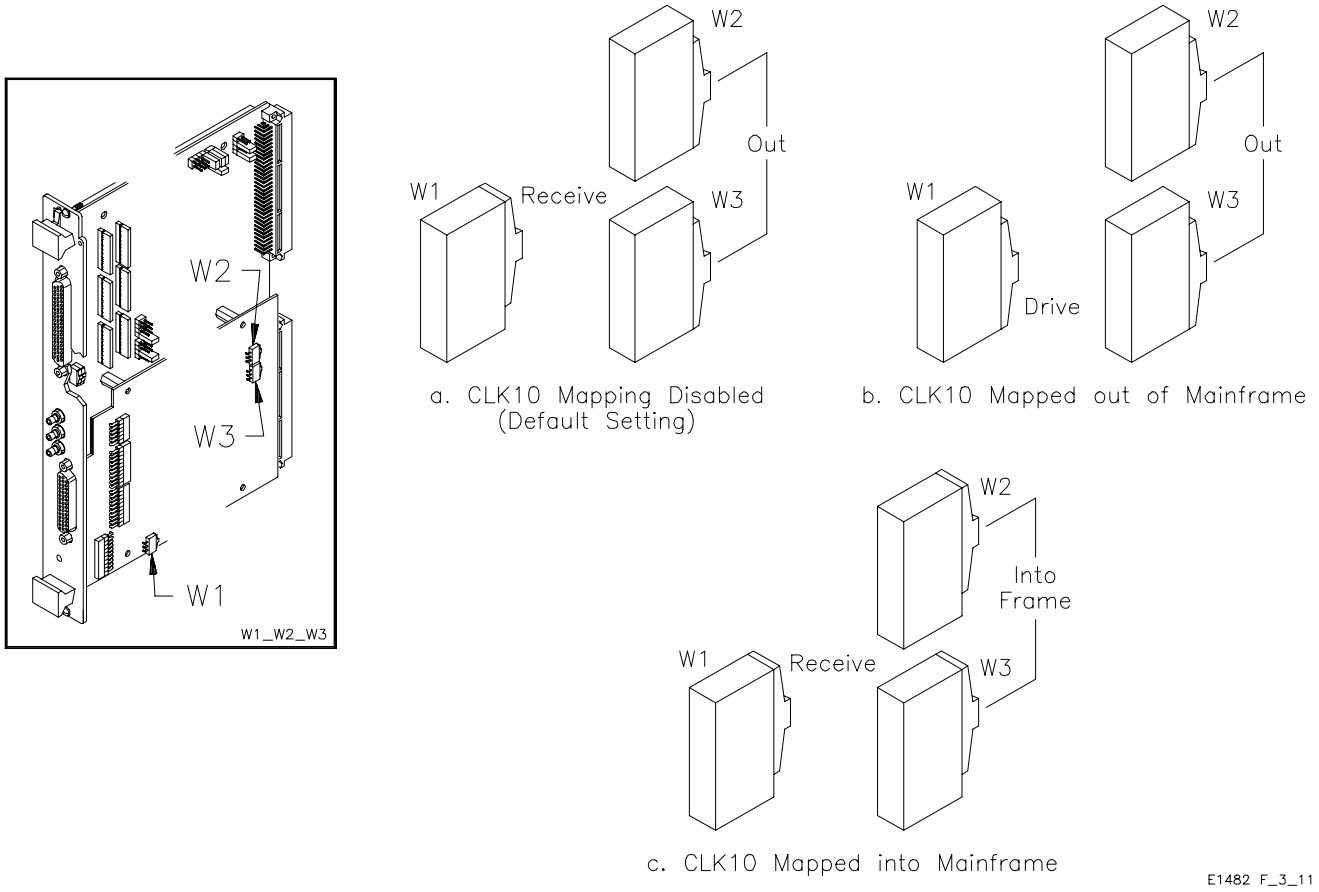


Figure 3-11. CLK10 Mapping Switches.

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EXT CLK SMB Input/Output

CLK10 signals in multiple VXIbus mainframes can be synchronized by connecting the CLK10 signals together using the EXT CLK SMB connectors on the front panel of the VXI-MXI. One mainframe should source the CLK10 signal to the SMB connection. The other device receives the CLK10 signal from the SMB connection and drives it on the VXIbus CLK10 lines. This device must be installed in Slot 0 so that it can drive the VXIbus CLK10 signal. The CLK10 Source Select jumpers, W9 and W10, should be set to select an external clock. EXT CLK SMB can be used as an **Input** to receive a CLK10 signal to drive on the VXIbus, or as an **Output** to source the CLK10 signal to another VXIbus mainframe. Figure 3-12 shows the **Input/Output** settings set by slide switch S6.

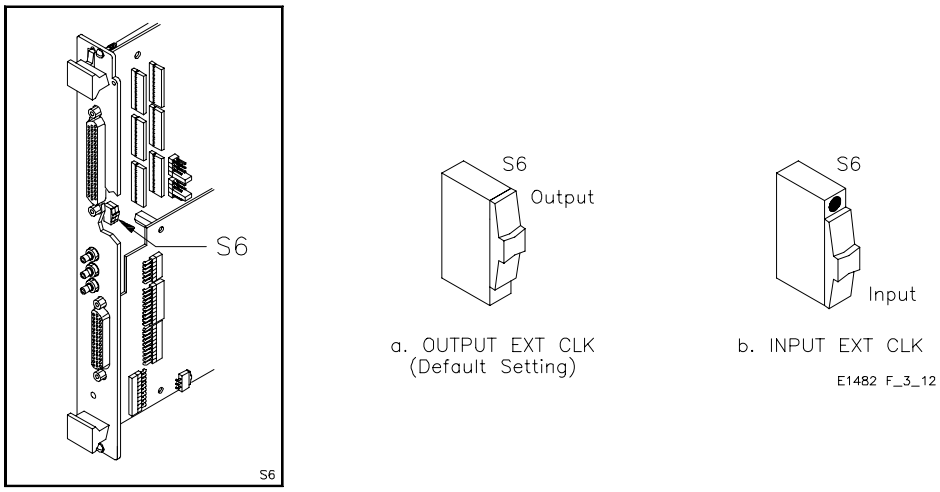


Figure 3-12. EXT CLK SMB Input/Output Setting.

Trigger Input Termination

The Trigger Input SMB connector can be terminated to 50 ohms by changing the position of slide switch S5. See Figure 3-13.

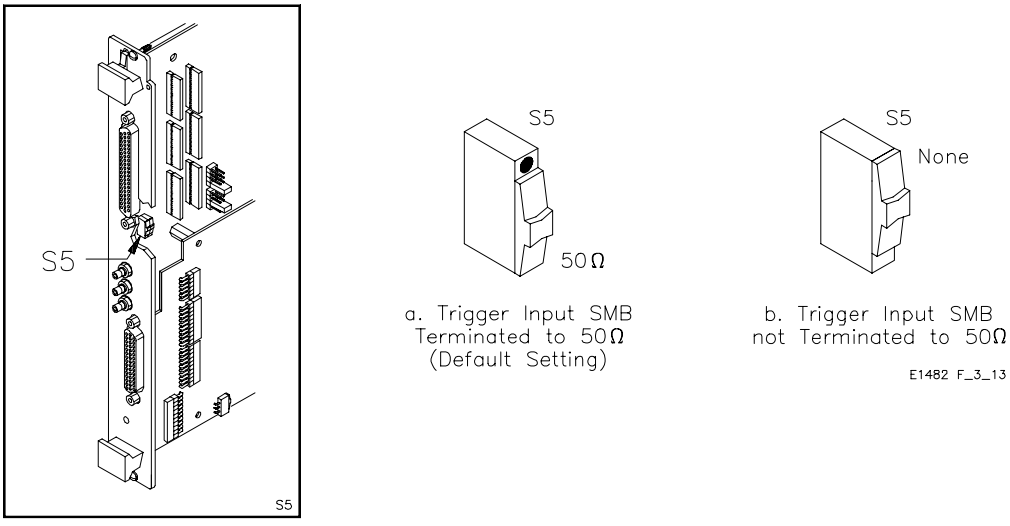


Figure 3-13. Trigger Input Termination Option Settings.

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Front Panel Pushbutton Reset

A pushbutton system reset switch is located on the front panel of the VXI-MXI. This button generates an active low pulse for at least 200 msec when depressed. Using slide switch S7, you can route the pulse to either VMEbus signal ACFAIL* or SYSRESET*. See Figure 3-14.

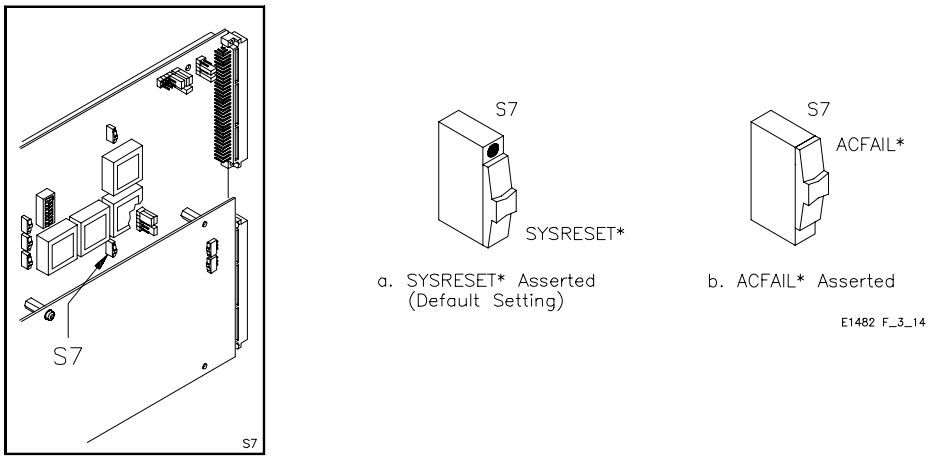


Figure 3-14. Pushbutton System Reset Settings.

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Chapter 4

Theory of Operation

About this Chapter

A brief description of the VXI-MXI is given in Chapter 1 along with a functional block diagram (see Figure 1-1). The major elements of the VXI-MXI are discussed in more detail in this chapter. For a detailed discussion of the VXIbus, refer to the VXIbus specification and the VMEbus specification. For a description of MXIbus, refer to the MXIbus specification.

VXIbus Address & Address Modifier Transceivers

The VXIbus address transceivers and associated logic control the direction of the VMEbus address lines and latch incoming address lines on the rising edge of the VMEbus Address Strobe (AS*) signal. The VMEbus Address Modifier lines are also controlled by this circuitry and are also latched on the rising edge of AS*.

VXIbus System Controller Functions

If the VXI-MXI is configured as the VMEbus System Controller, this circuitry provides the 16-MHz VMEbus system clock and the VMEbus data transfer bus arbiter. It also sources the CLK10 signal and provides a MODID register, as required for a VXIbus Slot 0 device.

The 16-MHz system clock driver is derived from an onboard clock with an accuracy of 100 ppm and a duty cycle of 50%±5%. The data transfer bus arbiter capability (PRI ARBITER) accepts bus requests from all four VMEbus requester levels, prioritizes the requests, and grants the bus to the highest priority requester.

The VXIbus specification requires Slot 0 devices to generate the VXIbus CLK10 signal on a differential ECL output. The VXI-MXI has the option to source this CLK10 signal with either an onboard 10-MHz clock with a 50% duty cycle, or an external frequency source connected to the EXT CLK SMB connector on the front panel. The MODID register required for Slot 0 devices is used to control and monitor the MODID lines. In accordance with the VXIbus specification for a Slot 0 device, the VXI-MXI pulls up each MODID line with a 16.9 kΩ resistor. When the VXI-MXI is not a Slot 0 device, the MODID0 line is pulled to ground with a 825Ω resistor.

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VXIbus Data Transceivers

The VMEbus data transceivers control the sending and receiving of data on the 32-bit data bus from the VMEbus.

VXIbus Control Signal Transceivers

The VXIbus control signal transceivers control the sending and receiving of the VXIbus control signals such as address strobe (AS*), the data strobes (DS1*, DS0*), longword (LWORD*), read/write (WRITE*), data transfer acknowledge (DTACK*), and bus error (BERR*). These signals indicate the beginning and end of a transfer, the size of data involved in the transfer (8, 16 or 32 bits), whether the transfer is a read or a write, and whether the transfer was successful.

VMEbus Requester and Arbiter Circuitry

Through the VMEbus requester and arbiter circuitry, a remote MXIbus device can access main memory in the VXIbus system via the VMEbus. The arbiter circuitry is only active on the VXI-MXI if it is configured as the VXI Slot 0 device.

The VXI-MXI requests use of the VMEbus when it detects a MXIbus address that maps through one of the mapping windows to the VMEbus. The VXI-MXI drives its VMEbus request line active to initiate arbitration for the VMEbus. When the VXI-MXI is the highest priority requesting device, the VMEbus System Controller sends a bus grant signal indicating that the VMEbus is granted to the VXI-MXI. The VXI-MXI drives the VMEbus BBSY* signal indicating that it owns the VMEbus, and then releases its bus request line.

A remote MXIbus device can lock the VMEbus so that it can perform indivisible operations across the VMEbus. When the LOCK bit in the Local Bus Lock Register is set by a MXIbus device, the VXI-MXI interface will not release the VMEbus the next time it is granted the bus (on the next transaction) until the LOCK bit is cleared by a MXIbus device.

TTL and ECL Trigger Lines and CLK10 Circuitry

The VXIbus TTL trigger lines (TTLTRG[7-0]), ECL trigger lines (ECLTRG[1-0]), and CLK10 circuitry provide triggering and synchronization for intermodule and interchassis communication. For connecting trigger lines and clock signals between mainframes, the VXI-MXI front panel has a TRG IN (Trigger In), a TRG OUT (Trigger Out), and an EXT CLK (External Clock) SMB connector. Trigger lines can be mapped out of the VXIbus or routed into the mainframes via the TRG OUT and TRG IN front panel connectors so that VXIbus devices in one mainframe can be configured to trigger devices in other mainframes. By writing to the MXIbus Trigger Configuration Register, individual VXIbus trigger lines can be selectively driven from the TRG IN SMB connector or sourced to the TRG OUT SMB connector.

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Using the Trigger Mode Selection Register and/or the Drive Triggers Register, the VXI-MXI can source and/or accept Asynchronous, Synchronous, Semi-synchronous, and Start/Stop trigger protocols, defined by the VXIbus specification, on any TTL or ECL Trigger Line. The VXI-MXI can be configured to generate an interrupt on the rising and/or falling edge of any trigger signal. This interrupt can be used to receive trigger protocols.

The Asynchronous protocol uses two trigger lines to communicate between a single source and a single acceptor. The source device initiates the operation by asserting the lower-numbered trigger line. The acceptor acknowledges by asserting the higher-numbered trigger line.

The Synchronous protocol is a single trigger line broadcast that does not require an acknowledge from its acceptors. The source must assert the trigger for a minimum of 30 nsec and allow at least 50 nsec between assertions. The rising edge or falling edge can be specified to initiate action in the receiver.

The Semi-synchronous protocol uses a single trigger line to communicate between a single source and multiple acceptors. The source device initiates the protocol by pulsing the trigger line for a minimum of 50 nsec. The acceptors must then assert the same trigger line within 40 nsec and release the line when each is ready for the next operation. The source sees the trigger line unasserted when all acceptors have released the trigger line, indicating that the operation is complete. The Trigger Mode Selection Register can be used to configure the VXI-MXI to source and receive the semi-synchronous protocol.

The Semi-synchronous protocol must be separated into two trigger lines when extended between two VXIbus mainframes: one line for the source and one line for the acceptor. Because acceptor devices must assert the trigger line within 40 nsec in response to the source asserting the line, this protocol can only be used for short extensions.

The Start/Stop protocol is used to start and stop modules synchronously on the same 10-MHz clock. The Slot 0 device drives the selected trigger line and synchronizes it to the 10-MHz clock. When asserted, the trigger line indicates a Start signal. When unasserted, the trigger line indicates a Stop signal.

The VXI-MXI can be configured either to drive its 10-MHz VXIbus CLK10 signal to other mainframes, or to receive a 10-MHz CLK10 signal from another mainframe via the EXT CLK SMB connector on the front panel. Multiple mainframes can be synchronized if configured to operate with the same 10-MHz CLK10 system clock.

SYSFAIL, ACFAIL, and SYSRESET

The VMEbus signals SYSFAIL*, ACFAIL*, and SYSRESET* can be individually monitored and driven by the VXI-MXI card. These three signals can also be used individually to generate an interrupt across the MXIbus IRQ line and/or one of the VMEbus interrupt request lines.

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Interrupt Circuitry

The MXIbus has one interrupt line, IRQ. This IRQ line can be mapped to or driven by one of the VMEbus interrupt lines IRQ[7-1]* or driven by VMEbus signals SYSFAIL*, ACFAIL*, and/or SYSRESET*, or the TRIGINT trigger interrupt. Registers in the MXIbus configuration space are used to configure the MXIbus IRQ* line operation.

Five local VXI-MXI conditions can be enabled to drive the VMEbus interrupt lines: SYSFAIL* asserted, ACFAIL* asserted, the Backoff condition, a Trigger Synchronous interrupt condition, and a Trigger Asynchronous interrupt condition.

The Backoff condition occurs when the VXI-MXI is a MXIbus master arbitrating for the MXIbus and a MXIbus transfer requesting the VMEbus is received. This situation results in a deadlock condition. The MXIbus master circuitry must send a BERR* to the VMEbus master initiating the MXIbus transfer so that the incoming transfer can complete. The VMEbus master can monitor the backoff interrupt. If the interrupt occurs, the master should retry its last MXIbus operation because it did not complete due to the deadlock condition.

The two trigger interrupt conditions are Trigger Synchronous and Trigger Asynchronous. A synchronous trigger interrupt occurs when the input trigger signal changes from low to high. The asynchronous trigger interrupt occurs when the input trigger signal changes from high to low. These interrupts can be used to receive trigger protocols.

VMEbus interrupt requests can be handled by an interrupt handler on another VMEbus device in the VXIbus mainframe or by an external device on the MXIbus. The VXI-MXI has IACK daisy-chain driver circuitry that passes interrupt acknowledge cycles not meant for the VXI-MXI to other interrupters in the VXIbus mainframe. Similarly, the MXIbus has an IACK daisy-chain mechanism that converts and passes interrupt acknowledge cycles from VMEbus to MXIbus to VMEbus, making transparent interrupt acknowledge cycles possible between VXIbus mainframes. Because multiple VMEbus IRQ lines can be mapped onto the single MXIbus IRQ line, interrupt acknowledge sequences for MXIbus IRQ requests cannot be completely transparent. You can have completely transparent interrupt handling through the use of the INTX daughter card option, in which each VMEbus interrupt line is mapped on a separate signal.

When multiple VMEbus IRQ lines are mapped onto the single shared MXIbus IRQ line, the interrupt handler routine can acknowledge the interrupts in one of two ways.

1. If the interrupt handler cannot perform MXIbus IACK cycles, it must poll all MXIbus devices to determine the source of the MXIbus IRQ signal. The interrupt handler polls the MXIbus IRQ Configuration Register and the Interrupt Status Register of each VXI-MXI on the MXIbus link to determine which VMEbus IRQ line is being sourced onto the MXI IRQ line. The interrupt handler can then read from the corresponding IRQ acknowledge register on the VXI-MXI driving the MXIbus IRQ line to acknowledge the interrupt request.

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2. If the interrupt handler can generate MXIbus IACK cycles, it is not necessary to poll MXIbus devices to find the source of the MXIbus IRQ signal. The interrupt handler can perform an IACK cycle for the VMEbus line onto which the MXIbus IRQ line is mapped in that frame. The VXI-MXI driving the MXIbus IRQ line responds with a Status/ID value in which the lower byte is the logical address of the VXI-MXI. The interrupt handler then polls the MXIbus IRQ Configuration Register and the Interrupt Status Register on the VXI-MXI at the logical address specified by the Status/ID value received to determine which VMEbus IRQ line is routed onto the MXIbus IRQ line. The interrupt handler can then read from the corresponding VXI-MXI IRQ acknowledge register to acknowledge the interrupt request.

When this process is completed and if another VMEbus IRQ is also driving the MXIbus IRQ, the interrupt handler module is interrupted again, and should follow the same procedure described above.

MXIbus defines a special interrupt acknowledge (IACK) cycle, which is denoted with a special MXIbus address modifier code, hex 12. When a VMEbus interrupt handler generates a VMEbus IACK cycle for an active interrupt request line that is mapped into its VXIbus mainframe from the MXIbus IRQ line, the VMEbus IACK cycle is converted into a MXIbus IACK cycle. The VXI-MXI driving the interrupt request initiates a VMEbus IACK cycle when it detects the MXIbus IACK cycle, and responds by driving its Status/ID on the data bus and asserting DTACK*. The interrupt handler receives the Status/ID and DTACK* from across the MXIbus as if it had been in the same mainframe as the VXI-MXI.

The Status/ID information returned by the remote VXI-MXI indicates its logical address. With this information, the interrupt handler can poll the remote VXI-MXI to determine which interrupt lines are mapped onto the MXIbus IRQ line and which interrupt lines are active. The interrupt is then acknowledged by reading the corresponding register shown in Table 4-1.

Multiple MXIbus devices can interrupt on the same interrupt line; therefore, a MXIbus interrupt acknowledge daisy-chain is required. The MXIbus GIN and GOUT signals are normally used for the arbitration bus grant in/bus grant out daisy-chain. However, when a MXIbus device initiates a MXIbus IACK cycle and drives the MXIbus address modifier code hex 12, the MXIbus GIN and GOUT lines are used as the interrupt acknowledge daisy-chain. The MXIbus System Controller starts the interrupt acknowledge daisy-chain when it detects the address modifier code hex 12. The interrupt acknowledge signal propagates down the daisy-chain to each MXIbus device. If the device is not interrupting the MXIbus, it passes the signal down the daisy-chain to the next device. If the MXIbus device is interrupting, the cycle is converted into a VMEbus IACK cycle.

A MXIbus device not capable of generating a MXIbus IACK cycle can service an interrupt in a remote VXIbus mainframe by reading from a designated address in the MXIbus configuration space on the remote VXI-MXI. The external device must know which VMEbus interrupt level it is servicing and read from the appropriate address. Table 4-1 shows the designated addresses for VMEbus IRQ[7-1].

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Table 4-1. VXI-MXI Addresses for VME Interrupt Levels.

VMEbus IRQ Line	VXI-MXI Configuration Register to Read
VMEbus IRQ1	Interrupt Acknowledge 1 (VXI-MXI offset=32)
VMEbus IRQ2	Interrupt Acknowledge 2 (VXI-MXI offset=34)
VMEbus IRQ3	Interrupt Acknowledge 3 (VXI-MXI offset=36)
VMEbus IRQ4	Interrupt Acknowledge 4 (VXI-MXI offset=38)
VMEbus IRQ5	Interrupt Acknowledge 5 (VXI-MXI offset=3A)
VMEbus IRQ6	Interrupt Acknowledge 6 (VXI-MXI offset=3C)
VMEbus IRQ7	Interrupt Acknowledge 7 (VXI-MXI offset=3E)

Reading from one of the addresses listed in Table 4-1 initiates a VMEbus IACK cycle. The information sent back from the read is the VXIbus Status/ID information defined in the VXIbus specification. The lower byte of the Status/ID is the logical address of the responding interrupter. The upper byte is user defined.

When one of the local VXI-MXI interrupt conditions is serviced by an interrupt handler, the Status/ID information returned is as follows:

15	14	13	12	11	10	9	8
LINT3	LINT2	LINT1	ACFAILINT	BKOFF	TRIGINT	SYSFAIL	ACFAIL
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
LADD7	LADD6	LADD5	LADD4	LADD3	LADD2	LADD1	LADD0

The VMEbus interrupt lines can be individually driven by writing to the Interrupt Status/Control Register. When one of these interrupt requests is serviced by an interrupt handler, the information in the Status/ID Register is returned during the IACK cycle and the interrupt request is cleared.

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Parity Check and Generation

All MXIbus devices are required to generate even parity. The VXI-MXI always generates and checks parity on all 32 MXIbus address and data lines. If upper bytes of the address or data are not driven, these lines are pulled high by the MXIbus termination circuitry and do not affect the parity generation.

A32, A24, A16, and LA Windows

Four addressing windows map in and out of the VXIbus mainframe. These windows represent the three VMEbus address spaces (A32, A24, and the lower 48 kilobytes of A16) plus a dedicated window for mapping the VXIbus configuration space (the upper 16 kilobytes of A16). For each window, the range that maps into the mainframe from the MXIbus to the VXIbus is whatever is left over from the window that maps out of the mainframe from the VXIbus to the MXIbus. VXI-MXI configuration registers are used to program these windows to indicate which addresses in each window are mapped onto the MXIbus.

VXI-MXI Configuration Registers

The VXI-MXI configuration registers are accessible from both the VXIbus and the MXIbus and are used to configure the VXI-MXI. These registers are described in detail in Appendix B, "Register Descriptions."

When the VXI-MXI interface decodes a VMEbus address specifying the configuration space on the card, the least significant VMEbus address lines are used to specify the registers in configuration space and the VMEbus operation does not need to request control of the MXIbus. Similarly, when the VXI-MXI interface decodes a MXIbus address specifying configuration space on the card, the least significant MXIbus address lines are used to specify the registers in configuration space and the access does not need to request control of the VMEbus. Onboard circuitry automatically arbitrates between the MXIbus and VMEbus for use of the dual-ported configuration space and prevents deadlock conditions on configuration space accesses.

MXIbus Master Mode State Machine

This state machine converts VXIbus cycles mapped into a MXIbus window into MXIbus cycles.

The VXI-MXI continuously compares VMEbus addresses and address modifiers to the four MXIbus addressing windows. When a VMEbus transfer involving an address corresponding to one of the outward mapping windows is detected, the VXI-MXI begins arbitrating for the MXIbus. The VXI-MXI can translate A32, A24, A16, D32, D16, and D08(EO) VMEbus transfers into corresponding MXIbus master mode transfers.

When the VXI-MXI wins ownership of the MXIbus, a MXIbus cycle is initiated and the VMEbus transfer is converted into a MXIbus transfer. The MXIbus address and address strobe are sent, followed by the data (if the transfer is a write) and a data strobe. The transfer is complete when the responding device sends DTACK* and the VXI-MXI releases the data strobe and address strobe. The VXI-MXI

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interface supports 8-bit, 16-bit, and 32-bit reads and writes across the MXIbus. The least significant data bit maps to MXIbus data line AD00 and the byte orientation on the MXIbus is standard 68000 format. Communication across the MXIbus between devices in separate VXIbus mainframes appears as normal transfers to the devices. The bus cycles are mapped from one device through the addressing windows, across the MXIbus, and through address windows on the second device. The first device initiates the transfer with an address strobe and data strobe, and the second device responds by asserting DTACK* or BERR*. Figure 4-1 illustrates that a master device initiates a transfer on the VMEbus, which is converted into a MXIbus transfer, then back into a VMEbus transfer to reach the target slave.

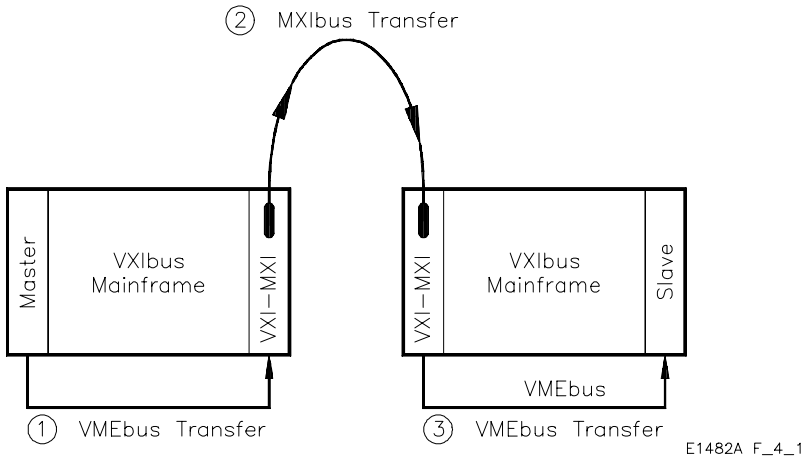


Figure 4-1. Master to Slave VMEbus/MXIbusTransfers.

The 32 VMEbus address lines map directly to the 32 MXIbus address lines. The VMEbus requires six address modifier lines, while MXIbus only defines five. The VMEbus address modifier lines map to the MXIbus address modifier lines as shown in Table 4-2. The VXI-MXI responds to the VMEbus address modifier codes shown in Table 4-3.

Table 4-2. Master to Slave VMEbus/MXIbus Transfers

VMEbus Address Modifier Line	MXIbus Address Modifier Line
VMEbus AM5	MXIbus AM4
VMEbus AM4	MXIbus AM3
VMEbus AM2	MXIbus AM2
VMEbus AM1	MXIbus AM1
VMEbus AM0	MXIbus AM0

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Table 4-3. Transfer Responses for VME Addr. Modifier

AM5	AM4	AM3	AM2	AM1	AM0	Transfer Type
H	H	H	H	H	H	A24 supervisory block transfer
H	H	H	H	H	L	A24 supervisory program access
H	H	H	H	L	H	A24 supervisory data access
H	H	H	L	H	H	A24 nonpriveledged block transfer
H	H	H	L	H	L	A24 nonpriveledged program access
H	H	H	L	L	H	A24 nonpriveledged data access
H	L	H	H	L	H	A16 supervisory access
H	L	H	L	H	L	MXIbus transparent IACK cycle
H	L	H	L	L	H	A16 nonpriveledged access
L	L	H	H	H	H	A32 supervisory block transfer
L	L	H	H	H	L	A32 supervisory program access
L	L	H	H	L	H	A32 supervisory data access
L	L	H	L	H	H	A32 nonpriveledged block transfer
L	L	H	L	H	L	A32 nonpriveledged program access
L	L	H	L	L	H	A32 nonpriveledged data access

Information specifying the number of bytes and which bytes are involved in a VMEbus transfer is sent on data strobe lines DS1* and DS0*, address line A01, and the LWORD* line. During MXIbus transfers, the same information is transferred on the Size line, and Address/Data lines 1 and 0 (AD01 and AD00). The VMEbus transfer size information is converted into MXIbus transfer size information during a MXIbus master transfer. Table 4-4 compares this information for the VMEbus and the MXIbus.

Table 4-4. VMEbus/MXIbus Transfer Size Comparison

	VMEbus				MXIbus			Bus Loactions			
	DS1*	DS0*	A01	LWORD*	Size	AD01	AD00	D24-31	D16-23	D08-15	D00-07
8-bit Transfers											
Byte(0)	0	1	0	1	0	0	0			Byte(0)	
Byte(1)	1	0	0	1	0	0	1				Byte(1)
Byte(2)	0	1	1	1	0	1	0			Byte(2)	
Byte(3)	1	0	1	1	0	1	1				Byte(3)
16-bit Transfers											
Byte(0-1)	0	0	0	1	1	0	0			Byte(0)	Byte(1)
Byte(2-3)	0	0	1	1	1	1	0			Byte(2)	Byte(3)
32-bit Transfers											
Byte(0-3)	0	0	0	0	1	1	1	Byte(0)	Byte(1)	Byte(2)	Byte(3)

The VXI-MXI generates and checks the parity of the address and data portions of all MXIbus cycles. The MXIbus PAR* signal is generated and sent during the address portion of all MXIbus cycles initiated by the VXI-MXI. It is also generated and sent during the data portion of MXIbus master write cycles. When the VXI-MXI detects a parity error in the data transfer portion of a MXIbus read cycle, it asserts the VMEbus BERR* signal to indicate to the VMEbus host that the data read contains an error.

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Deadlock occurs when a VMEbus master is arbitrating for the MXIbus at the same time that a remote MXIbus device is requesting the same VMEbus. This situation is shown in Figure 4-2 where the VMEbus master arbitrating for the MXIbus is the VXI-MXI in VXIbus Mainframe #2 and the remote MXIbus device requesting the VMEbus is in VXIbus Mainframe #1.

To overcome the deadlock condition, the VMEbus master that is arbitrating for the MXIbus terminates the transfer request by sending a BERR* to the VMEbus. The remote MXIbus transfer to the VMEbus can then arbitrate for the VMEbus and complete the transfer. In the situation in Figure 4-2, the VXI-MXI in VXIbus Mainframe #2 will send the VMEbus BERR* signal to resolve the deadlock condition. A Backoff condition occurs when a MXIbus master must terminate a transfer before acquiring the MXIbus in order to prevent deadlock. A VMEbus interrupt can be generated on this condition.

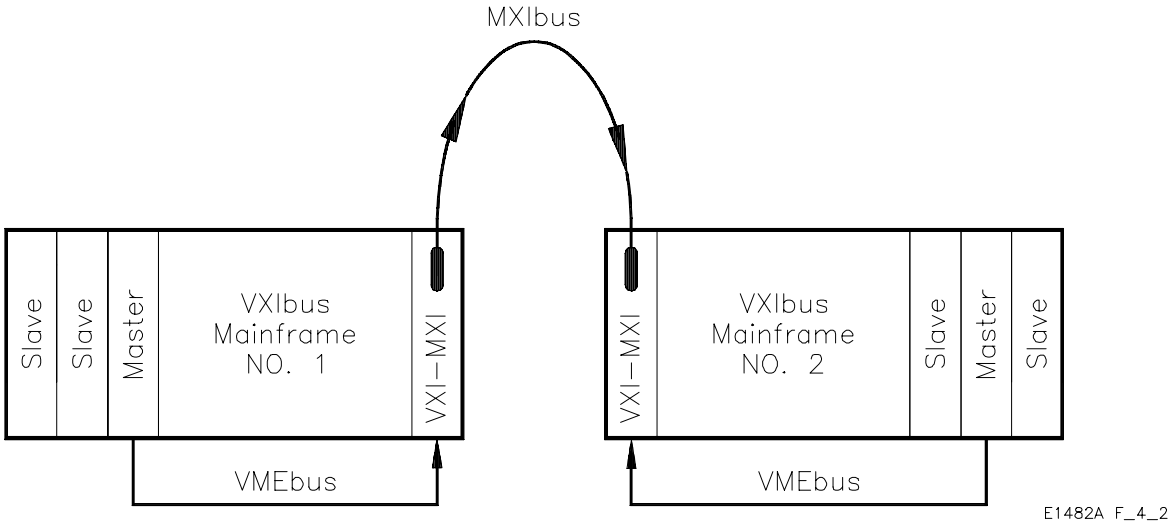


Figure 4-2. Deadlock Situation.

If the VXI-MXI responds with a VMEbus BERR* to a transfer initiated by a VXIbus device, the transfer was not completed successfully. The following situations are possible reasons for an unsuccessful transfer:

- A MXIbus timeout occurred.
- A local timeout occurred.
- A parity error occurred in the address or data portion of the transfer.
- A transfer attempted to access non-existent memory.

The MXIbus has a built-in block mode capability for high-speed transfers. VMEbus block mode transfers, which are identified by an address modifier code, and which are directed to outward windows through the VXI-MXI to the MXIbus, are transparently converted into MXIbus block transfers. Block mode MXIbus operations improve MXIbus performance because a single address is sent at the

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beginning of a block mode cycle. As block mode transfers can span over the address range of two MXIbus devices, all MXIbus slave devices are responsible for latching the initial address broadcast and for generating the successive addresses to determine if any of the remaining transfers of the block mode operation are directed to the slave. The amount of increment between successive addresses depends on whether the block mode transfer is 8 bits, 16 bits, or 32 bits wide.

MXIbus Slave Mode State Machine

This state machine converts MXIbus cycles mapped through a MXIbus window into the VXIbus mainframe into VXIbus cycles.

When the VXI-MXI is addressed by a remote MXIbus device, the VXI-MXI translates MXIbus 8-bit, 16-bit, and 32-bit read and write cycles into VMEbus read and write cycles in A16, A24 or A32 space. The VXI-MXI interface responds to 8-bit or 16-bit reads and writes to onboard registers located in MXIbus configuration space.

The VXI-MXI is continuously comparing MXIbus addresses and address modifiers to the four mapping windows. The VXI-MXI only responds to the address modifier codes listed in Table 4-3. When a transfer involving an address in one of the inward windows is detected, the VXI-MXI begins arbitrating for the VMEbus. When the VXI-MXI wins the VMEbus, the MXIbus transfer is converted into a VMEbus transfer. The data transfer size information is converted from MXIbus signals to VMEbus signals as shown in Table 4-4. The transfer is complete when the responding VMEbus device sends a DTACK or BERR signal across the MXIbus and the remote MXIbus device releases the address strobe and data strobe.

The VXI-MXI circuitry generates and checks parity during the address and data portions of all MXIbus cycles. The VMEbus is not requested if the MXIbus address received has a parity error. Parity is also checked when MXIbus data is written to the VXI-MXI slave circuitry. If a parity error occurs, the bad data is not written to the VMEbus and a BERR is sent back to the MXIbus master. The MXIbus PAR* signal is generated and sent during a MXIbus slave read cycle.

When the MXIbus address strobe remains low during multiple data transfers, the VXI-MXI interprets the transfer in one of three ways, depending upon the information sent on the address modifier lines and the state of the RMWMODE bit in the MXIbus Status/Control Register:

- If the address modifiers indicate a VMEbus block mode transfer, the MXIbus transfer is converted directly into a VMEbus block mode transfer, regardless of the state of the RMWMODE bit. MXIbus does not limit the length of the block transfer in any way; however, the VMEbus specification limits VMEbus block transfers to a maximum of 256 bytes in length. The VXI-MXI, therefore, will initiate a new block transfer after every 256 bytes of the MXIbus block transfer.
- If the RMWMODE bit is 0 and the address modifiers sent across the MXIbus indicate a non-VMEbus block mode transfer, the MXIbus transfer is interpreted as a read/modify/write (RMW) cycle and is converted into a VMEbus RMW cycle.

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- If the RMWMODE bit is 1 and the address modifiers sent across the MXIbus indicate a non-VMEbus block mode transfer, the VXI-MXI uses onboard 32-bit counters to convert the MXIbus block mode transfer into many VMEbus single cycle transfers. All MXIbus slaves are required to latch the MXIbus address into onboard address counters on the assertion edge of AS* and increment the counters on each trailing edge of DS*.

The length of a MXIbus block transfer is not limited to the address space of a single MXIbus device. A MXIbus master can perform a single block mode transfer to multiple address-consecutive MXIbus slaves. For this reason, each MXIbus slave must continually monitor the address count of all MXIbus block mode transfers and decode the output of the address counters to determine if the block transfer crosses into its inward address window. At any time the transfer can cross into one of the VXI-MXI's inward windows, requiring the circuitry to respond to the transfer.

MXIbus Address/Data and Address Modifier Transceivers

The MXIbus address/data transceivers and the associated circuitry multiplex and de-multiplex the MXIbus address and data information from the MXIbus AD[31-0] lines and control the direction of address and data flow. Address and address modifier information from the MXIbus is latched on the rising edge of the MXIbus address strobe. The address is latched into address counters that are incremented on each falling edge of the MXIbus data strobe.

MXIbus specifies trapezoidal bus transceivers to reduce noise and crosstalk in the MXIbus transmission system. These transceivers have open collector drivers that generate precise trapezoidal waveforms with typical rise and fall times of 9 nsec. The trapezoidal shape, due to the constant rise and fall times, reduces noise coupling to adjacent lines. The receiver uses a low pass filter to remove noise in conjunction with a high-speed comparator that differentiates the trapezoidal-shaped signal from the noise.

MXIbus cables are matched impedance cables. Each MXIbus signal line is twisted with a ground line and the impedance is controlled by the thickness of the insulation around the wires. This impedance matching minimizes skew between signals because they travel down the cable at the same speed. Signal reflections are also minimized because the signals travel through the same impedance as they daisy-chain through multiple cables. Termination resistor networks are placed at the first and last MXIbus devices to minimize reflections at the ends of the cable.

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MXIbus System Controller Functions

If the VXI-MXI is the MXIbus System Controller, this circuitry provides the MXIbus arbiter, interrupt daisy-chain generation, and the MXIbus System Controller timeout logic.

An onboard slide switch sets whether or not the VXI-MXI interface board is the MXIbus System Controller. If it is the system controller, the VXI-MXI must be the first device in the MXIbus daisy-chain. Onboard arbitration circuitry transparently performs the MXIbus arbitration for the MXIbus chain. If the VXI-MXI interface board is not the first device in the MXIbus daisy-chain, it can still be configured as the MXIbus System Controller. However, any devices in the MXIbus daisy-chain that are upstream from the MXIbus System Controller cannot be MXIbus masters because they will never be granted control of the MXIbus.

The MXIbus System Controller is also responsible for the MXIbus system timeout. This timeout, typically 200 µsec, begins when a MXIbus data strobe is received and stops when a MXIbus DTACK or BERR is detected. When the timeout expires, the MXIbus System Controller sends a MXIbus BERR to clear the MXIbus system. The VXI-MXI powers up with the MXIbus system timeout between 100 and 400 µsec, enabling the system Resource Manager to scan all logical addresses in a reasonable amount of time. When the Resource Manager has finished scanning and configuring the MXIbus system, it should set the LNGMXSCTO bit in the MXIbus Control Register. When this bit is set, the MXIbus system timeout will be between 100 and 400 msec, as recommended in the MXIbus specification.

MXIbus Control Signal Transceivers

The MXIbus control signal transceivers control the sending and receiving of the MXIbus control signals address strobe (AS*), data strobe (DS*), transfer size (SIZE*), read/write (WR*), data transfer acknowledge (DTACK*), bus error (BERR*), and parity (PAR*). These signals indicate the beginning and end of a transfer, the size of data involved in the transfer (8, 16, or 32 bits), whether the transfer is a read or write, and whether the transfer was successful.

MXIbus Requester and Arbiter Circuitry

The MXIbus requester and arbiter circuitry is used to request and grant the MXIbus to MXIbus devices. The arbiter circuitry is only active on the VXI-MXI if it is configured as the MXIbus System Controller.

All MXIbus masters must have bus request logic for requesting the MXIbus, and the MXIbus System Controller must have bus arbiter logic to grant the bus to requesting masters. Four signals are used for arbitration: bus request (BREQ*), bus grant in (BGIN*), bus grant out (BGOUT*), and bus busy (BUSY*). The MXIbus has a serial, release-on-request arbitration with fairness and bus lock options.

In a serial arbitration scheme, devices request the bus by asserting the BREQ* line. This signal is a wired-OR signal that indicates when one or more MXIbus devices are requesting use of the bus. When the System Controller detects BREQ* active, it grants the bus by driving the bus grant daisy-chain line BGOUT* active. BGOUT* propagates down the daisy-chain to the next device's BGIN* signal. If that device is

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not driving the BREQ* line, it passes the BGIN* signal on to the next device in the daisy-chain via its BGOUT* line. The first device that is driving BREQ* and receives an active low level on its BGIN* line is the device that is granted the bus. That device does not pass the bus grant signal on the daisy-chain to the next device.

When a requester is granted control of the bus, it drives the BUSY* line active and unasserts BREQ*. The BUSY* signal indicates to the other MXIbus devices that the bus is busy. The master in control of the bus holds BUSY* low until it is finished with the bus. At that time, if no other MXIbus device is driving BREQ*, the master can continue to drive BUSY* until it detects the BREQ* line active.

A VXIbus device can lock the MXIbus so that the device can perform indivisible operations across the MXIbus. When the LOCK bit in the Local Bus Lock Register is set by a VXIbus device, the VXI-MXI interface will not release the MXIbus the next time it is granted the bus (on the next transaction) until the LOCK bit is cleared by a VXIbus device.

A fairness feature ensures that all requesting devices will be granted use of the bus. If fairness is enabled, a master must refrain from driving BREQ* active after releasing it until it detects BREQ* inactive.

When the VXI-MXI is arbitrating for the MXIbus and a remote MXIbus transfer requesting the VMEbus is received, deadlock occurs. The VXI-MXI cannot win the MXIbus because another MXIbus device owns it, and that device wants to arbitrate for the VMEbus, which is currently owned by another device. To resolve the conflict, the MXIbus master transfer in the process of arbitrating for the MXIbus terminates its VMEbus transfer by sending a BERR to the VMEbus. The remote MXIbus transfer to the VMEbus can then arbitrate for the VMEbus and complete.

Unless the optional interlocked arbitration mode is used, VXI modules must be able to handle the BERR exceptions that occur because of deadlock conditions. In interlocked arbitration mode, only one device owns the VXIbus/MXIbus system at a time. Deadlocks are prevented because there is only one master of the entire system (VXIbus and MXIbus) at a time.

In interlocked arbitration mode, the VXIbus arbiter and the MXIbus arbiter are synchronized so that both buses are tightly coupled at all times. When the VXI-MXI receives a VMEbus BGIN* signal, it cannot drive the daisy-chain VMEbus BGOUT* signal until it owns the MXIbus (is driving the MXIbus BUSY* signal). Similarly, when the VXI-MXI receives a MXIbus BGIN* signal, it cannot drive the MXIbus BGOUT* lines until it owns the VMEbus (is driving the VMEbus BBSY* signal). When the VXI-MXI is driving the VMEbus BBSY* signal, it cannot release the line until it owns the MXIbus. Similarly, when the VXI-MXI is driving the MXIbus BUSY* signal, it cannot release the line until it owns the VMEbus. In other words, the VXI-MXI cannot release the bus it owns until it gains ownership of the other bus.

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For example, if the VXI-MXI owns the VMEbus and it receives a VMEbus bus request from another VXIbus device, the VXI-MXI continues holding the VMEbus and arbitrating for the MXIbus. When it wins the MXIbus, the VXI-MXI can then release the VMEbus so that another VMEbus requester can gain ownership of the VMEbus. Likewise, if the VXI-MXI owns the MXIbus and receives a MXIbus request from another device, the VXI-MXI continues to hold the MXIbus BUSY* line while it arbitrates for its VMEbus. Once it wins the VMEbus, it can release the MXIbus.

Transparent interoperability between VXIbus mainframes is an advantage of interlocked arbitration mode; however, this mode of operation does have disadvantages. In normal operation mode, the VMEbus activity within each mainframe is independent of the activity in other mainframes except when a device in one mainframe accesses a device in another mainframe. In interlocked arbitration mode, there can be only one master of the entire VXIbus/MXIbus system at a time. Devices in separate mainframes, therefore, cannot run operations in parallel. The global arbitration scheme required by interlocked arbitration mode also adds considerable overhead to each VMEbus access.

In a VXIbus/MXIbus system, some VXI-MXIs can be configured for normal operation mode and others for interlocked arbitration mode. The VXIbus mainframes configured in interlocked arbitration mode are interlocked with each other and the mainframes configured for normal operation can perform transfers in parallel. If no bus masters are in a VXIbus mainframe, or if the bus masters communicate only with the slaves in their mainframe and never attempt transfers across the MXIbus, a deadlock cannot occur. These VXIbus mainframes can be configured for normal operation in a VXIbus/MXIbus system with VXIbus mainframes configured for interlocked arbitration mode. Even though PCs with MXIbus interfaces do not support interlocked arbitration mode, they can be installed in a VXIbus/MXIbus system with VXIbus mainframes running in interlocked mode.

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Appendix A

Specifications

About this Appendix

This appendix contains the physical and electrical specifications for the VXI-MXI and describes the characteristics of key interface board components.

Electrical Characteristics

All integrated circuit drivers and receivers used on the VXI-MXI meet the requirements of the VMEbus specification.

All MXIbus transceivers meet the requirements of the MXIbus specification. The components used are as follows:

VMEbus Modules

The VXI-MXI has the following VMEbus modules:

- VMEbus Requester
- VMEbus Master
- VMEbus Slave
- Interrupter
- IACK Daisy-Chain Driver

When the VXI-MXI is configured as a VXIbus Slot 0 device, it also has the following VMEbus modules:

- VMEbus Timer
- Arbiter
- System Clock Driver

The VXI-MXI does not support the following VMEbus modules:

- Serial Clock Driver
- Power Monitor

MXIbus Bus Transfer Rate

VXI-MXI as MXIbus Slave

Block Mode: Up to 9 Mbytes/sec (32-bit transfers)
Single Transfers: Up to 5 Mbytes/sec (32-bit transfers)

VXI-MXI as MXIbus Master

Block Mode: Up to 8 Mbytes/sec (32-bit transfers)
Single Transfers: Up to 5 Mbytes/sec (32-bit transfers)

External Clock Input

TTL Levels

Input Impedance: 2 kΩ

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External Clock Output

TTL levels into 50Ω load

Initial Accuracy: 100ppm

Duty Cycle: 50%±5%

Trigger Input

TTL Levels

Input impedance: 2kΩ or 50Ω (switch selectable)

Trigger Output

TTL Levels

Input impedance: 2kΩ or 50Ω (switch selectable)

Power Requirement

DC Volts	DC Current	Dynamic Current
+5V	+6.7A max.	0.67A
-5.2V	0.5A max.	0.05A
-2V	.125A max.	0.02A

Physical

VXIbus board: C-size

Height: 233.35mm (9.187 in.)

Depth: 340.00mm (13.386 in.)

VXI Keying class: Class 1 TTL

Fully compatible with VXI specification

Fully enclosed and shielded

Operating Environment

Component Temperature: 0° to 70° C

Relative Humidity: 10% to 90% non-condensing

Emisions: CISPER 22

Storage Environment

Component Temperature: -40° to 85° C

Relative Humidity: 0% to 95% non-condensing

Cooling Requirements

For 10°C rise 3.0 liters/second 0.80mm H_20

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Appendix B

Error Messages

Using This Appendix

This appendix shows how to read an instrument's error queue, discusses the types of command language-related error messages, and provides a listing of all of the System Instrument's error messages and their probable causes.

- Reading an Instrument's Error Queue 87
- Error Types 88
- Error Messages and Causes 89
- Start-up Error Messages and Warnings.....95

Reading an Instrument's Error Queue

Executing the SYST:ERR? command reads the oldest error message from the instrument's error queue and erases that error from the error queue. The SYST:ERR? command returns response data in the form:

<error number> , " <error description string> "

Example error message: **-113,"Undefined header"**

Positive error numbers are specific to an instrument. Negative error numbers are command language related and discussed in the next section "Error Messages". Command language related errors also set a corresponding bit in the Standard Event Status Register (refer to Chapter 4 for more information).

Example: Reading the Error Queue

This program reads all errors (one error at a time, oldest to newest) from the System Instrument's (Command Module) error queue. After reading each error, that error is automatically erased from the queue. When the error queue is empty, this program returns: `+0,"No error"`.

```
10 OPTION BASE 1
20  DIM Message$[256]                 Create array for error message
30   REPEAT                           Repeat next 3 lines until error number = 0
40     OUTPUT 70900;"SYST:ERR?"       Read error number & message
50     ENTER 70900;Code,Message$      Enter error number & message
60     PRINT Code,Message$            Print error number & message
70   UNTIL Code=0
80 END
```

Error codes read from the error queue are preceded by the number 21. For example, error code 11 displayed on a monitor appears as 2111 if read from the error queue instead.

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Error Types

Negative error numbers are language related and categorized as shown in Table B-1. Positive error numbers are instrument specific, and for the System Instrument are summarized in the listing on the pages that follow. For other instruments, refer to the instrument's user manual for a description of error messages.

Table B-1. Negative Error Numbers

Error Number	Error Type
-199 to -100	Command Errors
-299 to -200	Execution Errors
-399 to -300	Device-Specific Errors
-499 to -400	Query Errors

Command Errors

A command error means the instrument cannot understand or execute the command. When a command error occurs, it sets the Cornmand Error Bit (bit 5) in the Standard Event Status Register. Command errors can be caused by:

- A syntax error was detected in a received command or message. Possible errors include a data element which violates the instrument's listening formats or is of the wrong type (binary, numeric, etc.) for the instrument.
- An unrecognizable command header was received. Unrecognizable headers include incorrect SCPI headers and incorrect or unimplemented Common Commands.
- A Group Execute Trigger (GET) was entered into the input buffer inside a Common Command.

Execution Errors

An execution error indicates the instrument is incapable of doing the action or operation requested by a command. When an execution error occurs, it sets the Execution Error Bit (bit 4) in the Standard Event Status Register. Execution errors can be caused by the following:

- A parameter within a command is outside the limits or inconsistent with the capabilities of an instrument.
- A valid command could not be executed because of an instrument failure or other condition.

Device-Specific Errors

A device-specific error indicates an instrument operation did not complete, possibly due to an abnormal hardware or firmware condition (self-test failure, loss of calibration or configuration memory, etc.). When a device-specific error occurs, it sets the Device-Specific Error Bit (bit 3) in the Standard Event Status Register.

Query Errors

A query error indicates a problem has occurred in the instrument's output queue. When a query error occurs, it sets the Query Error Bit (bit 2) in the Standard Event Status Register. Query errors can be caused by the following:

- An attempt was made to read the instrument's output queue when no output was present or pending.
- Data in the instrument's output queue has been lost for some reason.

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Error Messages and Causes

-101 Invalid character
Unrecognized character in specified parameter.

-102 Syntax error
Command is missing a space or comma between parameters.

-103 Invalid separator
Command parameter is separated by some character other than a comma.

-104 Data type error
The wrong data type (i.e. number, character, string expression) was used when specifying a parameter.

-108 Parameter not allowed
Parameter specified in a command which does not require one.

-109 Missing parameter
No parameter specified in the command in which a parameter is required.

-113 Undefined header
Command header was incorrectly specified.

-123 Numeric overflow
A parameter specifies a value greater than the command allows.

- 128 Numeric data not allowed
A number was specified for a parameter when a letter is required.

- 131 Invalid suffix
Parameter suffix incorrectly specified (e.g. .5SECOND rather than 5S or 5SEC).

-138 Suffix not allowed
Parameter suffix is specified when one is not allowed.

- 141 Invalid character data
The discrete parameter specified is not allowed (e.g. TRIG:SOUR INT - INT is not a choice).

-178 Expression data not allowed
A parameter other than the channel list is enclosed in parentheses.

- 211 Trigger ignored
Trigger occurred while the Pacer is in the idle state, or a trigger occurred from a source other than the specified source.

- 222 Data out of range
The parameter value specified is too large or too small.

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- 224 Illegal parameter value
The numeric value specified is not allowed.

- 240 Hardware error
Hardware error detected during power-on cycle. Return multimeter to Hewlett-Packard for repair.

- 310 System error
If caused by *DMC, then macro memory is full.

- 350 Too many errors
The error queue is full as more than 30 errors have occured.

- 410 Query interrupted
Data is not read from the output buffer before another command is executed.

- 420 Query unterminated
Command which generates data not able to finish executing due to a multimeter configuration error.

- 430 Query deadlocked
Command execution cannot continue since the mainframe's command input and data output buffers are full. Clearing the instrument restores control.

1500 External trigger source already allocated
"Event In" signal already allocated to another instrument such as a Switchbox.

2002 Invalid logical address
A value less than 0 or greater than 255 was specified for logical address.

2003 Invalid word address
An odd address was specified for a 16 bit read or write. Always use even addresses for 16 bit (word) accesses.

2005 No card at logical address
A non-existent logical address was specified with the VXI:READ? or VXl:WRlTE command.

2101 Failed Device
VXI device failed its self-test.

2102 Unable to combine device
Device type cannot be combined into an instrument such as a scanning voltmeter or a switchbox.

2103 Config warning, Device driver not found
ID of device does not match list of drivers available. Warning only.

2105 Config error 5, A24 memory overflow
More A24 memory installed in the mainframe than can be configured into the available A24 memory space.

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2108 **Config error 8, Inaccessible A24 memory**
A24 memory device overlaps memory space reserved by the mainframe's operating system.

2110 **Config error 10, Insufficient system memory**
Too many instruments installed for the amount of RAM installed in the mainframe. Cannot configure instruments. Only the system instrument is started.

2111 **Config error 11, Invalid instrument address**
A device's logical address is not a multiple of 8 and the device is not part of a combined instrument.

2112 **Invalid user-defined commander logical address**
The commander assigned to a device by a user-defined Configuration Table does not assign it a secondary address.

2114 **Invalid user-defined secondary address**
A secondary address assigned by a user configuration table is illegal.

2115 **Duplicate secondary address**
A secondary address specified by a user configuration table is used more than once.

2116 **Invalid servant area**
The logical address plus servant area of a commander is greater than 255 or greater than that of a superior commander within this tree.

2117 **Slot 0 functions disabled**
A command module is in slot 0 but slot 0 switches are in the disabled position.

2118 **Invalid commander logical address**
A device does not have a valid commander.

2119 **BNO failed**
Sending a BEGIN Normal Operation command to a device failed.

2120 **Write ready timeout**
A message-based device failed to become write ready.

2121 **Read ready timeout**
A message-based device failed to become read ready.

2122 **ERR* asserted**
The ERR* bit is asserted in a device's response register.

2123 **ENO failed**
Sending an End Normal Operation command to a device failed.

2124 **Interrupt line unavailable**
No line is available for a programmable interrupt handler. All lines are used or duplicate.

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2125 Invalid user-defined handler
The user-defined interrupt table specifies a device that is not a programmable interrupt handler, or does not exist.

2126 Invalid user-defined interrupter
The user-defined interrupt table specifies a device that is not a programmable interrupter, or does not exist.

2127 Diagnostic mode on
HP-IB address switch bit 6 is set wrong (warning only).

2128 Resource Manager not in Slot 0
A Command Module is configured for Slot 0 and Resource Manager but is installed in another slot (warning only).

2129 Warning, Sysfail detected
A device was asserting SYSFAIL on the backplane during startup.

2130 Pseudo instrument logical address unavailable
A physical device has the same logical address as IBASIC (240).

2131 File system startup failed
Insufficient system resources to allow the IBASIC file system to start.

2133 Invalid UDEF memory block
Invalid memory block in user-defined Memory table .

2134 UDEF memory block unavailable
The same base address or memory are specified more than once in the Memory table, or the addresses in the specified block are already in use.

2135 Invalid UDEF address space
The address specified in the Memory table is A24 but the device is A32, or vice versa.

2136 Duplicate UDEF memory LADD
A logical address is specified more than once in the Memory table. This does not apply to VME devices (address = -1).

2137 Invalid UDEF CNFG table
The valid flag in the Command/Servant Heirarchy table is not set to 1.

2138 Invalid UDEF CNFG table data
There are more than 254 entries in the Commander/Servant Heirarchy table.

2139 Invalid UDEF DC table
The valid flag in the Dynamic Configuration table is not set to 1.

2140 Invalid UDEF DC table data
There are more than 254 entries in the Dynamic Configuration Table.

2141 Invalid UDEF Interrupter
The logical address specified for an interrupter is a device that is not an interrupter.

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2142 Invalid UDEF INTR table
The Interrupter table valid flag is not 1.

2143 Invalid UDEF MEM table
The valid flag in the Memory table is not set to 1.

2144 Invalid UDEF MEM table data
An invalid logical address is specified in the Memory table.

2145 Warning, Non-volatile RAM contents lost
NVRAM was corrupted or a cold boot was executed.

2146 MESG based open access failed
I or I4 device is violating VXI specification.

2147 Granted device not found

2148 Warning, DRAM contents lost
Driver RAM was corrupted or a cold boot was executed.

2149 VME system controller disabled
VME SYSTEM CONTROLLER switch is disabled on the E1405 module.

2150 Extender not slot 0 device
VXIbus extender in remote mainframe is not in slot 0 of its mainframe.

2151 Invalid extender LADD window
MXI extender cannot be configured with a valid LADD window.

2152 Device outside of LADD window
A device is located outside the allowable logical address window range of an MXIbus extender.

2153 Invalid extender A24 window
MXIbus extender cannot be configured with a valid A24 memory window.

2154 Device outside of A24 window
An A24 memory device is located outside the allowable logical address window range of an MXIbus extender.

2155 Invalid extender A32 window
MXIbus extender cannot be configured with a valid A32 memory window.

2156 Device outside of A32 window
An A32 memory device is located outside the allowable logical address window range of an MXlbus extender.

2157 Invalid UDEF LADD window
User-defined logical address window has incorrect base address or size.

2158 Invalid UDEF A16 window
User-defined A16 memory window has incorrect base address or size.

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2159 Invalid UDEF A24 window
User-defined A24 memory window has incorrect base address or size.

2160 Invalid UDEF A32 window
User-defined A32 memory window has incorrect base address or size.

2161 Invalid UDEF EXT table
The valid flag in the Extender table is not set to 1.

2162 Invalid UDEF extender table data
There are more than 254 records in the Extender table.

2163 Unsupported UDEF TTL trigger
There is an extender table TTL trigger entry for a device which does not support TTL triggers.

2164 Unsupported UDEF ECL trigger
There is an extender table ECL trigger entry for a device which does not support ECL triggers.

2165 Device not in configure state
A message-based device was not in CONFIGURE state during re-boot.

2166 INTX card not installed
The INTX daughter card on the VXI-MXI module is not installed or is not functioning correctly.

2201 Unexpected interrupt from message-based card
A message-based card interrupted when an interrupt service routine has not been set up.

2202 Unexpected interrupt from non-message based card
A register-based card interrupted when an interrupt service routine has not been set up.

2809 Interrupt line has not been set up
A DIAG:INT:ACT or DIAG:INT:RESP command was executed before setting the interrupt with DIAG:INT:SET.

2810 Not a handler for this line
An attempt was made to set up an interrupt with DIAG:INT:SET for a line that has no handler. (See VXI:CONF:ITAB).

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Start-up Error Messages and Warnings

Start-up error messages and warnings are most often generated just after the mainframe is powered-up or re-booted (DIAG:BOOT command). These messages can be read from the error queue using the SYST:ERR? command. We recommend that you include a routine at the beginning if your application programs which checks for start-up errors before the program tries to access individual instruments. See your Installation and Getting Started Guide for an example program.

1 Failed Device
VXI device failed its self-test.

2 Unable to combine device
Device type cannot be combined into an instrument such as a scanning voltmeter or a switchbox.

3 Config warning, Device driver not found
ID of device does not match list of drivers available. Warning only.

4 DC device block too big
Dynamically configured device address block is greater than 127.

5 Config error 5, A24 memory overflow
More A24 memory is installed in the mainframe than can be configured into the available A24 memory space.

6 A32 memory overflow
More A32 memory is installed in the mainframe than can be configured into the available A32 memory space.

7 DC device move failed
A dynamically configured device failed to move to a new logical address.

8 Config error 8, Inaccessible A24 memory
An A24 memory device overlaps a memory space reserved by the mainframe's operating system.

9 Unable to move DC device
The block size for a set of address-blocked Dynamically Configured devices is too large for the available space, or an attempt was made to move a Dynamically Configured device to an already assigned Logical Address. Cannot configure instruments. Only the system instrument is started.

10 Config error 10, Insufficient system memory
Too many instruments installed for the amount of RAM installed in the mainframe. Cannot configure instruments. Only the system instrument is started.

11 Config error 11, Invalid instrument address
A device's logical address is not a multiple of 8 and the device is not part of a combined instrument.

12 Invalid user-defined commander logical address
The commander assigned to a device by a user-defined Configuration Table does not assign it a secondary address.

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14 Invalid user-defined secondary address
A secondary address assigned by a user configuration table is illegal.

15 Duplicate secondary address
A secondary address specified by a user configuration table is used more than once.

16 Invalid servant area
The logical address plus servant area of a commander is greater than 255 or greater than that of a superior commander within this tree.

17 Slot 0 functions disabled
A command module is in slot 0 but slot 0 switches are in the disabled position.

18 Invalid commander logical address
A device does not have a valid commander.

19 BNO failed
Sending a BEGIN Normal Operation command to a device failed.

20 Write ready timeout
A message-based device failed to become write ready.

21 Read ready timeout
A message-based device failed to become read ready.

22 ERR* asserted
The ERR* bit is asserted in a device's response register.

23 ENO failed
Sending an End Normal Operation command to a device failed.

24 Interrupt line unavailable
No line is available for a programmable interrupt handler. All lines are used or duplicate.

25 Invalid user-defined handler
The user-defined interrupt table specifies a device that is not a programmable interrupt handler, or does not exist.

26 Invalid user-defined interrupter
The user-defined interrupt table specifies a device that is not a programmable interrupter, or does not exist.

27 Diagnostic mode on
HP-IB address switch bit 6 is set wrong (warning only).

28 Resource Manager not in Slot 0
A Command Module is configured for Slot 0 and Resource Manager but is installed in another slot (warning only).

29 Warning, Sysfail detected
A device was asserting SYSFAIL on the backplane during start-up.

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30 Pseudo instrument logical address unavailable
A physical device has the same logical address as IBASIC (240).

31 File system startup failed
Insufficient system resources to allow the IBASIC file system to start.

32 Inaccessible A32 memory
Device has A32 memory below 200000000_{16} or above $DFFFFFFF_{16}$.

33 Invalid UDEF memory block
Invalid memory block in user-defined Memory table.

34 UDEF memory block unavailable
The same base address or memory are specified more than once in the Memory table, or the addresses in the specified block are already in use.

35 Invalid UDEF address space
The address specified in the Memory table is A24 but the device is A32, or vice versa.

36 Duplicate UDEF memory LADD
A logical address is specified more than once in the Memory table. This does not apply to VME devices (address = -1).

37 Invalid UDEF CNFG table
The valid flag in the Command/Servant Heirarchy table is not set to 1.

38 Invalid UDEF CNFG table data
There are more than 254 entries in the Commander/Servant Heirarchy table.

39 Invalid UDEF DC table
The valid flag in the Dynamic Configuration table is not set to 1.

40 Invalid UDEF DC table data
There are more than 254 entries in the Dynamic Configuration Table.

41 Invalid UDEF Interrupter
The logical address specified for an interrupter is a device that is not an interrupter.

42 Invalid UDEF INTR table
The Interrupter table valid flag is not 1.

43 Invalid UDEF MEM table
The valid flag in the Memory table is not set to 1.

44 Invalid UDEF MEM table data
An invalid logical address is specified in the Memory table.

45 Warning, NVRAM contents lost
NVRAM was corrupted or a cold boot was executed.

46 MESG-based open access failed
I or I4 device is violating VXI specification.

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47 Granted device not found

48 Warning, DRAM contents lost
Driver RAM was corrupted or a cold boot was executed.

49 VME system controller disabled
VME SYSTEM CONTROLLER switch is disabled on the E1405 module.

50 Extender not slot 0 device
VXIlbus extender in remote mainframe is not in slot 0 of its mainframe.

51 Invalid extender LADD window
MXI extender cannot be configured with a valid LADD window.

52 Device outside of LADD window
A device is located outside the allowable logical address window range of an MXIbus extender.

53 Invalid extender A24 window
MXIbus extender cannot be configured with a valid A24 memory window.

54 Device outside of A24 window
An A24 memory device is located outside the allowable logical address window range of an MXIbus extender.

55 Invalid extender A32 window
MXIbus extender cannot be configured with a valid A32 memory window.

56 Device outside of A32 window
An A32 memory device is located outside the allowable logical address window range of an MXIbus extender.

57 Invalid UDEF LADD window
User-defined logical address window has incorrect base address or size.

58 Invalid UDEF A16 window
User-defined A16 memory window has incorrect base address or size.

59 Invalid UDEF A24 window
User-defined A24 memory window has incorrect base address or size.

60 Invalid UDEF A32 window
User-defined A32 memory window has incorrect base address or size.

61 Invalid UDEF EXT table
The valid flag in the Extender table is not set to 1

62 Invalid UDEF extender table data
There are more than 254 records in the Extender table.

63 Unsupported UDEF TTL trigger
There is an extender table TTL trigger entry for a device which does not support TTL triggers.

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64 Unsupported UDEF ECL trigger
There is an extender table ECL trigger entry for a device which does not support ECL triggers.

65 Device not in configure state
A message-based device was not in CONFIGURE state during re-boot.

66 INTX card not installed
The INTX daughter card on the VXI-MXI module is not installed or is not functioning correctly.

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Appendix C

Register Definitions

About this Appendix

This appendix contains detailed information on the use of the VXI-MXI registers, which are used to configure and control the module's operation. All of these configuration registers are accessible from the VMEbus (in the VXIbus configuration space) and from the MXIbus. If you are not writing your own multiframe Resource Manager routines, you may skip over this appendix.

Register Maps

The register map for the VXI-MXI configuration registers is shown in Table C-1 and Table C-2. The table gives the register name, the register address, the size of the register in bits, and the type of the register (read only, write only, or read/write). The base address for the VXI-MXI configuration space in A16 space is equal to the VXIbus logical address assigned to the VXI-MXI shifted left six times and ORed with hex C000.

The VMEbus supports three different transfer sizes for read/write operations: 8-, 16-, or 32-bit. Table C-1 shows the size of the registers on the VXI-MXI. All 16-bit registers can be accessed using 8-bit read/write operations.

Register Description Format

Each register bit map shows a diagram of the register with the most significant bit (bit 15 for a 16-bit register, bit 7 for an 8-bit register) shown on the left, and the least significant bit (bit 0) shown on the right. A square is used to represent each bit. Each bit is labeled with a name inside its square. An asterisk (*) after the bit name indicates that the signal is active low. An`asterisk is equivalent to an overbar.

Hard and Soft Reset

Each register description indicates whether the bits are cleared by a hard and/or soft reset. A hard reset occurs when the mainframe is powered on and when the VMEbus SYSRESET signal is active. A hard reset clears all the registers on the VXI-MXI. A soft reset occurs when the RESET bit in the VXIbus Control Register is set. A soft reset clears signals that are asserted by bits in the configuration registers but does not clear configuration information stored in the configuration registers.

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Table C-1. VXI-MXI Registers.

Register Name	Offset from Base Address (Hex)	Type	Size
VXIbus ID Register	0	Read only	16-bit
Device Type Register	2	Read only	16-bit
VXIbus Status/Control Register	4	Read/Write	16-bit
MODID Register	8	Read/Write	16-bit
Logical Address Window Register	A	Read/Write	16-bit
A16 Window Map Register	C	Read/Write	16-bit
A24 Window Map Register	E	Read/Write	16-bit
A32 Window Map Register	10	Read/Write	16-bit
Subclass Register	1E	Read/Write	16-bit
MXIbus Status/Control Register	20	Read/Write	16-bit
MXIbus Lock Register	22	Read/Write	8-bit
MXIbus IRQ Configuration Register	24	Read/Write	16-bit
Drive Triggers/Read LA Register	26	Read/Write	16-bit
Trigger Mode Selection Register	28	Read/Write	16-bit
Interrupt Status/Control Register	2A	Read/Write	16-bit
Status/ID Register	2C	Read/Write	16-bit
External Trigger Port Configuration Register	2E	Read/Write	16-bit
Trigger Sync. Acknowledge Register	34	Write only	8-bit
Trigger ASync. Acknowldge Register	36	Write only	8-bit
Interrupt Acknowledge for IRQ1	32	Read only	16-bit
Interrupt Acknowledge for IRQ2	34	Read only	16-bit
Interrupt Acknowledge for IRQ3	36	Read only	16-bit
Interrupt Acknowledge for IRQ4	38	Read only	16-bit
Interrupt Acknowledge for IRQ5	3A	Read only	16-bit
Interrupt Acknowledge for IRQ6	3C	Read only	16-bit
Interrupt Acknowledge for IRQ7	3E	Read only	16-bit

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Table C-2. VXI-MXI Register Map.

	Offset from Base Logical Addresss	Name of Register
VXI-MXI Defined Registers	3E	Interrupt Acknowledge 7
	3C	Interrupt Acknowledge 6
	3A	Interrupt Acknowledge 5
	38	Interrupt Acknowledge 4
	36	Interrupt Ack 3/Trig ASync Ack
	34	Interrupt Ack 2/Trig Sync Ack
	32	Interrupt Acknowledge 1
	30	VXI/MXI Reserved
	2E	External Trigger Port Configuration
	2C	Status/ID Register
	2A	Interrupt Status/Control
	28	Trigger Mode Register
	26	Drive Triggers/Read LA
	24	MXIbus IRQ Configuration
	22	MXIbus Lock Register
	20	MXIbus Status/Control
VXIbus Extender Registers	1E	Subclass Register
	1C	VXI/MXI Reserved
	1A	VXI/MXI Reserved
	18	Utility Configuration
	16	VXI/MXI Reserved
	14	TTL Trigger Configuration
	12	Interrupt Configuration
	10	A32 Window Map Register
	0E	A24 Window Map Register
	0C	A16 Window Map Register
	0A	Logical Address Window
	08	MODID Register
Basic VXI Configuration Registers	06	Reserved
	04	VXIbus Status/Control
	02	Device Type Register
	00	VXIbus ID Register
		----------16 bit words----------

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VXIbus Configuration Registers

These registers are defined by the VXIbus specification for all VXIbus devices.

VXIbus ID Register

The VXIbus ID Register is a read only register accessed at address 00_{16}. The bits in this register are configured in hardware. Hard and soft resets have no effect on this register.

Base Address + 01_{16}								**Base Address + 00_{16}**							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DEVCLASS (1-0)		ADDR		MANID(11-0)											

DEVCLASS[1-0](device class): These bits indicate the device class of the VXIbus device as follows:

00 = Memory
01 = Extended
10 = Message Based
11 = Register Based

Since the VXI-MXI is an extended device, these bits are configured in hardware as binary 01.

ADDR (Address): These bits indicate the address spaces in which the VXIbus device has operational registers as follows:

00 = A16/A24
01 = A16/A32
10 = Reserved
11 = A16 Only

Since the VXI-MXI has operational registers in A16 only, these bits are configured in hardware as binary 11.

MANID[11-0] (Manufacturer ID Bits): This number uniquely identifies the manufacturer of the VXIbus device. These bits are configured as FFF_{16} in hardware, since the card is manufactured by Hewlett-Packard.

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Device Type Register

The Device Type Register is a read only register accessed at address 02_{16}. The bits in this register are configured in hardware. Hard/soft resets have no effect on this register.

Base Address + 03_{16}								Base Address + 02_{16}							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RQMEM(3-0)				MODEL(11-0)											

RQMEM[3-0] (Required Memory Bits): These bits show the amount of VMEbus memory required by this VXIbus device. The VXI-MXI does not need any memory; therefore, these bits are set in hardware to one.

MODEL[11-0] (Model Code Bits): These bits contain a unique number assigned to this device by the manufacturer to identify this device. Model codes between 00_{16} and FF_{16} are assigned to Slot 0 devices. When the VXI-MXI is in Slot 0, bit 11 is 0 and its model code is hex 0FE. When the VXI-MXI is not in Slot 0, bit 11 is 1 and its model code is hex 8FE.

VXIbus Status/Control Register

VXIbus Status/Control Register is a read/write register accessed at address 04_{16}. The RESET bit is cleared on a hard reset. Hard and soft resets have no effect on the other bits on this register.

Base Address + 05_{16}								Base Address + 04_{16}							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	MI*	EDTYPE(3-0)				1	ACC DIR	VERSION(3-0)				RDY	PASS	1	SR

MI* (MODID Line Status Bit - read only): This bit is 0 when the device is selected by the MODID line; it is 1 when the device is not selected.

EDTYPE[3-0] (Extended Device Type Class Bits - read only): The VXI-MXI INTX daughter card has been assigned extended device type class hex E. When the INTX daughter card is installed on the VXI-MXI, these bits are hex E. When a daughter card is not installed, these bits are hex F.

ACCDIR (Access Direction Bit - read only): This bit indicates the bus from which a device originates the current access to the Status register. If the ACCDIR bit is 1, access originated from a device on the MXIbus. If the ACCDIR bit is 0, access originated from a device on the VMEbus.

VERSION[3-0] (VXI-MXI Version Number Bits - read only): These bits specify the revision version number of the VXI-MXI according the table below.

Version Number	VXI-MXI Revision
Hex F	Revision B
Hex E	Revision C
Hex D	Revision D
Hex C	Revision E

RDY (Ready Bit - read only): This bit is set to one in hardware to indicate that the device is ready to execute its full functionality.

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PASS (Passed Bit - read only): This bit is set to one in hardware to indicate that the device is functional.

RESET (Reset Bit): When this bit is set, the VXI-MXI is forced into the Soft Reset state. When this bit is cleared, the VXI-MXI is in the normal operation state. This bit is readable and is cleared on a hard reset.

VXIbus Extender Registers

These registers are defined for VXIbus extender devices.

MODID Register

The MODID Register is a read/write register which provides control and status of the MODID lines when the VXI-MXI is installed in Slot 0.

Base Address + 09_{16}								Base Address + 08_{16}							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	OUTEN	MODID(12-0)												

OUTEN (MODID Output Enable Bit): When this bit is set, the VXI-MXI is enabled to drive the MODID lines. When this bit is cleared, the MODID drivers are disabled. This bit should only be set when the VXI-MXI is in Slot 0. This bit is cleared on both hard and soft resets.

MODID[12-0] (MODID Drive Bits): If the OUTEN bit is set, setting one of these bits drives the corresponding MODID line high, and clearing the bit drives the line low. Independent of OUTEN, reading these bits always returns the current status of the corresponding MODID lines. Hard and soft resets have no effect on these bits.

Logical Address Window Register

The Logical Address Window Register is a read/write register which defines the range of logical addresses that are mapped into and out of the VXI-MXI through the MXIbus. This register defines a configuration window in the upper 16 kilobytes of A16 space. These bits are cleared on a hard reset.

The CMODE bit in the MXIbus Control Register (base address +20h) selects the format of this register. If the CMODE bit is 0 (default), a Base/Size window comparison is used to determine the range of addresses in the window. If the CMODE bit is set, an upper and lower bound is used to determine the range of addresses in the window.

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The Logical Address Window Register has the following format when the CMODE bit is cleared:

Base Address + $0B_{16}$								Base Address + $0A_{16}$							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	LAEN	LADIR	0	LASIZE(2-0)				LABASE(7-0)							

LAEN (Logical Address Window Enable Bit): When this bit is set, the logical address mapping window is enabled. When this bit is cleared, the logical address mapping window is disabled except for the logical address of this device. Access to the VXI-MXI's own configuration space is always enabled.

LADIR (Logical Address Window Direction Bit): When this bit is set, the logical address window applies to MXIbus cycles that are mapped into VXIbus cycles (inward cycles). When this bit is cleared, the logical address window applies to VXIbus cycles that are mapped out into MXIbus cycles (outward cycles). The complement of the defined range is mapped in the opposite direction.

LASIZE[2-0] (Logical Address Window Size Bits): This 3-bit number specifies the number of significant address bits in the LABASE field that are compared when determining if an address is in the logical address window. The number of logical addresses in the window is 28-i where i is the value of LASIZE [2-0]. Because i can range from 0 to 7, the minimum size of a logical address window is 2, and the maximum size is 256.

LABASE[7-0] (Logical Address Window Base Address Bits): These bits, in conjunction with the LASIZE bits, define the base address of the Logical Address window for the VXI-MXI. The LASIZE bits indicate the number of LABASE bits that are most significant. LABASE7 is the most significant, and LABASE0 is the least. The LABASE bits that are not significant can be replaced with zeros to provide the base address of the logical address window.

The Logical Address Window Register has the following format when the CMODE bit is set:

Base Address + $0B_{16}$								Base Address + $0A_{16}$							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
LAHIGH(7-0)								LALOW(7-0)							

LAHIGH[7-0] (Logical Address Window Upper Bound Bits):These bits define the upper limit of the range of MXIbus logical addresses that map into the VXIbus.

LALOW[7-0] (Logical Address Window Lower Bound Bits): These bits define the lower limit of the range of MXIbus logical addresses that map into the VXIbus.

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This register defines the range of MXIbus logical addresses that map into the VXIbus where that range is:

LAHIGH range LALOW

The VXIbus logical addresses mapped out of the VXI-MXI are the inverse of this range, that is, MXIbus logical addresses greater than or equal to the LAHIGH value or less than the LALOW value.

To map a consecutive range of VXIbus logical addresses out of the VXI-MXI, the lower bound of the range must be placed in the LAHIGH field and the upper bound in the LALOW field. In this case, the range of VXIbus logical addresses mapped out of the VXI-MXI is:

LALOW range LAHIGH

The MXIbus logical addresses mapped into the VXIbus are the inverse of this range, that is, VXIbus logical addresses greater than or equal to the LALOW value or less than the LAHIGH value.

The window is disabled whenever LAHIGH = LALOW = 0. All VXIbus logical addresses are mapped out to the MXIbus when:

FF (hex) (LAHIGH = LALOW) 80 (hex)

All MXIbus logical addresses are mapped into the VXIbus when:

7F (hex) (LAHIGH = LALOW) 0

To accommodate 8-bit devices that write to this register, the window is not enabled until the lower byte of the register is written. Therefore, 8-bit devices should write the upper byte first, then the lower byte.

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A16 Window Map Register

The A16 Window Map Register is a read/write register which defines the range of addresses in the lower 48 kilobytes of A16 space that is mapped into and out of the VXI-MXI through the MXIbus.

The CMODE bit in the MXIbus Control Register selects the format of this register. If the CMODE bit is 0 (default), a Base/Size window comparison is used to determine the range of addresses in the window. If the CMODE bit is set, an upper and lower bound is used to determine the range of addresses in the window.

The A16 Window Map Register has the following format when the CMODE bit is cleared:

Base Address + $0D_{16}$								**Base Address + $0C_{16}$**							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	A16EN	A16DIR	1	1	A16SIZE(2-0)			A16BASE(7-0)							

A16EN (A16 Window Enable Bit): When this bit is set, the A16 mapping window is enabled. When this bit is cleared, the A16 mapping window is disabled.

A16DIR (A16 Window Direction Bit): When this bit is set, the A16 window applies to MXIbus cycles that are mapped into VXIbus cycles (inward cycles). When this bit is cleared, the A16 window applies to VXIbus cycles that are mapped out into MXIbus cycles (outward cycles). The complement of the defined range is mapped in the opposite direction.

A16SIZE[2-0] (A16 Window Size Bits): This 3-bit number specifies the number of significant address bits in the A16BASE field that are compared when determining if an address is in the A16 window. The number of A16 addresses in the window is $256 \times 2^{8-i}$ where i is the value of A16SIZE[2-0]. The minimum size of an A16 window is 512 bytes and the maximum size is 48 kilobytes (A16SIZE = 0).

A16BASE[7-0] (A16 Window Base Address Bits): These bits, in conjunction with the A16SIZE bits, define the base address of the A16 window for the VXI-MXI. The A16SIZE bits indicate the number of A16BASE bits that are most significant. A16BASE7 is the most significant and A16BASE0 is the least. The A16BASE bits that are not significant can be replaced with zeros to provide the base address of the A16 window.

The A16 Window Map Register has the following format when the CMODE bit is set:

Base Address + $0D_{16}$								**Base Address + $0C_{16}$**							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
A16HIGH(7-0)								A16LOW(7-0)							

A16HIGH[7-0] (A16 Window Upper Bound Bits): These bits define the upper limit of the range of MXIbus A16 addresses that map into the VXIbus.

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A16LOW[7-0] (A16 Window Lower Bound Bits): These bits define the lower limit of the range of MXIbus A16 addresses that map into the VXIbus.

This register defines the range of MXIbus A16 addresses that map into the VXIbus where that range is:

A16HIGH range A16LOW

The VXIbus A16 addresses mapped out of the VXI-MXI are the inverse of this range, that is, MXIbus A16 addresses greater than or equal to the A16HIGH value or less than the A16LOW value.

To map a consecutive range of VXIbus A16 addresses out of the VXI-MXI, the lower bound of the range must be placed in the A16HIGH field and the upper bound in the A16LOW field. In this case, the range of VXIbus A16 addresses mapped out of the VXI-MXI is:

A16LOW range A16HIGH

The MXIbus A16 addresses mapped into the VXIbus are the inverse of this range, that is, VXIbus A16 addresses greater than or equal to the A16LOW value or less than the A16HIGH value.

The window is disabled whenever A16HIGH = A16LOW = 0. All VXIbus A16 addresses are mapped out to the MXIbus when:

FF_{16} (A16HIGH = A16LOW) 80_{16}

All MXIbus A16 addresses are mapped into the VXIbus when:

$7F_{16}$ (A16HIGH = A16LOW) 00_{16}

To accommodate 8-bit devices that write to this register, the window is not enabled until the lower byte of the register is written. Therefore, 8-bit devices should write the upper byte first, then the lower byte.

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A24 Window Map Register

The A24 Window map Register is a read/write register which defines the range of addresses in A24 space that are mapped into and out of the VXI-MXI through the MXIbus. These bits are cleared on a hard reset.

The CMODE bit in the MXIbus Control Register selects the format of this register. If the CMODE bit is 0 (default), a Base/Size window comparison is used to determine the range of addresses in the window. If the CMODE bit is set, an upper and lower bound is used to determine the range of addresses in the window.

The A24 Window Map Register has the following format when the CMODE bit is cleared:

Base Address + $0F_{16}$								**Base Address + $0E_{16}$**							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	A24EN	A24DIR	1	1	A24SIZE(2-0)			A24BASE(7-0)							

A24EN (A24 Window Enable Bit): When this bit is set, the A24 mapping window is enabled. When this bit is cleared, the A24 mapping window is disabled.

A24DIR (A24 Window Direction Bit): When this bit is set, the A24 window applies to MXIbus cycles that are mapped into VXIbus cycles (inward cycles). When this bit is cleared, the A24 window applies to VXIbus cycles that are mapped out into MXIbus cycles (outward cycles). The complement of the defined range is mapped in the opposite direction.

A24SIZE[2-0] (A24 Window Size Bits): This 3-bit number specifies the number of significant address bits in the A24BASE field that are compared when determining if an address is in the A24 window. The number of A24 addresses in the window is 65536 X 2^{8-i} where i is the value of A24SIZE[2-0]. The minimum size of an A24 window is 128 kilobytes, and the maximum size is 16 megabytes.

A24BASE[7-0] (A24 Window Base Address Bits): These bits, in conjunction with the A24SIZE bits, define the base address of the A24 window for the VXI-MXI. The A24SIZE bits indicate the number of A24BASE bits that are most significant. A24BASE7 is the most significant and A24BASE0 is the least. The A24BASE bits that are not significant can be replaced with zeros to provide the base address of the A24 window.

The A24 Window Map Register has the following format when the CMODE bit is set:

Base Address +$0F_{16}$								**Base Address + $0E_{16}$**							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
A24HIGH(7-0)								A24HIGH(7-0)							

A24HIGH[7-0] (A24 Window Upper Bound): These bits define the upper limit of the range of MXIbus A24 addresses that map into the VXIbus.

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A24LOW[7-0] (A24 Window Lower Bound): These bits define the lower limit of the range of MXIbus A24 addresses that map into the VXIbus.

This register defines the range of MXIbus A24 addresses that map into the VXIbus where that range is:

A24HIGH range A24LOW

The VXIbus A24 addresses mapped out of the VXI-MXI are the inverse of this range, that is, MXIbus A24 addresses greater than or equal to the A24HIGH value or less than the A24LOW value.

To map a consecutive range of VXIbus A24 addresses out of the VXI-MXI, the lower bound of the range must be placed in the A24HIGH field and the upper bound in the A24LOW field. In this case the range of VXIbus A24 addresses mapped out of the VXI-MXI is:

A24LOW range A24HIGH

The MXIbus A24 addresses mapped into the VXIbus are the inverse of this range, that is, VXIbus A24 addresses greater than or equal to the A24LOW value or less than the A24HIGH value.

The window is disabled whenever A24HIGH = A24LOW = 0. All VXIbus A24 addresses are mapped out to the MXIbus when:

FF_{16} (A24HIGH = A24LOW) 80_{16}

All MXIbus A24 addresses are mapped into the VXIbus when:

$7F_{16}$ (A24HIGH = A24LOW) 00_{16}

To accommodate 8-bit devices that write to this register, the window is not enabled until the lower byte of the register is written. Therefore, 8-bit devices should write the upper byte first, then the lower byte.

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A32 Window Map Register

The A32 Window map Register is a read/write register which defines the range of addresses in A32 space that are mapped into and out of the VXI-MXI through the MXIbus. These bits are cleared on a hard reset.

The CMODE bit in the MXIbus Control Register selects the format of this register. If the CMODE bit is 0 (default), a Base/Size window comparison is used to determine the range of addresses in the window. If the CMODE bit is set, an upper and lower bound is used to determine the range of addresses in the window.

The A32 Window Map Register has the following format when the CMODE bit is cleared:

Base Address + 11_{16}								**Base Address +10_{16}**							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	A32EN	A32DIR	0	0	A32SIZE(2-0)			A32BASE(7-0)							

A32EN (A32 Window Enable Bit): When this bit is set, the A32 mapping window is enabled. When this bit is cleared, the A32 mapping window is disabled.

A32DIR (A32 Window Direction Bit): When this bit is set, the A32 window applies to MXIbus cycles that are mapped into VXIbus cycles (inward cycles). When this bit is cleared, the A32 window applies to VXIbus cycles that are mapped out into MXIbus cycles (outward cycles). The complement of the defined range is mapped in the opposite direction.

A32SIZE[2-0] (A32 Window Size Bits): This 3-bit number specifies the number of significant address bits in the A32BASE field that are compared when determining if an address is in the A32 window. The number of A32 addresses in the window is 16,777,216 X 2^{8-i} where i is the value of A32SIZE[2-0]. The minimum size of an A32 window is 32 megabytes, and the maximum size is 4 gigabytes.

A32BASE[7-0] (A32 Window Base Address Bits): These bits, in conjunction with the A32SIZE bits, define the base address of the A32 window for the VXI-MXI. The A32SIZE bits indicate the number of A32BASE bits that are most significant. A32BASE7 is the most significant and A32BASE0 is the least. The A32BASE bits that are not significant can be replaced with zeros to provide the base address of the A32 window.

The A32 Window Map Register has the following format when the CMODE bit is set:

Base Address + 11_{16}								**Base Address + 10_{16}**							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
A32HIGH(7-0)								A32LOW(7-0)							

A32HIGH[7-0] (A32 Window Upper Bound): These bits define the upper limit of the range of MXIbus A32 addresses that map into the VXIbus.

A32LOW[7-0] (A32 Window Lower Bound): These bits define the lower limit of the range of MXIbus A32 addresses that map into the VXIbus.

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This register defines the range of MXIbus A32 addresses that map into the VXIbus where that range is:

A32HIGH range A32LOW

The VXIbus A32 addresses mapped out of the VXI-MXI are the inverse of this range, that is, MXIbus A32 addresses greater than or equal to the A32HIGH value or less than the A32LOW value.

To map a consecutive range of VXIbus A32 addresses out of the VXI-MXI, the lower bound of the range must be placed in the A32HIGH field and the upper bound in the A32LOW field. In this case, the range of VXIbus A32 addresses mapped out of the VXI-MXI is:

A32LOW range A32HIGH

The MXIbus A32 addresses mapped into the VXIbus are the inverse of this range, that is, VXIbus A32 addresses greater than or equal to the A32LOW value or less than the A32HIGH value.

The window is disabled whenever A32HIGH = A32LOW = 0. All VXIbus A32 addresses are mapped out to the MXIbus when:

FF (hex) (A32HIGH = A32LOW) 80 (hex)

All MXIbus A32 addresses are mapped into the VXIbus when:

7F (hex) (A32HIGH = A32LOW) 0

To accommodate 8-bit devices that write to this register, the window is not enabled until the lower byte of the register is written. Therefore, 8-bit devices should write the upper byte first, then the lower byte.

Subclass Register

The Subclass Register is a read only register which defines the subclass of a VXIbus extended device. The VXI-MXI is a VXIbus Mainframe Extender. Such devices are assigned the subclass code hex FFFC. Hard and soft resets have no effect on this register.

Base Address + $1F_{16}$								**Base Address + $1E_{16}$**							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
SUBCLASS(15-0)															

SUBCLASS[15-0] (Manufacturer Subclass): These bits indicate the subclass code for the VXI-MXI. These bits are configured in hardware as hex FFFC.

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INTX Defined Registers

Interrupt Configuration Register

The Interrupt Configuration Register is a read/write register which is used to map the seven VMEbus interrupt lines to/from the seven INTX interrupt lines.

Base Address + 13_{16}								Base Address + 12_{16}							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EINT(7-0)EN								EINT(7-0)DIR							

EINT[7-1]EN (Extended Interrupt Enable Bits): Setting these bits individually enables the corresponding VMEbus IRQ lines to drive or to receive the corresponding INTX interrupt lines. The corresponding EINTDIR bits select whether the INTX interrupt line is driven or received by the VMEbus IRQ line. These bits are cleared on hard reset.

EINT[7-1]DIR (Extended Interrupt Direction Bits): Setting these bits determines whether the corresponding VMEbus IRQ lines drive or are driven by the corresponding INTX interrupt lines. If the EINTDIR bit is cleared and the corresponding EINTEN bit is set, the VMEbus IRQ line drives the corresponding INTX interrupt line. If the EINTDIR bit is set and the corresponding EINTEN bit is set, the INTX interrupt line drives the corresponding VMEbus IRQ line. These bits are cleared hard reset.

TTL Trigger Configuration Register

The TTL Trigger Configuration Register is a read/write register which is used to configure the mapping of the eight VXIbus trigger lines to/from the eight INTX trigger lines.

Base Address + 15_{16}								Base Address + 14_{16}							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
ETRGEN(7-0)								ETRDIR(7-0)							

ETRGEN[7-0] (Extended Trigger Enable Bits): Setting these bits individually enables the corresponding VXIbus TTL trigger lines to be mapped to the corresponding INTX trigger line as specified by the corresponding TRIGDIR bit. Clearing theese bits disables mapping of the trigger lines to the I NTX atrigger lines. These bits are cleared on hard reset.

ETRDIR[7-0] (Extended Trigger Direction Bits): Setting these bits determines the direction in which the corresponding trigger lines are mapped to the INTX trigger lines. If the TRIGEN and TRIGDIR bits are both set, the trigger line is driven by the signal received from the corresponding INTX trigger line. If the TRIGEN bit is set and the TRIGDIR bit is cleared, the TTL trigger line is driven out of the mainframe onto the corresponding INTX trigger line. These bits are cleared on hard reset.

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Utility Configuration Register

The Utility Configuration Register is a read/write register which is used to configure the mapping of the three VMEbus reset signals to/from the three corresponding INTX reset signals.

Base Address +19h							
15	14	13	12	11	10	9	8
0	0	0	0	0	0	0	0
Base Address +18h							
7	6	5	4	3	2	1	0
0	0	ACFAILIN	ACFAILOUT	SYSFAILIN	SYSFAILOUT	SYSRSTIN	SYSRSTOUT

ACFAILIN (Extended ACFAIL Inward Bit): Setting this bit enables the INTX ACFAIL line to be mapped in onto the VMEbus ACFAIL line. Clearing this bit disables the mapping of the INTX ACFAIL line onto the VMEbus ACFAIL line. This bit is cleared on power-up.

ACFAILOUT (Extended ACFAIL Outward Bit): Setting this bit enables the VMEbus ACFAIL line to be mapped out onto the INTX ACFAIL line. Clearing this bit disables the mapping of the INTX ACFAIL line onto the VMEbus ACFAIL line. This bit is cleared on power-up.

SYSFAILIN (Extended SYSFAIL Inward Bit): Setting this bit enables the INTX SYSFAIL line to be mapped in onto the VMEbus SYSFAIL line. Clearing this bit disables the mapping of the INTX SYSFAIL line onto the VMEbus SYSFAIL line. This bit is cleared on power-up.

SYSFAILOUT (Extended SYSFAIL Outward Bit): Setting this bit enables the VMEbus SYSFAIL line to be mapped out onto the INTX SYSFAIL line. Clearing this bit disables the mapping of the SYSFAIL line onto the INTX SYSFAIL line. This bit is cleared on power-up.

SYSRSTIN (Extended SYSRESET Inward Bit): Setting this bit enables the INTX SYSRESET line to be mapped in onto the VMEbus SYSRESET line. Clearing this bit disables the mapping of the INTX SYSRESET line onto the VMEbus SYSRESET line. This bit is cleared on power-up.

SYSRSTOUT (Extended SYSRESET Outward Bit): Setting this bit enables the VMEbus SYSRESET line to be mapped out onto the INTX SYSRESET line. Clearing this line disables the mapping of the SYSRESET line onto the INTX SYSRESET line. This bit is cleared on power-up.

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MXIbus Defined Registers

MXIbus Status/Control Register

The MXIbus Status/Control Register is a read/write register which contains status and control bits for various types of MXIbus operators.

Base Address + 21_{16}								
	15	14	13	12	11	10	9	8
Rd	RMWMODE	CMODE	1	1	MXSCTO	INTLCK	DSYSFAIL	FAIR
Wr	RMWMODE	CMODE	ECL1EN	ECL1DIR	ECL0EN	ECL0DIR	DSYSFAIL	DSYRST
Base Address + 20_{16}								
	7	6	5	4	3	2	1	0
Rd	MXISC	MXTRIGINT	MXSRSTINT	MXACFLINT	LNGMXSCTO	MXBERR	MXSYSFINT	PARERR
Wr	0	MXTRIGEN	MXSRSTEN	MXACFAILEN	LNGMXSCTC	BOFFCLR	0	0

RMWMODE (Read/Modify Write Select Mode Bit - read/write): This bit, along with the MXIbus Address Modifiers, selects how the VXI-MXI will treat a MXIbus cycle when the MXIbus Address Strobe is held low for multiple data transfers. This bit is cleared on hard and soft resets.

If this bit is cleared and the MXIbus address modifiers do not label the transfer for block mode, the MXIbus cycle is a RMW (Read/Modify/Write) cycle, which is converted into a VMEbus RMW cycle. If this bit is cleared and the MXIbus address modifiers indicate that the transfer is a block mode operation, the MXIbus block mode transfer is converted into a VMEbus block mode transfer.

If this bit is set and the MXIbus address modifiers do not indicate that the transfer is a block mode operation, the MXIbus block mode transfer is converted into single transfer VMEbus accesses. This mode should be used when transferring large amounts of data with MXIbus block mode to a VMEbus device that does not support block mode. If this bit is set and the MXIbus address modifiers indicate that the transfer is a block mode operation, the MXIbus block mode transfer is converted into a VMEbus block mode transfer.

CMODE (Comparison Mode Bit - read/write): This bit selects the range comparison mode for the logical address, A16, A24, and A32 Window Mapping Registers. If CMODE is cleared, a Base/Size range comparison is used to determine the range of addresses in the windows. If CMODE is set, an upper and lower bound is used to determine the range of addresses in the windows. The upper and lower bound method is not VXI compliant and is not supported by H-P. This bit is cleared on hard and soft resets.

ECL1EN (ECL Trigger 1 Enable Bit - write only): Setting this bit enables the ECL Trigger line 1 to be mapped to the Trigger Out SMB connector or from the Trigger In SMB connector on the front panel, as specified by the ECL1DIR bit. Clearing this bit disables the mapping of ECL Trigger Line 1 to the front panel SMB connectors. This bit is cleared on a hard reset.

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ECL1DIR (ECL Trigger Line 1 Direction Bit - write only): If ECL1EN is set, this bit determines the direction in which the ECL Trigger Line 1 is mapped. If ECL1EN and ECL1DIR are both set, ECL trigger line 1 is driven by the signal received on the front panel Trigger In SMB connector. If ECL1EN is set and ECL1DIR is cleared, the ECL Trigger Line 1 is driven out of the mainframe through the Trigger Out SMB connector on the front panel. This bit is cleared on a hard reset.

MXSCTO (MXIbus System Controller Timeout Status Bit - read only): If this VXI-MXI is the MXIbus System Controller, this bit is set if the VXI-MXI sent a MXIbus BERR on the last MXIbus transfer in response to a MXIbus System Controller Timeout. This bit is cleared when this register is read and on hard and soft resets.

ECL0EN (ECL Trigger 0 Enable Bit - write only): Setting this bit enables the ECL Trigger line 0 to be mapped to the Trigger Out SMB connector or from the Trigger In SMB connector on the front panel, as specified by the ECL0DIR bit. Clearing this bit disables the mapping of ECL Trigger Line 0 to the front panel SMB connectors. This bit is cleared on a hard reset.

INTLCK (VXI-MXI Interlocked Bus Operation Status Bit - read only): When this bit is set, the VXI-MXI is configured to operate in interlocked bus mode. This mode of operation prevents deadlocks by allowing only one master of the entire system (VXIbus and MXIbus) at any given time. When this bit is cleared, the VXI-MXI is configured to operate in normal mode. INTLCK is selected with slide switch S3. This bit is not affected by hard or soft resets.

ECL0DIR (ECL Trigger Line 0 Direction Bit - write only): If ECL0EN is set, this bit determines the direction in which the ECL Trigger Line 0 is mapped. If ECL0EN and ECL0DIR are both set, ECL trigger line 0 is driven by the signal received on the front panel Trigger In SMB connector. If ECL0EN is set and ECL0DIR is cleared, the ECL Trigger Line 0 is driven out of the mainframe through the Trigger Out SMB connector on the front panel. This bit is cleared on a hard reset.

DSYSFAIL (Drive SYSFAIL Bit - read/write): When this bit is set, the VXI-MXI is driving the VXIbus SYSFAIL line active. When this bit is cleared, the VXI-MXI is not asserting the SYSFAIL line. This bit is cleared on hard and soft reset.

FAIR (VXI-MXI Fairness Status Bit - read only): When this bit is set, the VXI-MXI is configured as a fair MXIbus requester. If this bit is cleared, the VXI-MXI is configured as an unfair MXIbus requester. FAIR is selected with slide switch S2. This bit is not affected by hard or soft resets.

DSYSRST (Drive SYSRESET line Bit - write only): Setting this bit will cause the VXIbus SYSRESET line to pulse asserted for a minimum of 200 msec. This bit is automatically cleared after the assertion of SYSRESET.

MXISC (MXIbus System Controller Status Bit - read only): When this bit is set, the VXI-MXI is configured as the MXIbus System Controller. When this bit is cleared, the VXI-MXI is not configured as the MXIbus System Controller. MXISC is selected with slide switch S4. This bit is not affected by hard or soft resets.

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MXTRIGINT (MXIbus Trigger Interrupt Status Bit - read only): When this bit is set, the VXIbus Trigger Interrupt signal (TRIGINT in the Interrupt Status Register) is active and is being driven across the MXIbus IRQ line. When this bit is cleared, the TRIGINT signal is not driving the MXIbus IRQ line. This bit is cleared on a hard reset.

MXTRIGEN (MXIbus Trigger Interrupt Enable Bit - write only): Setting this bit enables the VXIbus Trigger Interrupt signal (TRIGINT in the Interrupt Status Register) to be driven across the MXIbus IRQ line. When this bit is cleared, the TRIGINT signal is not mapped to the MXIbus IRQ line. This bit is cleared on a hard reset.

MXSRSTINT (MXIbus SYSRESET Status Bit - read only): When this bit is set, the VXIbus SYSRESET line is active and is being driven across the MXIbus IRQ line. When this bit is cleared, the SYSRESET signal is not driving the MXIbus IRQ line. This bit is cleared on a hard reset.

MXSRSTEN (MXIbus SYSRESET Enable Bit - write only): Setting this bit enables the VXIbus SYSRESET line to be driven across the MXIbus IRQ line. When this bit is cleared, the VXIbus SYSRESET line is not mapped to the MXIbus IRQ line. This bit is cleared on a hard reset.

MXACFAILINT (MXIbus ACFAIL Status Bit - read only): When this bit is set, the VXIbus ACFAIL line is active and is being driven across the MXIbus IRQ line. When this bit is cleared, the ACFAIL signal is not driving the MXIbus IRQ line. This bit is cleared on a hard reset.

MXACFAILEN (MXIbus ACFAIL Enable Bit - write only): Setting this bit enables the VXIbus ACFAIL line to be driven across the MXIbus IRQ line. When this bit is cleared, the VXIbus ACFAIL line is not mapped to the MXIbus IRQ line. This bit is cleared on a hard reset.

LNGMXSCTO (**L**ong MXIbus System Controller Timeout Bit - read/write): When the VXI-MXI powers on, this bit is cleared and, if the VXI-MXI is the MXIbus System Controller, the MXIbus System Controller timeout is between 100 and 400 µsec (selected by jumper W6). When this bit is set, a longer MXIbus System Controller timeout value is used (a value between 100 and 400 msec) if the VXI-MXI is the MXIbus System Controller. This bit is cleared on a hard reset.

MXBERR (MXIbus Bus Error Bit - read only): If this bit is set, the VXI-MXI terminated the previous MXIbus transfer by driving the MXIbus BERR line. This bit is cleared on hard and soft reset and on successful MXIbus transfers.

BOFFCLR (Backoff Condition Clear Bit - write only): Setting this bit clears the BACKOFF bit in the Interrupt Status Register. The BACKOFF condition occurs when a VMEbus transfer to the MXIbus could not complete because another MXIbus transfer directed to the VXI-MXI was already in progress. This condition is called deadlock. This bit must be cleared before it can be set again to clear the BACKOFF bit. This bit is cleared on a hard reset.

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MXSYSFINT (MXIbus SYSFAIL Status Bit - read only): When this bit is set, the VXIbus SYSFAIL line is active and is being driven across the MXIbus IRQ line. The VXIbus SYSFAIL line is enabled to drive the MXIbus IRQ line with the SYSFOUT bit in the MXIbus IRQ Configuration Register. When this bit is cleared, the SYSFAIL signal is not driving the MXIbus IRQ line. This bit is cleared on a hard reset.

PARERR (Parity Error Bit - read only): If this bit is set, a MXIbus parity error occurred on either the address or the data portion of the last MXIbus transfer. This bit is cleared on hard and soft resets and on MXIbus transfers without a parity error.

MXIbus Lock Register

The MXIbus Lock Register is a read/write register. The single bit in this register performs differently depending on whether it was accessed by the VMEbus or the MXIbus. This register is cleared on hard and soft resets.

Base Address + 23_{16}								Base Address + 22_{16}							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	LOCKED

LOCKED (Lock MXIbus or VXIbus Bit): When this bit is set by a VXIbus device, the MXIbus is locked by that device as soon as the MXIbus is won by the VXI-MXI. When the MXIbus is locked, indivisible operations to remote resources can be performed across the MXIbus. When this bit is set by a device from across the MXIbus, the VXIbus is locked by that device so that indivisible operations to local VXIbus resources can be performed from the MXIbus.

Similarly, when a VXIbus device reads this bit as a one, it indicates that the MXIbus is locked. When a MXIbus device reads this bit as a one, it indicates that the VXIbus is locked.

MXIbus IRQ Configuration Register

The MXIbus IRQ Configuration Register is a device dependent read/write register which either maps the MXIbus IRQ line into a VMEbus IRQ line, or maps a VMEbus IRQ line into the MXIbus IRQ line. These bits are cleared on a hard reset.

Base Address + 25_{16}								Base Address + 24_{16}							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
SYSFOUT	MIRQ(7-1)EN							SYSFIN	MIRQ(7-1)DIR						

SYSFOUT (SYSFAIL Output Enable Bit): Setting this bit enables the VXIbus SYSFAIL line to be routed onto the MXIbus IRQ line. When this bit is cleared, the SYSFAIL line is not mapped to the MXIbus IRQ line.

MIRQ[7-1]EN (MXIbus IRQ Enable Bits): Setting these bits individually enables the corresponding VMEbus IRQ lines to drive or receive the MXIbus IRQ interrupt line. The corresponding MIRQDIR bits select whether the MXIbus IRQ interrupt line is driven or received by the VMEbus IRQ line.

SYSFIN (SYSFAIL Input Enable Bit): Setting this bit enables the MXIbus IRQ line to be driven on the VMEbus SYSFAIL line. When this bit is cleared, the MXIbus IRQ line is not mapped onto the SYSFAIL line.

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MIRQ[7-1]DIR (MXIbus IRQ Direction Bits): Setting these bits determines whether the corresponding VMEbus IRQ lines drive or are driven by the MXIbus IRQ interrupt lines. If the MIRQDIR bit is cleared and the corresponding MIRQEN bit is set, the corresponding VMEbus IRQ line drives the MXIbus IRQ line. If multiple VMEbus IRQ lines are enabled to drive the MXIbus IRQ line, the selected VMEbus IRQ lines are ORed together and the result drives the MXIbus IRQ line. If the MIRQDIR bit is set and the corresponding MIRQEN bit is set, the MXIbus IRQ line drives the corresponding VMEbus IRQ line.

Drive Triggers/Read LA Register

The Drive Triggers/Read LA Register is a read/write register which provides the logical address of the VXI-MXI and the status of the eight TTL Trigger lines on the VXIbus. This register is also used to drive the TTL and ECL Trigger lines individually. The bits in this register are cleared on hard and soft resets.

Base Address + 27_{16}									**Base Address + 26_{16}**							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Rd	DTRIG(7-0)								LADD(7-0)							
Wr	DTRIG(7-0)								0	0	0	0	0	PULSE	DRIVECL1	DRIVECL0

DTRIG[7-0] (Drive VXIbus Trigger Lines Bits): Setting these bits asserts the corresponding VXIbus TTL Trigger line(s) after synchronizing the signal with the 10-MHz clock. Reading these bits returns the current status of the corresponding trigger lines.

LADD[7-0] (Logical Address Status Bits): Reading these bits returns the logical address of this VXI-MXI. The logical address is selected with the DIP switch located at U46.

PULSE (Pulse Selected Trigger Line Bit): Writing a zero to this bit generates either a 100-nsec active low pulse, a 100-nsec active low level, or an active level on the trigger line, as specified by the OTS[2-0] bits in the Trigger Mode Selection Register. Before another signal can be generated, a one must be written to this bit. To generate a stream of pulses, a zero should be written to this bit, immediately followed by a one. In terms of the START/STOP protocol, writing a zero to this register generates a START signal, and writing a one generates a STOP signal on the specified trigger line.

DRVECL1 (Drive ECL Trigger Line 1 Bit): Setting this bit asserts the VXIbus ECL Trigger Line 1 after synchronizing the signal with the 10-MHz clock.

DRVECL0 (Drive ECL Trigger Line 0): Setting this bit asserts the VXIbus ECL Trigger Line 0 after synchronizing the signal with the 10-MHz clock.

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Trigger Mode Selection Register

The Trigger Mode Selection Register is a read/write register which configures the ECL and TTL Trigger lines for interrupt generation and trigger protocol generation. These bits are cleared on soft and hard resets.

Bass Address + 29h								
	15	14	13	12	11	10	9	8
Rd	1	1	1	1	1	1	1	1
Wr	OMS(2-0)			ITS(3-0)				ETOEN
Base Address + 28h$_{16}$								
	7	6	5	4	3	2	1	0
Rd	ECLSTAT1	ECLSTAT0	1	1	TRIGIN	TRIGOUT	ASINT*	SSINT*
Wr	OTS(3-0)				ETRIG	0	ASIE	SSIE

OMS[2-0] (Output Trigger Mode Select Bits): These bits select whether the trigger protocol or signal is driven on the trigger line specified by the OTS[3-0] bits.

OMS2	OMS1	OMS0	Trigger Output Mode
0	0	0	Disabled
0	0	1	Sync, Semi-Sync, or Async Source
0	1	0	Start-Stop Source
0	1	1	Semi-Sync Acceptor
1	0	0	Source from TRIG IN SMB
1	0	1	Reserved
1	1	X	Reserved

When in Sync, Semi-Sync, or Async Source Mode, write a zero to the PULSE bit in the Drive Triggers Register to generate a pulse on the trigger line selected by the OTS[3-0] bits. You must write a one to the PULSE bit before another pulse can be generated.

In Start-Stop Source Mode, write a zero to the PULSE bit in the Drive Triggers Register to generate a Start signal on the trigger line selected by the OTS[3-0] bits. Writing a one to the PULSE bit generates a Stop signal.

When in the Semi-Sync Acceptor Mode, the ITS[3-0] bits select the trigger line that the acceptor protocol is responding to. The acceptor signal is driven onto the trigger line selected by the OTS[3-0] bits. Write to the ASACK register to clear the acceptor signal.

ITS[3-0] (Input Trigger Select Bits): These bits select which VXIbus TTL or ECL trigger line is used to generate the synchronous and asynchronous trigger interrupts.

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ITS3	ITS2	ITS1	ITS0	Trigger Output Mode
0	0	0	0	TTL Trigger Line 0
0	0	0	1	TTL Trigger Line 1
0	0	1	0	TTL Trigger Line 2
0	0	1	1	TTL Trigger Line 3
0	1	0	0	TTL Trigger Line 4
0	1	0	1	TTL Trigger Line 5
0	1	1	0	TTL Trigger Line 6
0	1	1	1	TTL Trigger Line 7
1	0	0	0	Reserved
1	0	0	1	ECL Trigger Line 0
1	0	1	0	ECL Trigger Line 1
1	0	1	1	Reserved
1	1	X	X	Reserved

ETOEN (External trigger Output Enable): Setting this bit enables the OMS[2-0] modes to drive the selected trigger line to the TRIG OUT SMB connection.

ECLSTAT1 (ECL Trigger Line 1 Status Bit): Reading this bit returns the current status of ECL Trigger Line 1.

OTS[3-0] (Output Trigger Select Bits): These bits select which VXIbus TTL or ECL trigger line is used to route the trigger signal specified by the OMS[2-0] bits.

OTS3	OTS2	OTS1	OTS0	Trigger Output Mode
0	0	0	0	TTL Trigger Line 0
0	0	0	1	TTL Trigger Line 1
0	0	1	0	TTL Trigger Line 2
0	0	1	1	TTL Trigger Line 3
0	1	0	0	TTL Trigger Line 4
0	1	0	1	TTL Trigger Line 5
0	1	1	0	TTL Trigger Line 6
0	1	1	1	TTL Trigger Line 7
1	0	0	0	ECL Trigger Line 0
1	0	0	1	ECL Trigger Line 1
1	0	1	1	Reserved
1	1	X	X	Reserved

ECLSTAT0 (ECL Trigger Line 0 Status Bit): Reading this bit returns the current status of ECL Trigger Line 0.

TRIGIN (Trigger Input Status Bit): If this bit is set, the signal input from the Trigger In SMB connector on the front panel is high. If this bit is cleared, that input signal is low.

ETRIG (Enable Trigger Lines Bit): When this bit is set, the protocols selected by the OMS[2-0] bits are enabled to drive the trigger line specified by the OTS[3-0] bits.

TRIGOUT (Trigger Output Status Bit): If this bit is set, the trigger signal routed to the Trigger Out SMB connector on the front panel is high. If this bit is cleared, that trigger signal is low.

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ASINT* (Asynchronous Interrupt Status Bit): If this bit is cleared, the trigger signal selected by the ITS[3-0] bits is monitored and, when the signal changes from unasserted to asserted (high to low), an interrupt request is generated and this bit is cleared. ASINT* is set again by writing to the Trigger Asynchronous Acknowledge Register. In terms of the asynchronous protocol, this bit is cleared after the acceptor has sent an acknowledge by asserting the selected trigger line.

ASIE (Asynchronous Interrupt Enable Bit 0): When this bit is set, an interrupt request is generated when the trigger line selected by the ITS[3-0] bits changes from unasserted to asserted (high to low).

SSINT* (Synchronous Interrupt Status Bit): If this bit is clear, the trigger signal selected by the ITS[3-0] bits is monitored and, when it changes from asserted to unasserted (low to high), an interrupt request is generated and this bit is cleared. This bit is set again by writing to the Trigger Synchronous Acknowledge Register. In terms of the synchronous protocol, this bit is cleared after all the acceptors have unasserted the trigger line.

SSIE (Synchronous Interrupt Enable Bit): When this bit is set, an interrupt request is generated when the trigger line selected by the ITS[3-0] bits changes from asserted to unasserted (low to high).

Interrupt Status/Control Register

The Interrupt Status/Control Register is a read/write register which is used to configure local interrupts, drive the VMEbus IRQ lines individually, and reflect the status of the VMEbus IRQ lines. The upper byte (bits 15 through 8) of this register is cleared on a hard reset. The lower byte (bits 7 through 0) is cleared on hard and soft resets.

Bass Address + 2Bh								
	15	14	13	12	11	10	9	8
Rd	LINT(3-1)			ACFAILINT	BKOFF	TRIGINT	SYSFAIL	ACFAIL
Wr	LINT(3-1)			0	BKOFFIE	TRIGINTIE	SYSFAILIE	ACFAILIE
Base Address + 2Ah$_{16}$								
	7	6	5	4	3	2	1	0
Rd	SYSFINT	IRQ(7-1)						
Wr	0	DIRQ(7-1)						

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LINT[3-1] (Local Interrupt Line Bits): These bits select the VMEbus interrupt request line onto which the local VXI-MXI interrupts are routed. The local interrupts are BKOFF, TRIGINT, ACFAIL, and SYSFAIL.

LINT3	LINT2	LINT1	VMEbus Interrupt Request Line
0	0	0	Local Interrupts disabled
0	0	1	Interrupt Request Line 1
0	1	0	Interrupt Request Line 2
0	1	1	Interrupt Request Line 3
1	0	0	Interrupt Request Line 4
1	0	1	Interrupt Request Line 5
1	1	0	Interrupt Request Line 6
1	1	1	Interrupt Request Line 7

ACFAILINT (VXIbus ACFAIL Interrupt Status Bit): If this bit is set, an interrupt is currently driven on the VMEbus interrupt line selected by the LINT[3-1] bits because the VXIbus ACFAIL line became set. This bit is cleared on an interrupt acknowledge cycle for the interrupt level selected by the LINT[3-1] bits.

BKOFF (Backoff Status Bit): This bit is set if a VMEbus transfer to or from the MXIbus could not complete because another MXIbus transfer to this module was already in progress; in other words, a deadlock condition occurred. The interrupt generated by this bit is cleared on an interrupt acknowledge cycle for the interrupt level selected by the LINT[3-1] bits. This bit is cleared by writing to the BOFFCLR bit in the MXIbus Control Register.

BKOFFIE (Backoff Interrupt Enable Bit): If this bit is set, an interrupt is generated on the VMEbus interrupt line selected by the LINT[3-1] bits when a VMEbus Backoff condition occurs.

TRIGINT (Trigger Interrupt Bit): This bit is set when either the ASINT* or SSINT* bit is cleared in the Trigger Mode Selection Register. These bits become set and generate an interrupt when the trigger signal selected by the ITS[3-0] bits changes state. The interrupt generated by this bit is cleared on an interrupt acknowledge cycle for the interrupt level selected by the LINT[3-1] bits. This bit is cleared when the ASACK and SSACK Registers are read.

TRIGINTIE (Trigger Interrupt Enable Bit): If this bit is set, an interrupt is generated on the VMEbus interrupt line selected by the LINT[3-1] bits when an ASINT* or SSINT* interrupt occurs.

SYSFAIL (VXIbus SYSFAIL Status Bit): This bit reflects the status of the VXIbus SYSFAIL line.

SYSFAILIE (VXIbus SYSFAIL Interrupt Enable Bit): If this bit is set, an interrupt is generated on the VMEbus interrupt line selected by the LINT[3-1] bits when the VXIbus SYSFAIL line is set.

ACFAIL (VXIbus ACFAIL Status Bit): This bit reflects the status of the VXIbus ACFAIL line.

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ACFAILIE (VXIbus ACFAIL Interrupt Enable Bit): If this bit is set, an interrupt is generated on the VMEbus interrupt line selected by the LINT[3-1] bits when the VXIbus ACFAIL line is set.

SYSFAILINT (VXIbus SYSFAIL Interrupt Status Bit): If this bit is set, an interrupt is currently driven on the VMEbus interrupt line selected by the LINT[3-1] bits because the VXIbus SYSFAIL line became set. This bit is cleared on an interrupt acknowledge cycle for the interrupt level selected by the LINT[3-1] bits.

IRQ[7-1] (IRQ Status Bit): These bits reflect the status of the corresponding VMEbus IRQ lines.

DIRQ[7-1] (Drive IRQ Line Bits): Setting these bits drives the corresponding VMEbus IRQ lines. When the VMEbus IRQ line driven by one of these bits is serviced by an VMEbus interrupt acknowledge cycle, the corresponding bit is cleared.

Status/ID Register

The Status/ID Register is a read/write register which contains the Status/ID value returned to the Interrupt Handler acknowledging an interrupt request driven by one of the DIRQ bits in the Interrupt Control Register.

Base Address + $2D_{16}$								**Base Address + $2C_{16}$**							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
S(15-0)															

S[15-0] (Status/ID Value): This 16-bit value is the Status/ID data that is returned during a VMEbus interrupt acknowledge cycle used to handle a VMEbus interrupt request driven by one of the DIRQ bits in the Interrupt Control Register. This register powers up to an indeterminate value and is not cleared on either a hard or soft reset.

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External Trigger Port Configuration Register

The External Trigger Port Configuration Register is a read/write register which maps the VXIbus TTL Trigger lines to and from the Trigger In and Trigger Out SMB connectors on the front panel of the VXI-MXI. These bits are cleared on a hard reset.

Base Address + $2F_{16}$								Base Address + $2E_{16}$							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
TRIGEN(7-0)								TRIGDIR(7-0)							

TRIGEN[7-0] (Trigger Enable Bits): Setting these bits individually enable the corresponding VXIbus TTL trigger lines to be mapped to the Trigger Out SMB connector or from the Trigger In SMB connector on the front panel as specified by the corresponding TRIGDIR bit. Clearing these bits disables the mapping of the trigger lines to the front panel SMB connectors.

TRIGDIR[7-0] (Trigger Direction Bits): Setting these bits determines the direction in which the corresponding TTL Trigger lines are mapped to the front panel SMB connectors. If the TRIGEN and TRIGDIR bits are both set, the corresponding trigger line is driven by the signal received from the front panel Trigger In SMB connector. If the TRIGEN bit is set and the TRIGDIR bit is cleared, the corresponding TTL Trigger line is driven out of the mainframe through the Trigger Out SMB connector.

Trigger Synchronous Acknowledge Register

The Trigger Synchronous Acknowledge Register is a write only register accessed from base address + 34_{16}. Writing any value to this register re-initializes the SSINT* bit in the Trigger Mode Selection Register.

Base Address + 35_{16}								Base Address + 34_{16}							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Trigger Asynchronous Acknowledge Register

The Trigger Asynchronous Acknowledge Register is a write only register accessed from base address + 36_{16}. Writing any value to this register re-initializes the ASINT* bit in the Trigger Mode Selection Register.

Base Address + 37_{16}								Base Address + 36_{16}							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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IRQ Acknowledge Registers

The 7 IRQ Acknowledge Registers are read only registers accessible at the addresses shown below.

IRQ	Address
IRQ1*	Base Address + 32_{16}
IRQ2*	Base Address + 34_{16}
IRQ3*	Base Address + 36_{16}
IRQ4*	Base Address + 38_{16}
IRQ5*	Base Address + $3A_{16}$
IRQ6*	Base Address + $3C_{16}$
IRQ7*	Base Address + $3E_{16}$

These registers generate a VMEbus interrupt acknowledge cycle when they are read from a MXIbus device.

Register Address + 1 (See above)								Register Address + 0 (See above)							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
I(15-0)															

I[15-0] (Interrupt Acknowledge Status/ID): Reading from these registers generates an interrupt acknowledge cycle on the VMEbus and returns the Status/ID value from the interrupt acknowledge cycle. These registers can be used to handle interrupts across the MXIbus. Each VMEbus IRQ line has a separate interrupt acknowledge register, as shown above in the VXIbus Address. The value returned when these registers are read by a VMEbus device is hex FFFF.

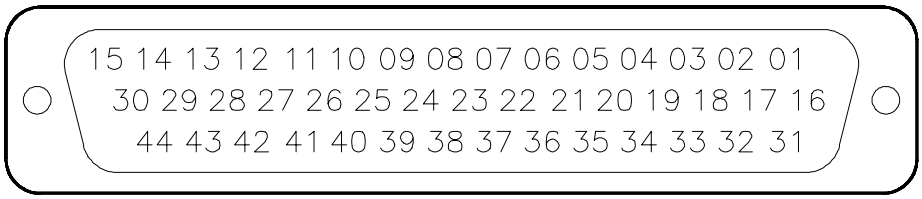
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Appendix D

INTX/MXI Connector Pinouts

About this Appendix

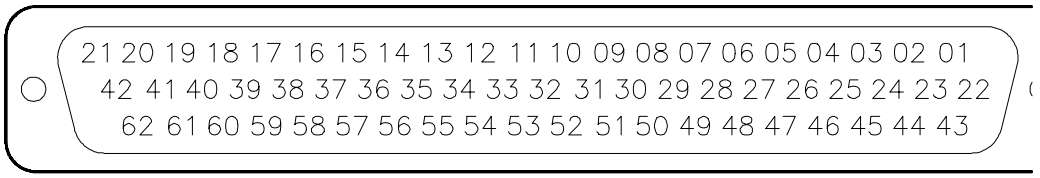
This appendix contains the pinouts for the INTX connector and the MXI connector.



Pin	Signal	Pin	Signal	Pin	Signal
1	SD+	16	SC-	31	SD-
2	SYSFAIL	17	Reserved	32	GND
3	GND	18	IRQ7*	33	IRQ3*
4	ACFAIL	19	IRQ6*	34	GND
5	GND	20	GND	35	IRQ2*
6	SYSRST*	21	IRQ5*	36	GND
7	GND	22	GND	37	IRQ1*
8	TRIG8+	23	IRQ4*	38	GND
9	TRIG8-	24	GND	39	TRIG3+
10	TRIG7+	25	TRIG5+	40	TRIG3-
11	TRIG7-	26	TRIG5-	41	TRIG2+
12	TRIG6+	27	TRIG4+	42	TRIG2-
13	TRIG6-	28	TRIG4-	43	TRIG1+
14	SC+	29	GND	44	TRIG1-
15	CLK+	30	CLK-		

Figure D-1. INTX Connector Pinout.

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Pin	Signal	Pin	Signal	Pin	Signal
1	AM4*	22	AD15*	43	PAR*
2	AM3*	23	AD14*	44	SIZE*
3	AM2*	24	AD13*	45	BREQ*
4	AM1*	25	AD12*	46	BUSY*
5	AM0*	26	AD11*	47	GND
6	AD31*	27	AD10*	48	GND
7	AD30*	28	AD09*	49	GND
8	AD29*	29	AD08*	50	GND
9	AD28*	30	AD07*	51	GND
10	AD27*	31	AD06*	52	GND
11	AD26*	32	AD05*	53	GND
12	AD25*	33	AD04*	54	GND
13	AD24*	34	AD03*	55	GND
14	AD23*	35	AD02*	56	GND
15	AD22*	36	AD01*	57	GND
16	AD21*	37	AD00*	58	GND
17	AD20*	38	DS*	59	GOUT*
18	AD19*	39	AS*	60	GIN*
19	AD18*	40	WR*	61	IRQ*
21	AD17*	41	DTACK*	62	TERMPWR
21	AD16*	42	BERR*		

Figure D-2. MXI Connector Pinout.

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