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Getting Started with Your VXI-AT2000 and the NI-VXI™ Software for MS-DOS



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Federal Communications Commission

This device complies with Part 15 of the Federal Communications Commission (FCC) Rules for a Class A digital device. Operation is subject to the following two conditions:

1. This device may not cause harmful interference in commercial environments.

2. This device must accept any interference received, including interference that may cause undesired operation.

Canadian Department of Communications

This device complies with the limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications (DOC).

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le règlement sur le brouillage radioélectrique édicté par le ministère des communications du Canada.

Instructions to Users

These regulations are designed to provide reasonable protection against harmful interference from the equipment to radio reception in commercial areas. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

There is no guarantee that interference will not occur in a particular installation. However, the chances of interference are much less if the equipment is installed and used according to this instruction manual.

If the equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, one or more of the following suggestions may reduce or eliminate the problem.

- Operate the equipment and the receiver on different branches of your AC electrical system.
- Move the equipment away from the receiver with which it is interfering.
- Reorient or relocate the receiver's antenna.
- Be sure that the equipment is plugged into a grounded outlet and that the grounding has not been defeated with a cheater plug.

Notice to user: Changes or modifications not expressly approved by National Instruments could void the user's authority to operate the equipment under the FCC Rules.

If necessary, consult National Instruments or an experienced radio/television technician for additional suggestions. The following booklet prepared by the FCC may also be helpful: *How to Identify and Resolve Radio-TV Interference Problems.* This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock Number 004-000-00345-4.

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About This Manual

This manual contains instructions for installing and configuring the National Instruments VXI-AT2000 interface kit. This manual is meant to be used with the *NI-VXI Software Reference Manual for C* (part number 320307-01), the *NI-VXI Software Reference Manual for BASIC* (part number 320328-01), and the *NI-VXI DOS Utilities Reference Manual* (part number 320323-01).

Organization of This Manual

Getting Started with Your VXI-AT2000 and the NI-VXI Software for MS-DOS is organized as follows:

- Chapter 1, *Introduction*, describes the VXI-AT2000 interface kit, contains a picture of the VXI-AT2000 interface kit, lists the contents of your kit, and lists optional equipment and software.
- Chapter 2, *Hardware Configuration and Installation*, contains the instructions to configure and install the VXI-AT2000 interface kit.
- Chapter 3, *NI-VXI Software Configuration and Installation*, lists all the programs and files located on the NI-VXI distribution diskettes, contains instructions for installing and configuring the NI-VXI software for MS-DOS, and contains a description of the `VXIEDIT` configuration editor.
- Appendix A, *Specifications*, lists various module specifications of the AT-MXI and VXI-MXI, such as physical dimensions and power requirements.
- Appendix B, *Troubleshooting*, addresses certain problems you may encounter when using the NI-VXI bus interface software on the AT-MXI platform.
- Appendix C, *Customer Communication*, contains forms you can use to request help from National Instruments or to comment on our products and manuals.
- The *Glossary* contains an alphabetical list and description of terms used in this manual, including abbreviations, acronyms, metric prefixes, and symbols.

Conventions Used in This Manual

The following conventions are used to distinguish elements of text throughout this manual:

bold	Bold text denotes menu items.
italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
bold italic	Bold italic text denotes a note, caution, or warning.
`monospace`	Text in this font denotes text or characters that are to be literally input from the keyboard, the proper names of disk drives, paths, directories, programs, subprograms, device names, filenames and extensions, and for statements and comments taken from program code.
`bold monospace`	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen.
<>	Angle brackets enclose the name of a key on the keyboard–for example, <Esc>.

Abbreviations, acronyms, metric prefixes, mnemonics, symbols, and terms are listed in the *Glossary*.

How to Use the Documentation Set

We suggest that you begin by reading this manual to guide you through the installation and configuration of the hardware and software. The software configuration requires that you first complete the installation and configuration of the hardware.

When you are familiar with the material in this manual, you can begin to use the *NI-VXI Software Reference Manual for C*. Chapter 1, *Introduction to VXI,* and Chapter 2, *Introduction to the NI-VXI Functions,* present the concepts of VXI and prepare you for detailed explanations of the NI-VXI functions. Study the descriptions of each function given in Chapters 3 through 13 to fully understand the purpose and syntax of each function. The *NI-VXI Software Reference Manual for BASIC* covers the same material with BASIC syntax. Refer to the *NI-VXI DOS Utilities Reference Manual* to learn more about the `VIC` and `VXIEDIT` programs. The *LabWindows VXI Library Reference Manual*, part number 320318-01, explains how to install and use the optional LabWindows VXI Library for the AT-MXI.

Related Documentation

The following documents contain information that you may find helpful as you read this manual:

- *IEEE Standard for a Versatile Backplane Bus: VMEbus*, ANSI/IEEE Standard 1014-1987
- *Multisystem Extension Interface Bus Specification*, Version 1.2 (part number 340007-01)
- VXI-1, *VXIbus System Specification*, Rev. 1.4, VXIbus Consortium (available from National Instruments Corporation, part number 350083-01)
- VXI-6, *VXIbus Mainframe Extender Specification*, Rev. 1.0, VXIbus Consortium (available from National Instruments Corporation, part number 340258-01)
- *VXI-MXI User Manual* (part number 320222-01)

Customer Communication

National Instruments wants to receive your comments on our products and manuals. We are interested in the applications you develop using our products, and we want to help if you have problems with them. To make it easy for you to contact us, this manual contains comment and configuration forms for you to complete. These forms are in Appendix C, *Customer Communication*, at the end of this manual.

Chapter 1
Introduction

This chapter describes the VXI-AT2000 interface kit, contains a picture of the VXI-AT2000 interface kit, lists the contents of your kit, and lists optional equipment and software.

The VXI-AT2000 is an interface kit that links any IBM Personal Computer AT or compatible computer (hereafter referred to as the PC AT) directly to the VXIbus. A PC AT equipped with a VXI-AT2000 can function as a VXI Commander and Resource Manager. The VXI-AT2000 makes the PC AT appear as though it were plugged directly into the VXI backplane as an embedded CPU VXI module.

Figure 1-1 shows the VXI-AT2000 interface kit.

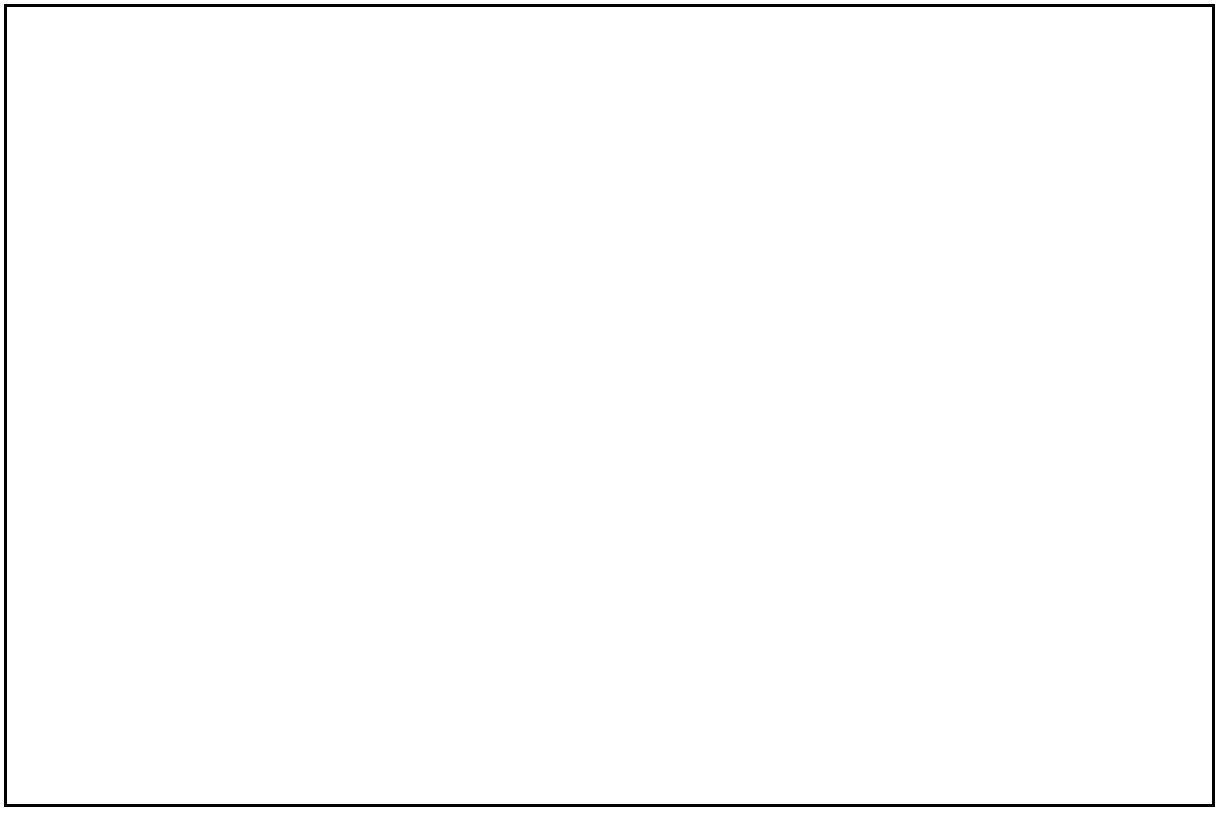


Figure 1-1. VXI-AT2000 Interface Kit

What Your Kit Should Contain

Your kit should contain the following components:

Component	Part Number
AT-MXI Interface Board	180775-01
Standard VXI-MXI Interface Module or Enhanced VXI-MXI Interface Module with INTX option	181045-01 181045-02
3.5 in. NI-VXI Distribution Disks for the AT-MXI and and MS-DOS and 5.25 in. NI-VXI Distribution Disks for the AT-MXI and and MS-DOS	422178-48 422179-48 420178-48 420179-48
2 m Type M1 MXIbus Cable *	180758-02
Getting Started with Your VXI-AT2000 and the NI-VXI Software for MS-DOS	320219-01
NI-VXI DOS Utilities Reference Manual	320323-01
NI-VXI Software Reference Manual for BASIC	320328-01
NI-VXI Software Reference Manual for C	320307-01

* The 2 m Type M1 MXIbus cable is included in your kit unless you specified otherwise in your order. You may have ordered your kit without this cable so that you could order a different type or length of MXIbus cable. Refer to the *Optional Equipment* section on the following page.

Make sure each of these items is in your kit. If any item is missing, contact National Instruments.

Optional Equipment

Equipment	Part Number
Type M1 MXIbus Cables Straight Point-to-Point Connectors:	
– 1 m	180758-01
– 2 m	180758-02
– 4 m	180758-04
– 8 m	180758-08
– 20 m	180758-20
Type M2 MXIbus Cables Straight Point-to-Right Angle Daisy-Chain Connectors:	
– 1 m	180760-01
– 2 m	180760-02
– 4 m	180760-04
– 8 m	180760-08
– 20 m	180760-20
Type M3 MXIbus Cables Right Angle Point-to-Right Angle Daisy-Chain Connectors:	
– 1 m	180761-01
– 2 m	180761-02
– 4 m	180761-04
– 8 m	180761-08
– 20 m	180761-20
MXIbus Terminating Pac (External)	180780-01
VXI-MXI Standard VXIbus Mainframe Extender Kit	776310-01
VXI-MXI Enhanced VXIbus Mainframe Extender Kit	776310-02
VME-MXI Standard VMEbus Chassis Extender Kit	776434-01
VME-MXI Enhanced VMEbus Chassis Extender Kit	776434-02

Optional Software

If you want to use LabWindows with your VXI-AT2000 system, you can order either the LabWindows for DOS, VXI Development System, or the LabWindows/CVI for Windows, VXI Development System. If you want LabWindows/CVI, you must also order NI-VXI Windows Software for the AT-MXI. The following table lists the subcomponents of the two kits.

Software	Part Number
LabWindows for DOS, VXI Development System: LabWindows for DOS Full Develoment System, LabWindows for DOS VXI Libraries, LabWindows for DOS VXI Instrument Library	776729-21
LabWindows/CVI for Windows, VXI Development System: LabWindows/CVI for Windows Full Develoment System, LabWindows/CVI for Windows VXI Libraries, LabWindows/CVI for Windows VXI Instrument Library	776804-21
NI-VXI Windows Software for the AT-MXI (required for LabWindows/CVI for Windows only)	776458-01

If you want to use LabVIEW with your VXI-AT2000, you must order NI-VXI Windows Software for the AT-MXI and the LabVIEW for Windows VXI Development System.

Software	Part Number
LabVIEW for Windows VXI Development System: LabVIEW for Windows Full Development System, LabVIEW for Windows VXI Library, LabVIEW for Windows/Sun VXI Instrument Library	776674-21
NI-VXI Windows Software for the AT-MXI	776458-01

Chapter 2
Hardware Configuration and Installation

This chapter contains the instructions to configure and install the VXI-AT2000 interface kit. The instructions are given in the order that you should perform them. A summary of the steps is as follows:

1. Unpack the AT-MXI and VXI-MXI hardware.
2. Configure the AT-MXI hardware.
3. Install the AT-MXI hardware.
4. Configure the VXI-MXI hardware.
5. Install the VXI-MXI hardware.
6. Connect the MXIbus cable.

Step 1. Unpack the AT-MXI and VXI-MXI

Follow these steps when unpacking your AT-MXI board and VXI-MXI module:

1. Before attempting to configure or install the AT-MXI and VXI-MXI, inspect the shipping container and its contents for damage. If damage appears to have been caused in shipment, file a claim with the carrier. Retain the packing material for possible inspection and/or for reshipment.
2. Verify that the pieces contained in the package you received match the kit parts list. *Do not* remove the boards from their plastic bags at this point.
3. Your AT-MXI board and VXI-MXI module are shipped packaged in antistatic plastic bags to prevent electrostatic damage. Some of the circuitry on the AT-MXI and VXI-MXI use CMOS technology and can be damaged by electrostatic discharge. Before removing the boards from their antistatic bags, touch the bags to a metal part of your computer chassis.
4. As you remove the AT-MXI and VXI-MXI from their bags, be sure to handle them only by their edges. Avoid touching any of the IC components or connectors. Inspect them for loose components or any other sign of damage. Notify National Instruments if either board appears damaged in any way. *Do not* install equipment that appears to be damaged.

Step 2. Configure the AT-MXI Hardware

Figure 2-1 shows the location of the AT-MXI configuration jumpers and switches.

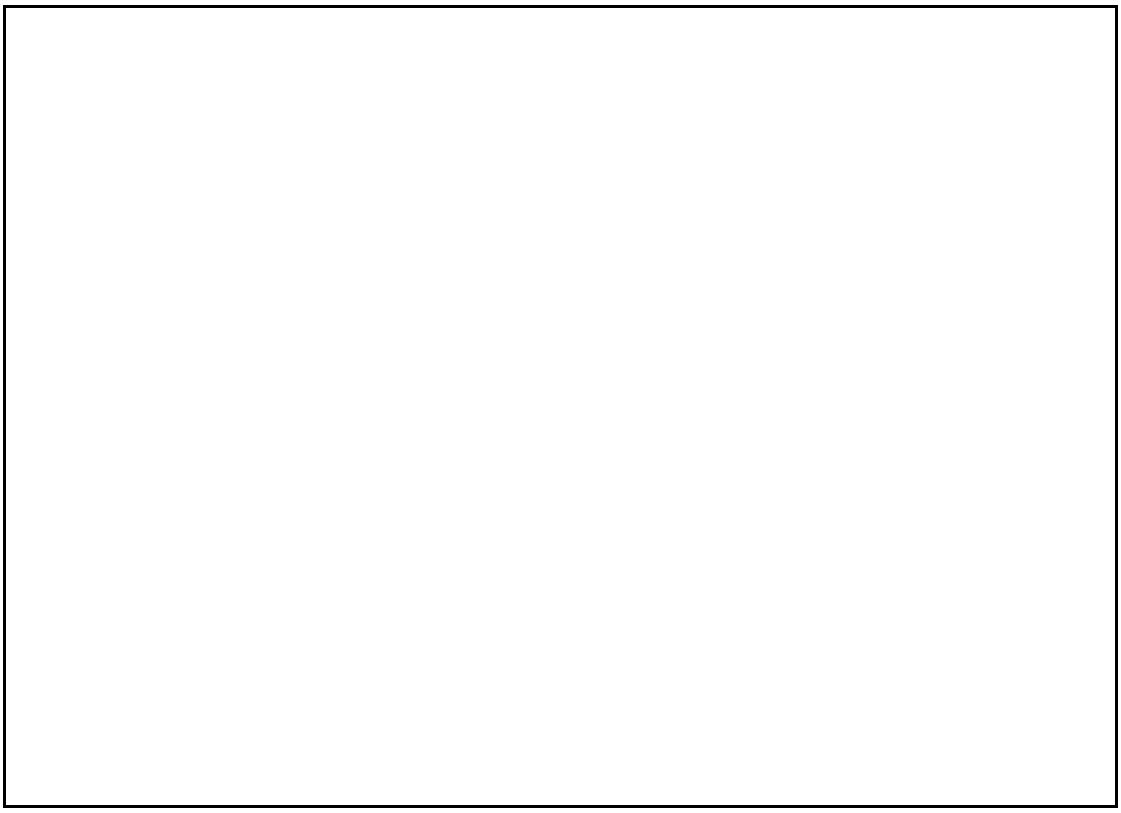


Figure 2-1. AT-MXI Parts Locator Diagram

Switch and Jumper Settings

You can configure three options on the AT-MXI board:

- Base I/O address
- Interrupt levels
- DMA channels

Table 2-1 shows the factory settings and optional configurations for the switches and jumpers on the AT-MXI.

Table 2-1. AT-MXI Factory Default Settings and Optional Configurations

AT-MXI	Default	Optional
Base I/O Address (hex)	340	100 to 3E0, increments of 20 hex
Master DMA Channel	6	0, 1, 2, 3, 5, 6, 7, and Not Used
Slave DMA Channel	3	0, 1, 2, 3, 5, 6, 7, and Not Used
Board Interrupt Level	12	3, 4, 5, 6, 7, 9, 10, 11, 12, 14, and 15
MXIbus Interrupt Level	10	3, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, and Not Used

The factory-configured settings of the base I/O address, the interrupt levels, and the Direct Memory Access (DMA) channels are suitable for most computer systems. The following sections describe under what conditions you would be required to change the configuration switches and/or jumpers on the AT-MXI and how to make these changes.

Base I/O Address Selection

The base I/O address of the AT-MXI is the starting address of the AT-MXI configuration registers in PC AT I/O space. The base I/O address is determined by the position of the five switches at location U31, as shown in Figure 2-1. The switches are set at the factory for a base I/O address of 340 hex. Because the AT-MXI requires 32 bytes of consecutive I/O space for its internal registers, the factory configuration uses the I/O address space in the range of 340 to 35F hex.

Note: ***Check to determine that this space is not already used by other I/O interfaces installed in your PC AT computer. If any equipment in your computer uses this I/O address space, you must change either the base I/O address of the AT-MXI or the I/O address space requirements of the other device. All PC AT devices must have a unique partition of the system's I/O address space. If you change the base I/O address of the AT-MXI, you must make a corresponding change to the AT-MXI configuration software as described in the*** *Configuring the NI-VXI Software* ***section of Chapter 3 of this manual.***

Each switch in U31 (1 through 5) corresponds to one of the PC AT address lines (A5 through A9). The first switch (1) corresponds to address line A5, the next switch (2) corresponds to address line A6, and so on. The five least significant bits of the address (A4 through A0) are used by the AT-MXI to select the appropriate AT-MXI register and cannot be changed; therefore, bits A4 through A0 are always zeros when determining the base I/O address.

To change the base I/O address of the AT-MXI, press the side marked *OFF* to select a binary value of 1 for the corresponding address bit. Press the *ON* side of the switch to select a binary value of 0 for the corresponding address bit. Refer to Table 2-2.

Figure 2-2 shows two possible switch settings.

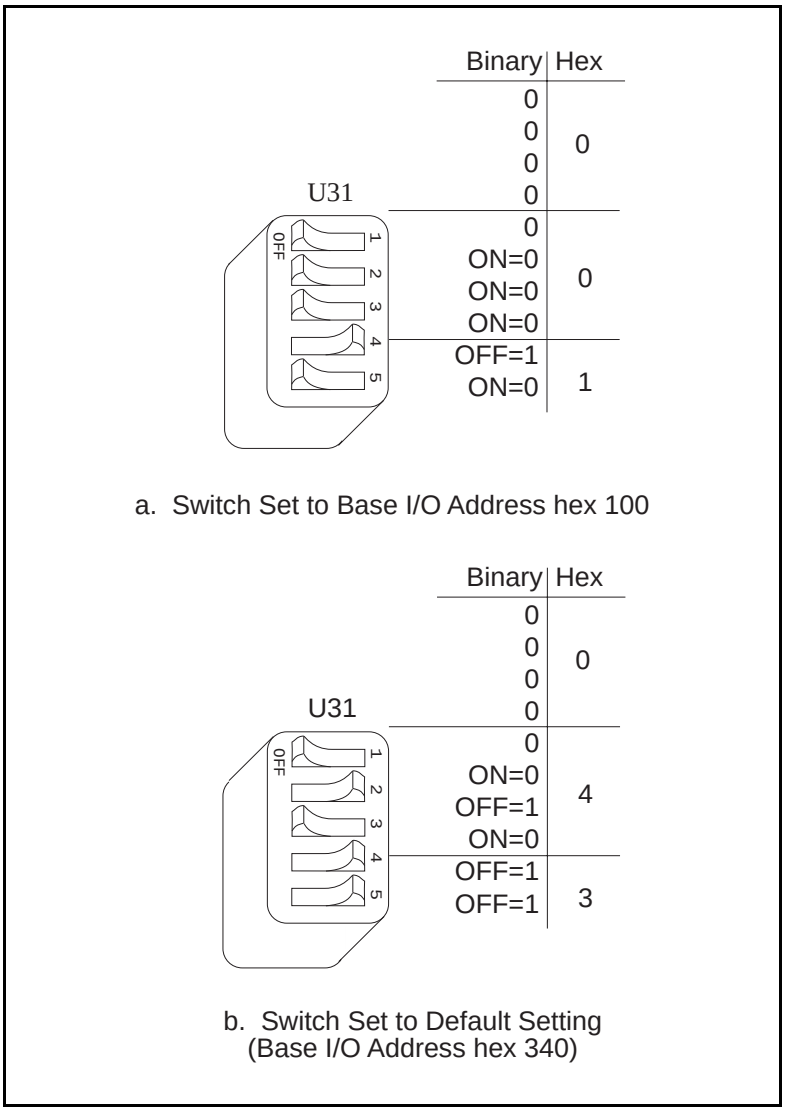


Figure 2-2. Base I/O Address Switch Settings

Table 2-2 lists the 24 possible switch settings, the corresponding base I/O address, and the I/O address space used for that setting. Notice that the base address settings that correspond to an I/O address in the range from 0 to FF hex are not listed. These addresses are used by logic on the PC AT motherboard and cannot be used by I/O adapter modules.

Table 2-2. Possible Base I/O Address Settings for the AT-MXI

Switch Setting A9 A8 A7 A6 A5	Base I/O Address (hex)	I/O Ports Used (hex)
0 1 0 0 0	100	100 - 11F
0 1 0 0 1	120	120 - 13F
0 1 0 1 0	140	140 - 15F
0 1 0 1 1	160	160 - 17F
0 1 1 0 0	180	180 - 19F
0 1 1 0 1	1A0	1A0 - 1BF
0 1 1 1 0	1C0	1C0 - 1DF
0 1 1 1 1	1E0	1E0 - 1FF
1 0 0 0 0	200	200 - 21F
1 0 0 0 1	220	220 - 23F
1 0 0 1 0	240	240 - 25F
1 0 0 1 1	260	260 - 27F
1 0 1 0 0	280	280 - 29F
1 0 1 0 1	2A0	2A0 - 2BF
1 0 1 1 0	2C0	2C0 - 2DF
1 0 1 1 1	2E0	2E0 - 2FF
1 1 0 0 0	300	300 - 31F
1 1 0 0 1	320	320 - 33F
1 1 0 1 0	340 (default)	340 - 35F

(continues)

Table 2-2. Possible Base I/O Address Settings for the AT-MXI (Continued)

Switch Setting A9 A8 A7 A6 A5	Base I/O Address (hex)	I/O Ports Used (hex)
1 1 0 1 1	360	360 - 37F
1 1 1 0 0	380	380 - 39F
1 1 1 0 1	3A0	3A0 - 3BF
1 1 1 1 0	3C0	3C0 - 3DF
1 1 1 1 1	3E0	3E0 - 3FF

Interrupt Level Selection

The AT-MXI interface board can use either one or two of the eleven interrupt levels of the PC AT I/O channel. Setting up an interrupt level for operation involves two steps. First you select the interrupt level by arranging the jumpers on an array of pins. Next you enable the interrupt level in the system software.

Note: ***You must enable the interrupt levels in the system software before they can function. If you do not enable the interrupt level, that level will not be driven and can be used by other devices, regardless of the positions of the jumpers.***

Interrupt levels are selected by the position of two jumpers on the 3 by 11 array of pins labeled *W3*, located above the I/O card-edge connector on the AT-MXI (refer to Figure 2-1). Use the jumper *farther* from the card-edge connector to select the PC AT interrupt level that will convey board status and error information. Remember to enable this level, or board interrupt, in the system software for the AT-MXI to function properly. The factory default setting is level 12 and is enabled on this level by the default configuration software.

Use the jumper on the W3 pin array *closer* to the I/O card-edge connector to select which PC AT interrupt level corresponds to the MXIbus interrupt signal *IRQ**. Because the MXIbus interrupt is also one of the conditions covered by the other jumper, you normally do not need to use a separate interrupt level for the MXIbus *IRQ** signal; it is useful only if you want a different interrupt vector or priority for MXIbus interrupts. This jumper is set at the factory to a default level of 10.

Note: ***The AT-MXI does not have the ability to share interrupt levels with other devices. If you select an interrupt level by placing a jumper on a particular level and enable that level in software, no other device in the system can use that level. Make sure that no other devices in your system use the interrupt level(s) selected and enabled for use by the AT-MXI. If they do, change the interrupt level(s) of either the AT-MXI or the other devices. If you change an AT-MXI interrupt level, make a corresponding change to the AT-MXI configuration software as described in the*** *Configuring the NI-VXI Software* ***section of Chapter 3.***

The AT-MXI can use interrupt levels IRQ3, 4, 5, 6, 7, 9, 10, 11, 12, 14, and 15. Be careful when re-assigning interrupt levels on the AT-MXI. Notice that most PC ATs use interrupt level 6 for the diskette drive controller and interrupt level 14 for the hard disk drive controller. Other interrupt levels might be used by standard logic devices on the motherboard so check your computer documentation before changing interrupt levels.

Once you have chosen an interrupt level, place the jumper on the appropriate pins to select that interrupt level. Use the two rows of pins farther from the card-edge connector to select the board interrupt level, and the two rows of pins closer to the card-edge connector to select the MXIbus interrupt level. Figure 2-3a shows the factory default interrupt jumper setting of the AT-MXI, with board interrupt level 12 and MXIbus interrupt level 10.

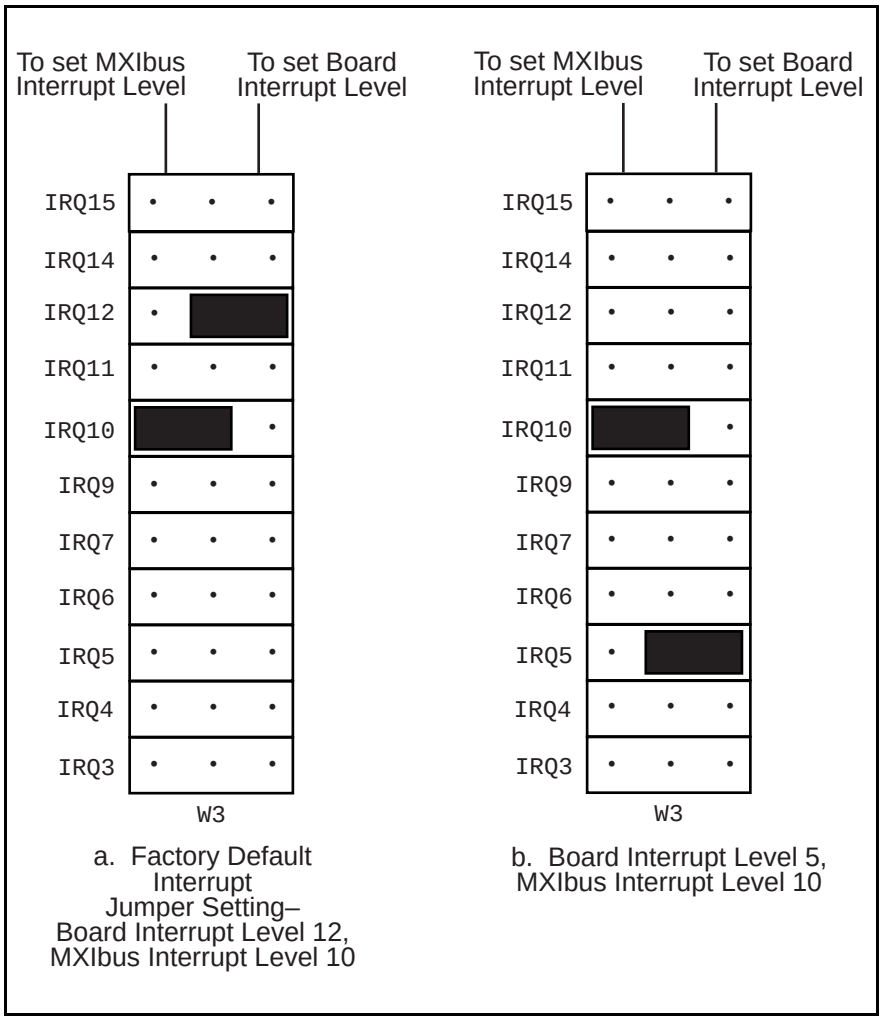


Figure 2-3. Board and MXIbus Interrupt Jumper Settings

To change to another interrupt level, remove the appropriate jumper from its current position and place it on the new posts. Figure 2-3b shows the board interrupt level changed to IRQ5.

DMA Channel Selection

The AT-MXI interface board can use one, two, or none of the seven DMA channels of the PC AT I/O channel. Setting up a DMA channel for operation involves two steps. First you select the DMA channel by arranging the jumpers on an array of pins. Next you enable the DMA channel in the system software.

Note: ***You must enable the DMA channels in the system software before they can function. If you do not enable the DMA channel, that channel will not be driven and can be used by other devices, regardless of the positions of the jumpers.***

Select the DMA channels on the two 3 by 7 arrays of pins labeled *W1* and *W2*, located above the I/O card-edge connector on the AT-MXI (refer to Figure 2-1). Use the W1 array to select the DMA request line(s), and use the W2 array to select the DMA acknowledge line(s). You must position two jumpers to select a single DMA channel. The DMA ACKnowledge (DACK*n*) and DMA ReQuest (DRQ*n*) lines selected must have the same numeric suffix for proper operation. Therefore, make sure that the jumper positions on the W1 array are identical to the jumper positions on the W2 array.

Master Mode Versus Slave Mode

The AT-MXI can function as both a MXIbus master and a MXIbus slave. As a MXIbus master, the AT-MXI circuitry determines whether a PC AT cycle is to be mapped into a MXIbus cycle intended for some external MXIbus device such as a VXIbus mainframe. As a MXIbus slave, the AT-MXI circuitry determines whether an external device is attempting to access PC AT memory or I/O resources.

Note: ***When allocating DMA channels for use by the AT-MXI, keep in mind that master-mode and slave-mode operation are two distinct asynchronous functions and require different DMA channels.***

Although the master-mode DMA jumpers are set at the factory to use DMA channel 6, the software statically disables the master-mode DMA channel with a setting of `NONE` and cannot be changed. While the AT-MXI itself is capable of using DMA to perform high-speed block-mode transfers to or from external MXIbus devices, the processor is able to transfer data at significantly faster rates by using the `movs` (move string) instruction. DMA transfers offer superior performance only in asynchronous function calls, which begin an operation and return immediately, freeing the processor to do other useful work. However, because DMA transfers would be applicable only for the `VXImove` function, which is *not* asynchronous, the software is configured to ignore this option, making the hardware setting irrelevant. The field remains in the `VXIEDIT` software configuration program for backward compatibility only.

The slave-mode DMA jumpers are set at the factory to use DMA channel 3. Although the default software configuration enables this setting, several factors effectively disable the slave-mode DMA channel. As a result, DMA channel 3 can be used by other devices if you do not need to use slave-mode DMA with your AT-MXI.

The slave-mode DMA channel is necessary only for setting up shared access to PC AT resource from external MXIbus devices. If you intend to communicate with VXI devices using a shared

memory protocol that uses the PC AT memory, you must select and enable a slave-mode DMA channel. However, because the AT-MXI does not share resources in its default software configuration, you need to change some software settings before you can use this feature. Refer to the *Logical Address Configuration* section of Chapter 3, *NI-VXI Software Installation and Configuration*, to see the default settings of the fields that affect the slave-mode DMA channel. The default settings are as follows:

- The **Address Space** field is set to A16 only. To share RAM you need to change this field to A16/A24.
- The **VXI Shared RAM Window Size** field is disabled. To share RAM you need to assign a value in the allowable range.
- The **Slave I/O Window Size** field is disabled. To share I/O space you need to assign a value in the allowable range.
- The **Slave DMA Channel** field is set to use channel 3, which is acceptable. If you modified this field to the NONE setting, slave accesses to shared RAM in VXI space and PC I/O space would not succeed. You could assign a NONE setting to this field if you intend to keep the three settings described above in their default settings. This change would free up the DMA channel for use by other devices in the system. On the other hand, if you ever need to switch back and forth between A16 and A24 space, it would be easier to have a slave DMA channel already reserved for the AT-MXI, and just change the appropriate settings in `VXIEDIT`. Remember that the hardware and software settings must match if you intend to use a slave DMA channel.

Note: ***Seldom, if ever, can the AT-MXI share DMA channels with other devices. If you have selected a DMA channel by placing jumpers on that channel's request and acknowledge lines and enabled the channel in software, no other devices in your system should use that channel. If DMA channels conflict, change the DMA channel(s) used by either the AT-MXI or the other device(s). If you change an AT-MXI DMA channel, make a corresponding change to the AT-MXI configuration software as described in the*** *Configuring the NI-VXI Software* ***section of Chapter 3.***

The AT-MXI can use DMA Channels 0, 1, 2, 3, 5, 6, and 7. Be careful when reassigning DMA channels on the AT-MXI. Notice that most PC ATs use DMA Channel 2 for the disk controller interface. It is possible that various standard logic devices on the motherboard may use other DMA channels, so check your computer documentation before changing DMA channels.

Notice that the PC AT makes a distinction between 8-bit and 16-bit DMA channels. The 8-bit channels are 0, 1, 2, and 3. The 16-bit channels are 5, 6, and 7. The master-mode DMA channel setting must match the data width of the intended block transfers. It is preferable to use one of the 16-bit channels for the master-mode interface because a 16-bit DMA channel can transfer twice the amount of data in the same number of cycles. The slave-mode DMA channel is used only to request the PC AT bus for an alternate PC AT bus master cycle. It can use any available 8-bit or 16-bit channel regardless of the intended data width of the transfers.

Use the two rows of pins farther from the card-edge connector to select the master-mode DMA channel and the two rows closer to the card-edge connector to select the slave-mode DMA channel. Remember that the jumper positions should be identical on both the W1 and W2 arrays.

Figure 2-4a shows the factory default DMA channel setting of the AT-MXI, with master-mode DMA Channel 6 and slave-mode DMA Channel 3.

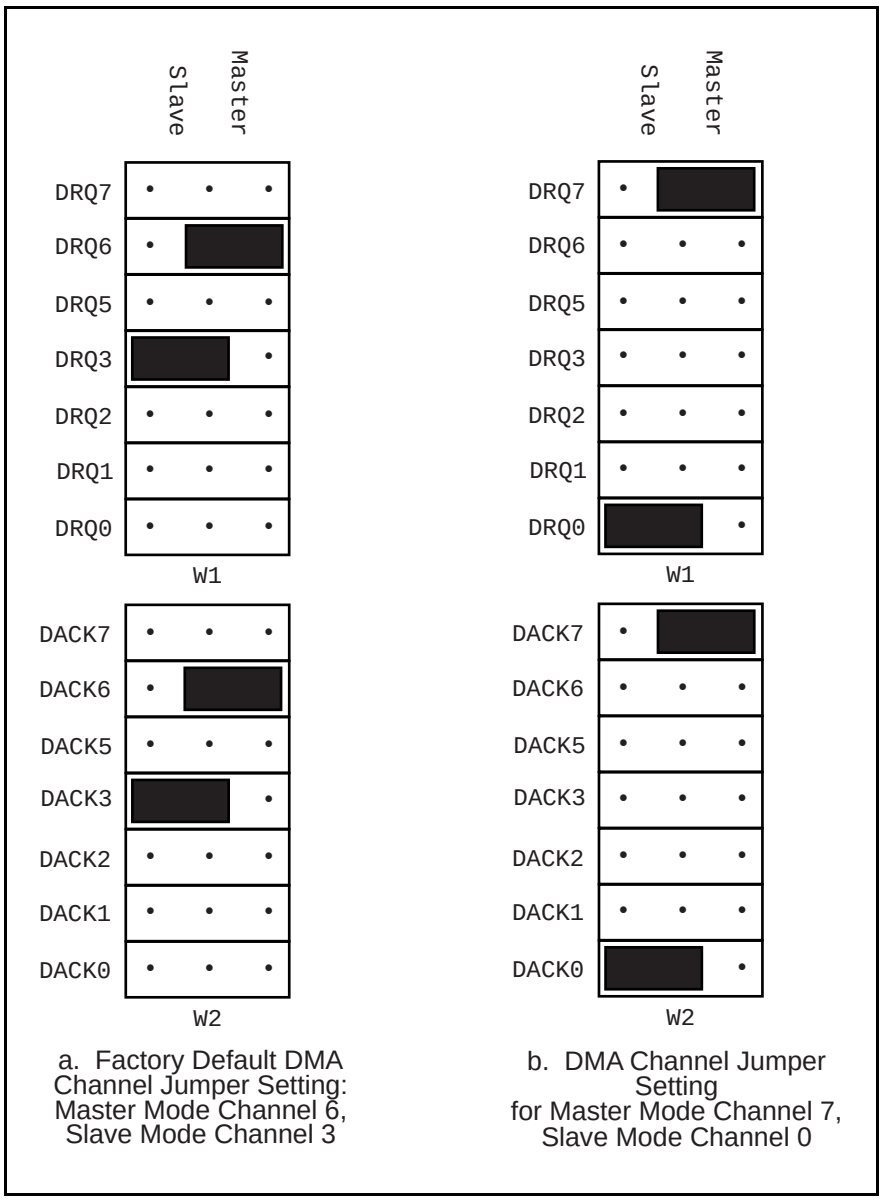


Figure 2-4. DMA Channel Settings

To select a new DMA channel, move both the DRQ and DACK jumpers onto the appropriate pins. Remember to make a corresponding change in the system software to enable the new DMA channels. Figure 2-4b displays the jumper position for selecting master-mode DMA Channel 7 and slave-mode DMA Channel 0.

Step 3. Install the AT-MXI Hardware

In the space provided here, record the settings of the base I/O address, the DMA channel(s), and the interrupt level(s) for future reference. You will need this information when you install the software.

AT-MXI	Setting
Base I/O Address	
Board Interrupt Level	
MXIbus Interrupt Level	
Master DMA Channel	
Slave DMA Channel	

Before attempting to install the AT-MXI, notice that some MXIbus cable connector hoods are slightly wider than most standard connector hoods and might interfere with other cables installed in adjacent PC AT slots. Normally, this will only be a problem if the cable connector hoods for the adjacent slots are also oversized. When choosing a PC AT slot in which to install the AT-MXI, verify that the MXIbus cable connector will not interfere with cables and connectors in other PC AT slots. If necessary, reposition the boards in the system to prevent cabling conflicts. It may also help to install the AT-MXI in one of the end slots so that you will only have to contend with the cable connectors of one other board.

If you cannot configure the AT-MXI to co-exist in an existing PC AT system by repositioning the boards, you can use one of the MXIbus cable options with a standard connector hood on the cable end that attaches to the AT-MXI. The standard connector hood is narrower than the MXIbus dual-connector arrangement and provides an easier fit for many system configurations. However, this approach requires that the AT-MXI be the first device in the MXIbus daisy-chain because a cable with a single connector end cannot accept another MXIbus cable to propagate the bus. Remember that the first device in the MXIbus daisy-chain must also be configured as the MXIbus System Controller.

The following instructions are general installation instructions. Consult the user or technical reference manual of your computer for specific instructions and warnings.

1. Plug in your PC AT computer before installing the AT-MXI. The plug grounds the computer and protects it from electrical damage while you are setting up.

   Warning: ***To protect both yourself and the computer from electrical hazards, the computer should remain off until you are finished installing the board.***

2. Remove the top cover or access port to the PC AT I/O bus.

3. Select any available 16-bit full-length PC AT expansion slot. The 16-bit expansion slots have two card-edge receptacle connectors.

4. Locate the metal bracket that covers the cut-out in the back panel of the PC AT chassis for the slot you have selected. Remove and save the bracket-retaining screw and the bracket cover.

5. Touch the metal part of the power supply case inside the computer to discharge any static electricity that might be on your clothes or body.

6. Line up the AT-MXI with the MXIbus connector near the cut-out on the back panel and the other card edge lined up with the respective slot guide. Slowly push down on the front of the AT-MXI until its card edge connector is resting on the expansion slot receptacle. Using slow, evenly distributed pressure, press the AT-MXI straight down until it seats in the expansion slot.

7. Reinstall the bracket retaining screw to secure the AT-MXI to the back panel rail.

8. Check the installation.

9. Replace the computer cover.

Figure 2-5 shows an AT-MXI installed in a PC AT with a MXIbus cable attached.

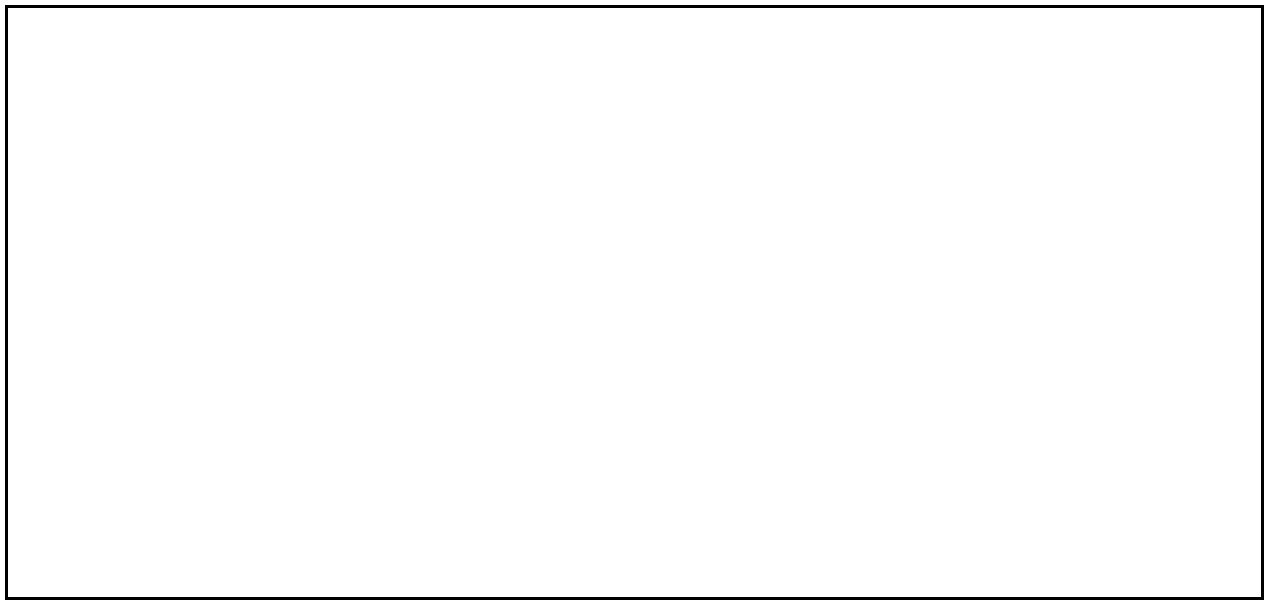


Figure 2-5. AT-MXI Installed in a Computer

Step 4. Configure the VXI-MXI Hardware

Figure 2-6 shows the location and factory default settings of the configuration switches and jumpers for a VXI-MXI without the INTX daughter card option. The remainder of this chapter describes only those options that are user-configurable. Do not change the default settings of other jumpers and switches on the VXI-MXI board unless you plan to install more than one VXI-MXI in the same mainframe. If this is the case, refer to the *VXI-MXI User Manual* that came with your additional VXI-MXI interface for more information.

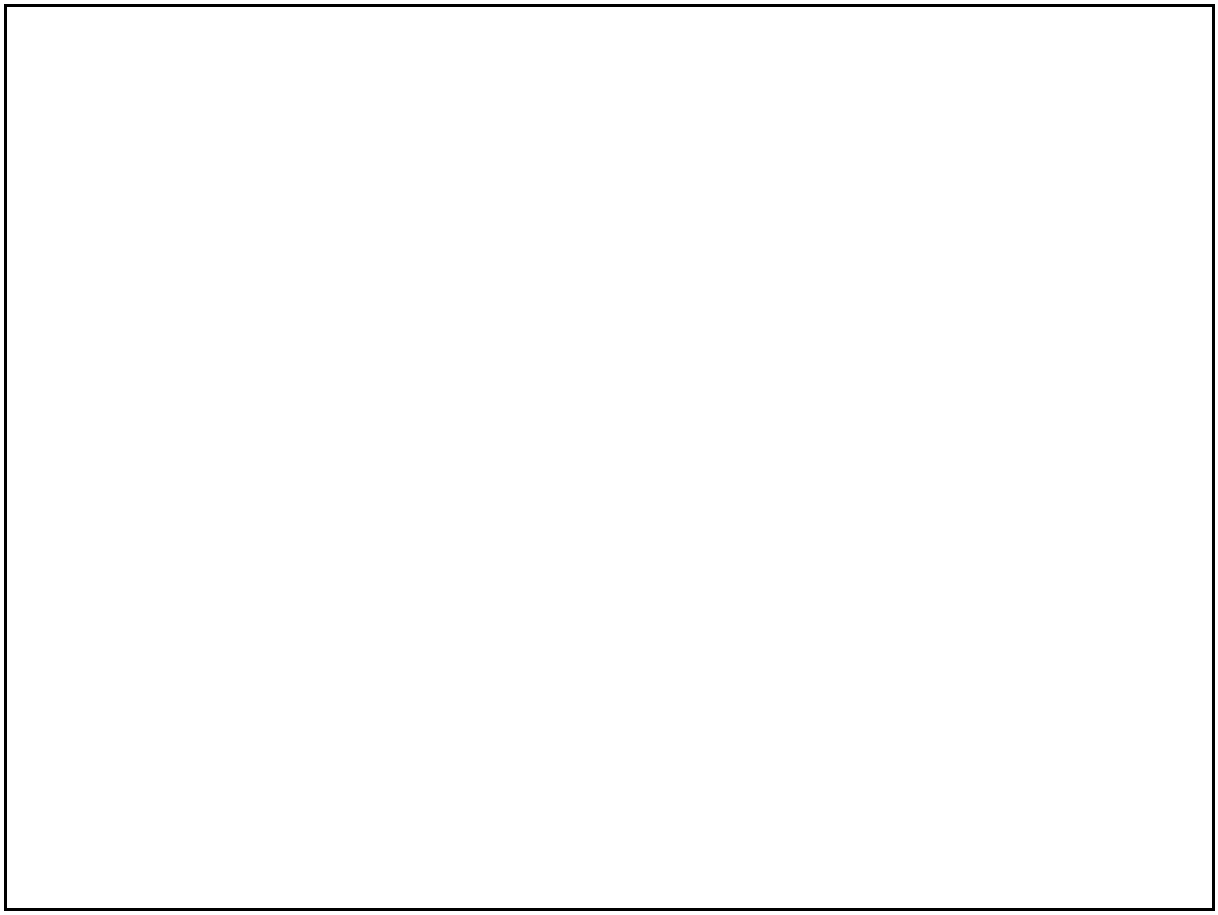


Figure 2-6. VXI-MXI Parts Locator Diagram

Figure 2-7 shows the location and factory default settings of the configuration switches and jumpers for a VXI-MXI with the INTX daughter card option. The options described in the rest of this chapter apply to VXI-MXI modules with or without the INTX option. For more information about configuring modules with the INTX option, refer to the *VXI-MXI User Manual*.

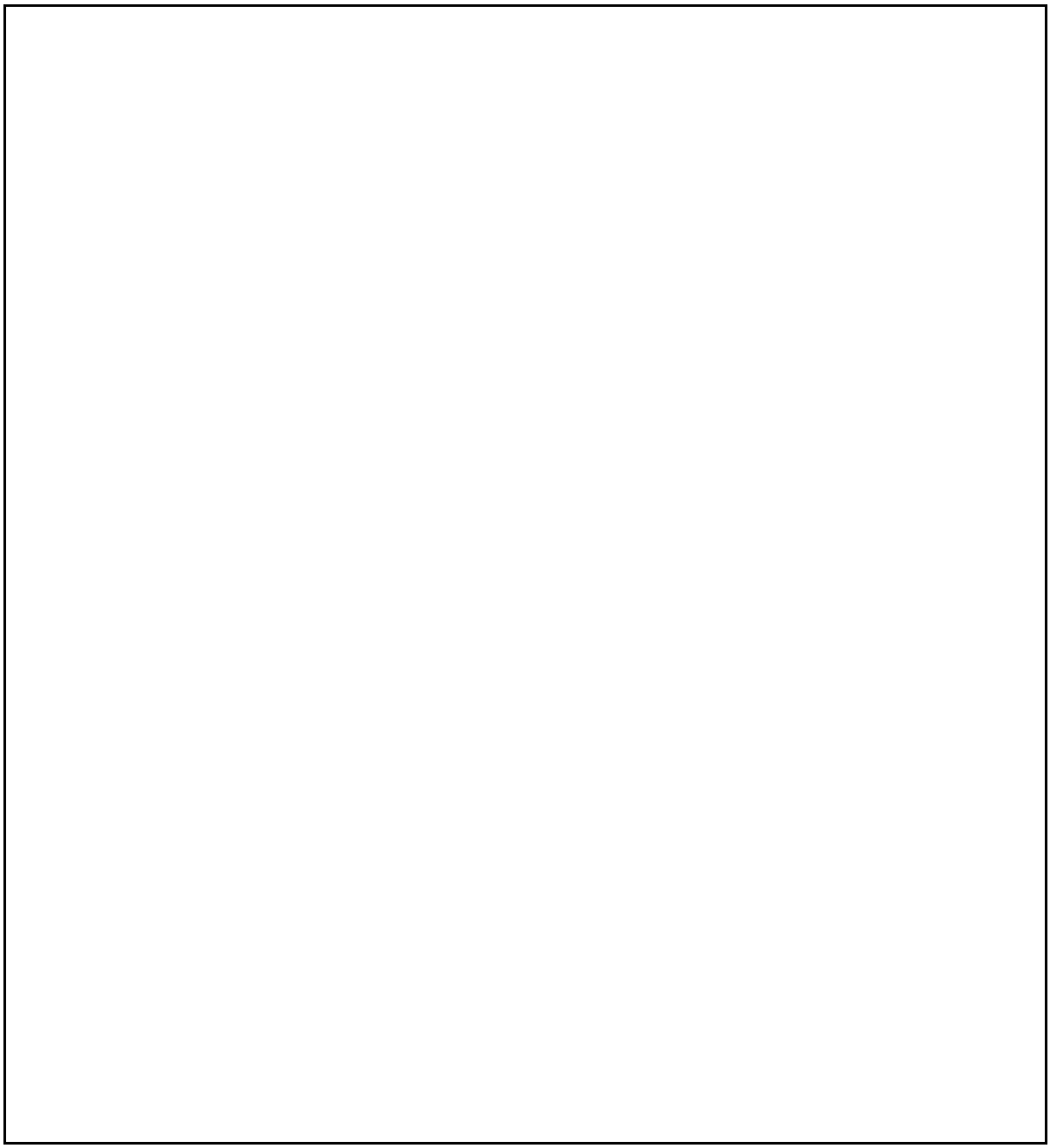


Figure 2-7. VXI-MXI with INTX Parts Locator Diagram

Front Panel Features

The VXI-MXI has the following front panel features:

- Three front panel LEDs
  - *FAILED* LED indicates that the VMEbus SYSFAIL line is asserted.
  - *VXI 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
- Three SMB connectors
  - Trigger input
  - Trigger output
  - External clock
- System reset pushbutton
- INTX connector (if you have a VXI-MXI with the INTX daughter card connection)

Removing the Metal Enclosure

The VXI-MXI is housed in a metal enclosure to improve EMC performance and to provide easy handling. Because the enclosure includes cutouts to facilitate changes to the switch and jumper settings, it should not be necessary to remove it under normal circumstances.

Should you find it necessary to open the enclosure, remove the three screws on the top, the three screws on the bottom, and the three screws on the right side panel of the enclosure.

VXIbus Slot 0

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

Warning: ***Do not install a device configured for Slot 0 into another slot without first reconfiguring it for Non-Slot 0 use. Doing so could result in damage to the Non-Slot 0 device, the VXIbus backplane, or both.***

Figure 2-8 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 and jumper blocks W7 (labeled *VME BTO Chain Position* on the front panel), and W9 and W10 (labeled *CLK10 Source Select* on the front panel) as shown in Figure 2-9.

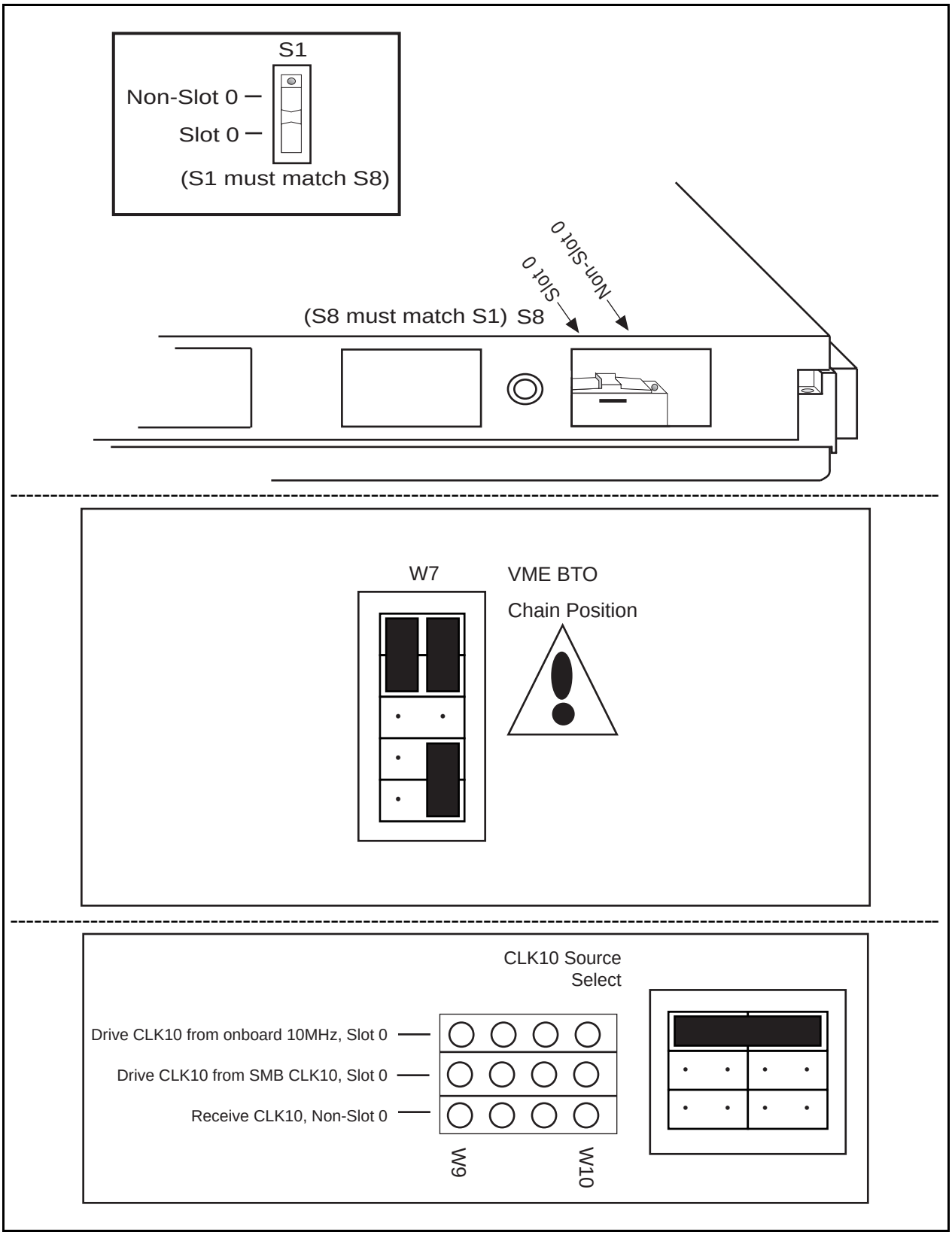


Figure 2-8. VXIbus Slot 0 Configuration

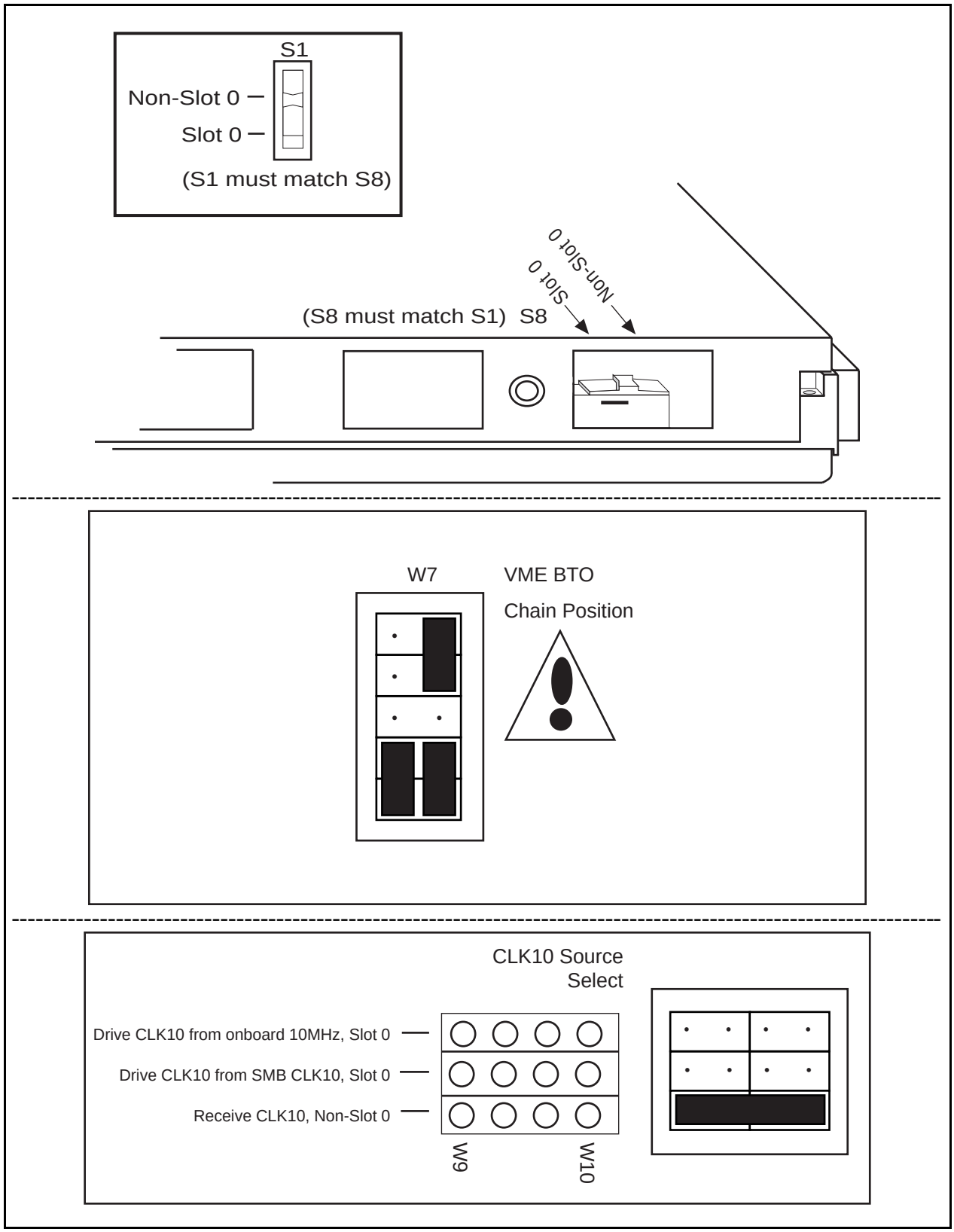


Figure 2-9. VXIbus Non-Slot 0 Configuration

When the VXI-MXI is installed in Slot 0, it becomes the VMEbus System Controller (set by slide switches S1 and S8). As a VMEbus System Controller, it has VMEbus Data Transfer Bus Arbiter (PRI ARBITER) circuitry that accepts bus requests on all four VMEbus request levels, prioritizes the requests, and grants the bus to the highest priority requester. As VMEbus System Controller, the VXI-MXI also drives the 16-MHz VMEbus system clock by an onboard 16-MHz oscillator with a 50% ±5% duty cycle.

The VXI-MXI also performs VMEbus BTO functions as described in the following section. The setting of the VME BTO Chain Position jumper block determines how to control these functions. As required by the VXIbus specification for a Slot 0 device, the VXI-MXI drives the 10-MHz signal, CLK10, on a differential ECL output. This is controlled by the CLK10 Source Select jumpers at locations W9 and W10. The Slot 0 setting of the CLK10 Source Select jumpers cause the VXI-MXI to drive CLK10 on the backplane. When configured for Non-Slot 0, the VXI-MXI instead receives 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.***

VMEbus BTO

The VMEbus Bus Timeout (BTO) is a watchdog timer for transfers on the VMEbus Data Transfer Bus. After a specified amount of time (usually user-configurable), the BTO circuitry terminates a VMEbus cycle if no slave has responded. The VXI-MXI must provide the VMEbus BTO to function properly because, when a MXIbus cycle is involved, the VMEbus timeout must be disabled and the MXIbus BTO enabled. You should disable the BTO of any other BTO module residing in the mainframe. If this is not possible, set it to its maximum setting to give the MXIbus cycles as much time as possible to complete.

VXI Logical Address

Each device in a VXIbus/MXIbus system is assigned a unique number between 0 and 254. This 8-bit number, called the *logical address*, defines the base address for the VXI 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 KB of A16 space.

Some VXIbus devices have *dynamically configurable* logical addresses. These devices have an initial logical address of hex FF, which indicates that they can be dynamically configured. While the VXI-MXI does support dynamic configuration of VXI devices within its mainframe, it is itself a *statically configured* device and is preset at the factory with a VXI logical address of 1.

The AT-MXI is designated as the VXIbus Resource Manager (RM). As defined by the VXIbus specification, the RM in a VXI system has a logical address of 0.

Ensure that no other statically configurable VXIbus devices have logical addresses of either 0 or 1. If they do, change the logical address settings of the other devices so that every device in the system has a unique associated logical address.

Do not change the logical address of the VXI-MXI unless you are connecting multiple VXI-MXIs to the MXIbus. In this case, refer to the *VXI-MXI User Manual* that came with

your additional VXI-MXIs for more information. You can change the logical address of the VXI-MXI by changing the setting of the 8-bit DIP switch labeled *LOGICAL ADDRESS SWITCH* on the front panel. 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. Verify that the VXI-MXI does not have the same logical address as any other statically configured VXIbus device in your system. Remember that logical addresses hex 0 and FF are not allowed for the VXI-MXI.

Figure 2-10 shows switch settings for logical address hex 1 and C0.

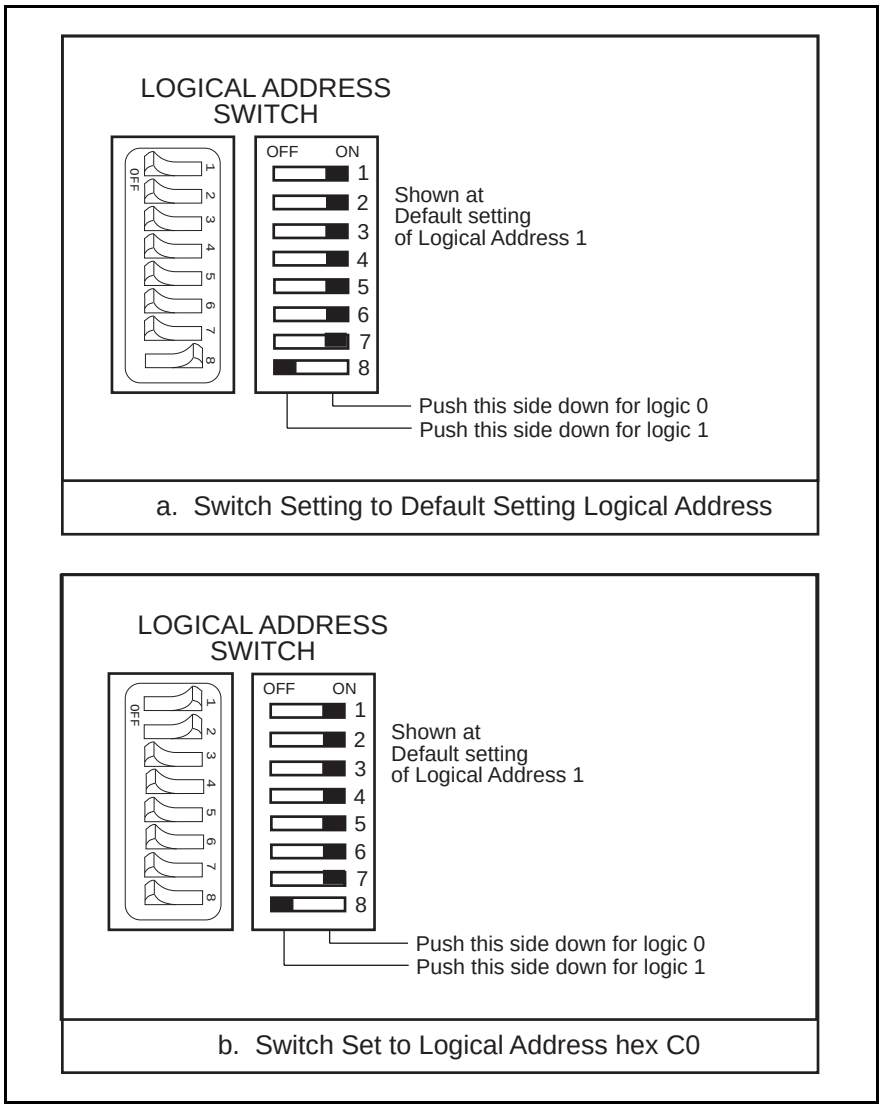


Figure 2-10. Logical Address Selection

VMEbus Request Level Selection

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

device, such as a PC AT computer with an AT-MXI interface, attempts a transfer that maps into the VXIbus mainframe.

The VXI-MXI uses VMEbus request level 3 in its factory default setting, as required by the VXIbus specification. This is suitable for most VXIbus systems. However, you can change the VXI-MXI to use any of the other three request levels (0, 1, or 2) by changing the jumper configuration on the jumper blocks labeled *VMEbus Request Level* on the front panel. 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 2-11.

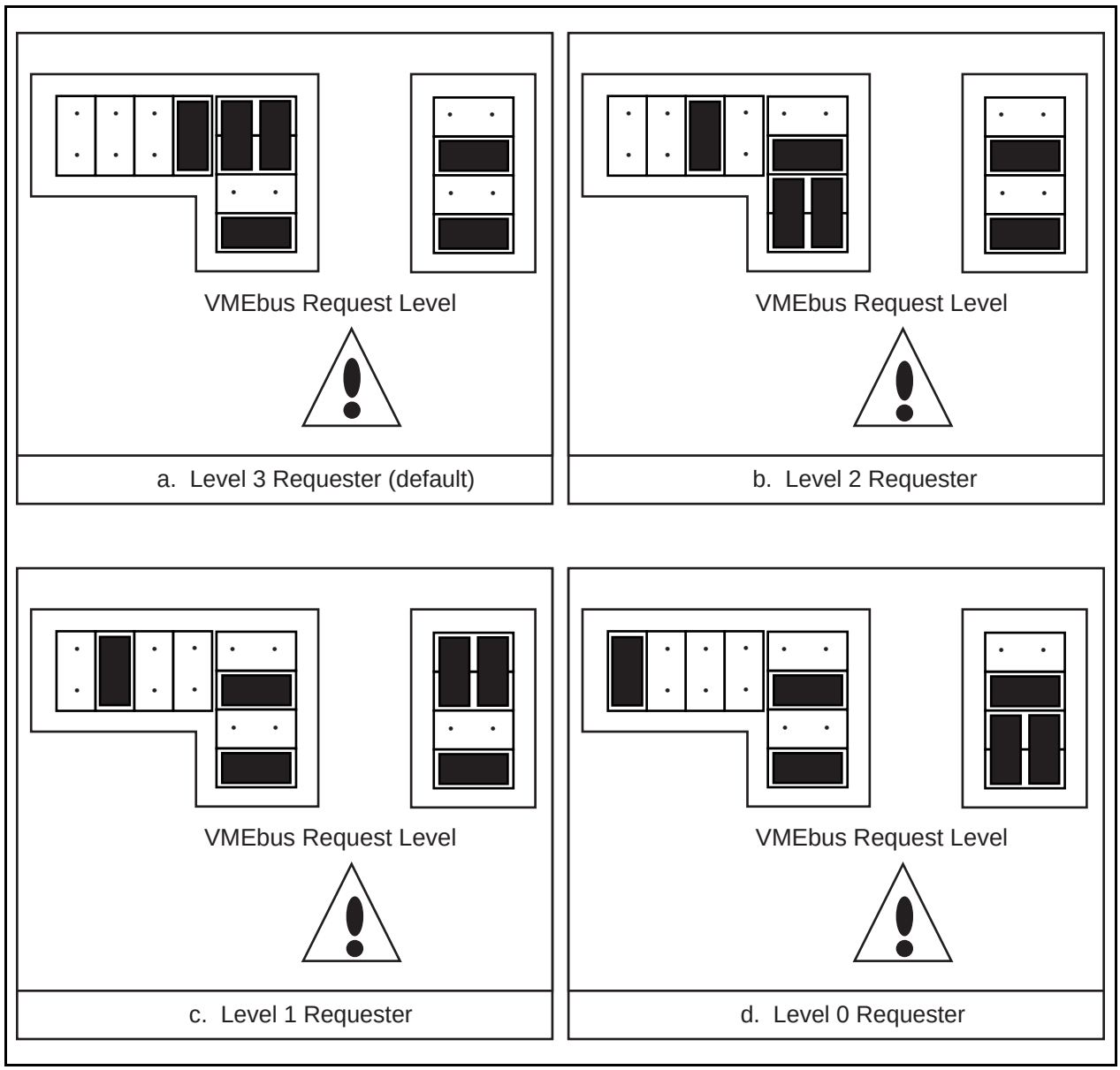


Figure 2-11. VXI-MXI VMEbus Requester Jumper Settings

Step 5. Install the VXI-MXI Hardware

This section lists general installation instructions for the VXI-MXI. Consult the user manual or technical reference manual of your VXIbus mainframe for specific instructions and warnings.

1. Plug in your mainframe before installing the VXI-MXI. The plug grounds the mainframe and protects it from electrical damage while you are installing boards.

   Warning: ***To protect both yourself and the mainframe from electrical hazards, the mainframe should remain off until you are finished installing the board.***

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.

   Warning: ***Be certain that the slot you select in your VXIbus mainframe matches the VXI-MXI configuration as either a Slot 0 device or a Non-Slot 0 device. If you install your VXI-MXI into a slot that does not correspond with the jumper settings, you risk damage to the VXI-MXI, the VXIbus backplane, or both.***

4. Insert the VXI-MXI in the slot you have selected by aligning the top and bottom of the card with the card-edge guides inside the mainframe. Slowly push the VXI-MXI straight into the slot until its plug connectors are resting on the backplane's receptacle connectors. Using slow, evenly distributed pressure, press the VXI-MXI straight in until it seats in the expansion slot. The front panel of the VXI-MXI should be even with the front panel of the mainframe.

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

6. Check the installation.

7. Connect the cables as described in the following section before restoring power.

8. Replace or close any doors or covers to the mainframe.

Step 6. Connect the MXIbus Cable

There are two basic types of MXIbus cables. MXIbus cables can have either a single connector on each end, or a single connector on one cable end and a double connector on the other end. Your VXI-AT2000 kit comes standard with a cable with single connectors on each end.

Nonpolarized Cables

The cable with a single connector on each cable end is nonpolarized and may be installed with either end connected to either device. Be sure to tighten the screw locks to ensure proper pin connection. See Figure 2-12.

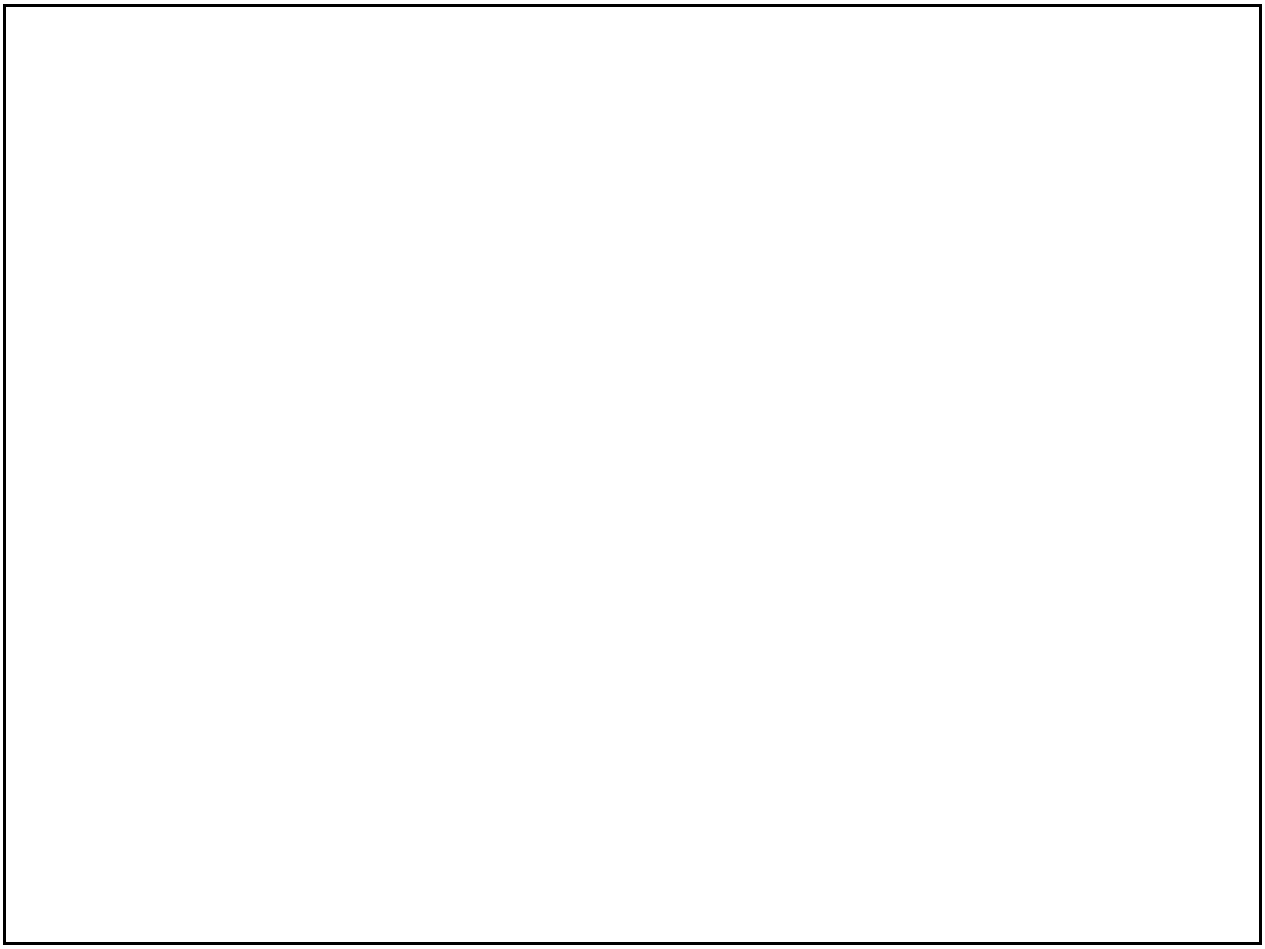


Figure 2-12. MXIbus Single-Ended Cable Configuration

Polarized Cables

If you are using a MXIbus cable with a single connector on one cable end and a double connector on the other end, it is a polarized cable that you must install correctly for the system to function properly. Connect the end with the *single* connector to the AT-MXI and the end of the cable with the *double* connector to the VXI-MXI. Be sure to tighten the screw locks to ensure proper pin connection. See Figure 2-13.

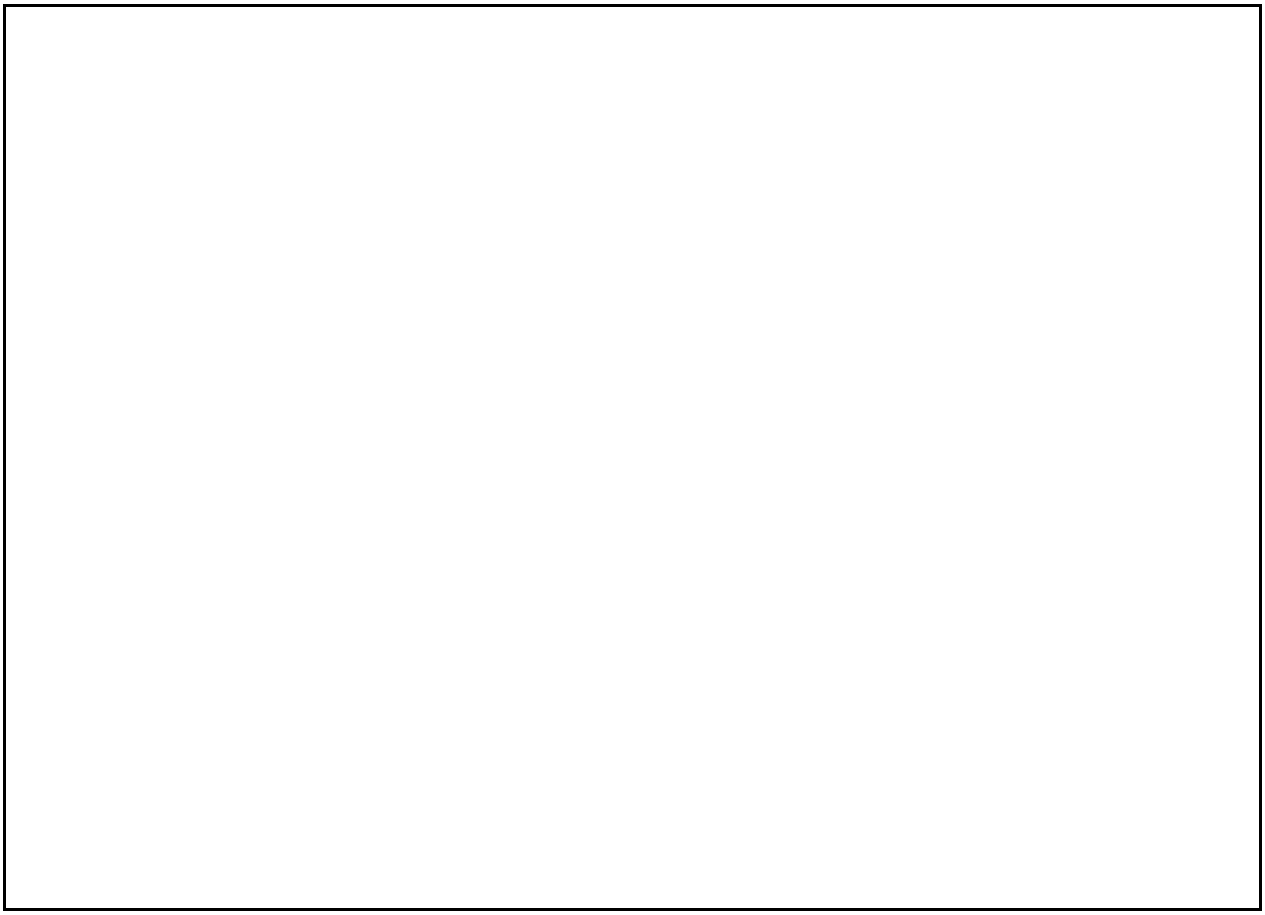


Figure 2-13. MXIbus Dual-Ended Cable Configuration

When you have properly connected the MXIbus cable, power on the VXI mainframe and then the PC AT computer.

Note: ***Always turn on the mainframe first. Doing so makes it possible for the PC AT to access the VXI cards in the mainframe as soon as the PC AT starts up.***

Chapter 3
NI-VXI Software Installation and Configuration

This chapter lists all the programs and files located on the NI-VXI distribution diskettes, contains the instructions for installing the NI-VXI software, and describes how to use the VXIEDIT and VXITEDIT configuration editors to configure the NI-VXI software. This chapter also discusses programming information for you to consider when developing applications that use the NI-VXI driver.

NI-VXI Software Overview

The following files make up the NI-VXI software.

Main Programs and Files

The main programs and files of the NI-VXI software package are found in the C:\NIVXI directory.

- VXIINIT.EXE is the AT-MXI initialization program. This program initializes the board interrupts, shared RAM, VXI register configurations, and bus configurations. VXIINIT.EXE can be included in the DOS batch file AUTOEXEC.BAT so that the AT-MXI is automatically initialized at startup. The configuration settings can be modified using the VXIEDIT.EXE program.

- RESMAN.EXE is the National Instruments multimainframe Resource Manager. RESMAN.EXE may be executed only after VXIINIT.EXE has been run.

- VIC.EXE is an interactive control program that executes functions you enter from the keyboard. It helps you learn the functions, program your VXI devices, and develop and debug your application programs. This program is described in detail in the *NI-VXI DOS Utilities Reference Manual.*

- VICTEXT.EXE is a text-based interactive control program that is functionally equivalent to VIC.EXE. This program is described in detail in the *NI-VXI Text Utilities Reference Manual.*

- VXIEDIT.EXE is the VXI resource editor program. You can use this program to configure the system, edit the manufacturer name and ID numbers, and edit the model names of VXI and non-VXI devices in the system, as well as the system interrupt configuration information. This program also displays the system configuration information generated by the Resource Manager. This program is described in detail in the *NI-VXI DOS Utilities Reference Manual.*

- VXITEDIT.EXE is the text-based VXI resource editor program that is functionally equivalent to VXIEDIT.EXE. This program is described in detail in the *NI-VXI Text Utilities Reference Manual.*

- README.DOC contains the latest updates and corrections to the manual when appropriate.

Additional Programs and Files

The C:\NIVXI\HLP directory contains various help files used by the VIC.EXE and VXIEDIT.EXE programs.

The C:\NIVXI\TBL directory contains the following files.

- MFNAMEID.TBL contains the database of manufacturer names and their ID numbers.

- MODEL.TBL contains the database of model names, manufacturer names, and the model codes numbers.

- DEVICE.TBL contains the database of device names, manufacturer names, model names, and frame and slot associations for devices in the system.

- NONVXI.TBL contains the database for all non-VXI devices in the system.

- INTCFG.TBL contains the system interrupt configuration information.

- TRIGCFG.TBL contains the system trigger configuration information.

- UTILBUS.TBL contains the utility bus configuration information.

- CREG.TBL contains device-dependent information to be written to the Control register by the Resource Manager.

- REGS.TBL contains the register names of VXI devices.

- WSCMDS.TBL contains the VXI Word Serial command values.

- VXIBUS.CFG contains the AT-MXI MXIbus configuration information.

- VXILA.CFG contains the AT-MXI logical address configuration information.

- VXIDEV.CFG contains the AT-MXI device-specific configuration information.

- VXIMF.CFG, if present, contains information specific to the board manufacturer.

- DVXI.CFG contains information for internal use by the driver.

The C:\NIVXI\INCLUDE directory contains files for the Microsoft C, Borland C, and QuickBASIC language interfaces. The include files are as follows.

- NIVXI.H is the main header file containing the C prototypes for the NI-VXI functions.
- DATASIZE.H contains data size specifications.
- BUSACC.H contains parameter and return values for the bus access functions.
- DEVINFO.H contains parameter and return values for the device information and system configuration functions.
- VXIINT.H contains parameter and return values for the interrupt and signal functions.
- SYSINT.H contains parameter and return values for the system interrupt functions.
- TRIG.H contains parameter and return values for the trigger functions.
- WS.H contains parameter and return values for the Commander and Servant Word Serial functions.
- NIVXI.INC is the include file for the Microsoft QuickBASIC Language interface.

The C:\NIVXI\DOS directory contains the following files.

- RESMAND.EXE is used by RESMAN in the DOS environment. RESMAN calls this file directly.
- VICD.EXE is used by VIC in the DOS environment. VIC calls this file directly.
- VICTEXTD.EXE is used by VICTEXT in the DOS environment. VICTEXT calls this file directly.
- VXIEDITD.EXE is used by VXIEDIT in the DOS environment. VXIEDIT calls this file directly.
- VXITEDID.EXE is used by VXITEDIT in the DOS environment. VXITEDIT calls this file directly.

The C:\NIVXI\DOS directory contains up to three subdirectories.

The C:\NIVXI\DOS\BORLANDC subdirectory is installed if you choose to install both the DOS environment and the Borland C libraries. It contains the following file and subdirectory.

- NIVXIDOS.LIB is the NI-VXI Large Memory Model function library for the Borland C Language interface.
- The C:\NIVXI\DOS\BORLANDC\EXAMPLES subdirectory contains various example programs that show how to use the NI-VXI software with Borland C.

The C:\NIVXI\DOS\MSC subdirectory is installed if you choose to install both the DOS environment and the Microsoft C libraries. It contains the following file and subdirectory.

- NIVXIDOS.LIB is the NI-VXI Large Memory Model function library for the Microsoft C Language interface.

- The C:\NIVXI\DOS\MSC\EXAMPLES subdirectory contains various example programs that show how to use the NI-VXI software with Microsoft C.

The C:\NIVXI\DOS\QB subdirectory contains the following object, library, and batch files to generate the Microsoft library for QuickBASIC.

- QBNIVXI.LIB contains the NI-VXI function library for the QuickBASIC interface.

- QBNIVXI.OBJ contains the NI-VXI symbols used to generate the QuickBASIC library for all versions.

- MKQLB*.BAT and MKQLB*.LNK are batch and response files used to generate a QuickBASIC library for the desired version.

- MKAPPBC.BAT and MKAPPBC.LNK are batch and response files that contain an example of how to build a BASIC application using NI-VXI functions.

Also included are the following files containing system functions used in the generation of QuickBASIC libraries for version 4.5 (default) and version 7.0 (7F and 7N).

- QB.OBJ
- QBMEM.OBJ
- QB1.LIB
- QB1_7F.LIB
- QB1_7N.LIB
- QB2.LIB
- B1_71F.LIB
- B1_71N.LIB
- B2_71.LIB

Installing the Software

The NI-VXI distribution disks that came with your AT-MXI contain the NI-VXI files as well as an INSTALL program. The INSTALL program is used to install the entire NI-VXI software package, a software update, or to reinstall software in the event that your files were accidentally erased. Follow these steps to install all or part of the NI-VXI software.

1. The NI-VXI software requires approximately 2 MB of free space on your hard disk. Create the necessary free space on the hard disk before starting the installation.

2. Run INSTALL.EXE on distribution disk 1. INSTALL is a text-based, interactive, self-guiding program, which will install all the necessary files (for a complete or partial installation, as user-specified) on the hard disk. In addition, it will optionally modify the AUTOEXEC.BAT initialization file accordingly. The program prompts you to enter the following information.

   - Whether to install NI-VXI for DOS: If you need to add only a certain component (for example, QuickBASIC) but already have the NI-VXI package installed, you can respond *No*. The default is to install the DOS applications.

   - Languages to install: You can choose whether to install the Microsoft C, Borland C, and/or QuickBASIC libraries. The default is to install all of them, but if you are using only one compiler, you can select only that compiler.

   - Source drive: This is the floppy drive in which you inserted the distribution disks.

   - Destination directory: This is the complete pathname of the directory where you want to install the software.

   - Modifying DOS initialization files: You can choose whether INSTALL modifies the AUTOEXEC.BAT file to reflect the location of the NI-VXI library. If you choose to let INSTALL do this, you must also enter the drive where AUTOEXEC.BAT can be found.

   If INSTALL detects a previous installation of the NI-VXI software, it will prompt you to determine whether to delete or overwrite the previous version, or to provide an alternate path in which to install the new version.

   Note: INSTALL ***will not create a backup for you. If there are files you want to preserve, be sure to exit the installation program at this time and make a backup before continuing.***

   You can quit the INSTALL program at any time by choosing **Exit** from the initial screen, or by pressing <Control-C> once installation has begun. INSTALL will prompt you to be certain you really want to quit at that time. If you choose to run the INSTALL program again, it starts over and recopies all the necessary files. Of course, if you made any changes from the default configuration, you will need to specify those changes once again.

   As mentioned previously, INSTALL *optionally* modifies the AUTOEXEC.BAT file. If you *do* modify it, INSTALL changes the old file's extension to .BAK and keeps it for safety purposes. If you do *not* modify it, INSTALL creates a file in the NI-VXI directory with the changes it proposes you make to the file, and names it AUTOEXEC.VXI.

Modifying the AUTOEXEC.BAT File

If you choose to let INSTALL modify your AUTOEXEC.BAT file, it updates the setting of environment variables PATH, LIB, and INCLUDE to specify the relevant subdirectories of the NI-VXI directory. The previously specified directories in PATH, LIB, and INCLUDE remain unchanged. INSTALL also adds a new environment variable NIVXIPATH, and appends a command line to execute VXIINIT.EXE automatically.

If you choose not to let INSTALL modify your AUTOEXEC.BAT file, refer to the AUTOEXEC.VXI file in your NI-VXI directory for suggestions on how to change the following lines manually.

- The PATH variable should include the full path to the subdirectory where the NI-VXI utilities are located, in addition to whatever other directories you have already specified in PATH. Normally, these files reside in the root of the NI-VXI directory.
- The LIB variable should include the full path to the subdirectories that contain the Microsoft C libraries if you installed the Microsoft C language interface. Because the Borland C compiler does not use the LIB variable, you must manually set the path to the NI-VXI libraries for Borland in your makefiles or projects.
- The INCLUDE variable should include the full path to the subdirectory that contains the NI-VXI include files. By default, the include files reside in the INCLUDE subdirectory of the NI-VXI directory.
- The NIVXIPATH variable should contain the full path to the NI-VXI directory.

Notes: ***After you execute*** INSTALL***, you should reboot your machine (or at least run*** AUTOEXEC.BAT***) to make your system aware of the NI-VXI directory.***

Once the NI-VXI package is installed, run VXIINIT.EXE ***and then*** RESMAN.EXE***.***

Configuring the NI-VXI Software

Run VXIINIT to display the AT-MXI configuration settings. The AT-MXI is configured in hardware as Resource Manager (Logical Address 0) and Message-Based device, and cannot be changed. The default configuration is MXIbus System Controller, not MXIbus fair requester, base I/O address of 340h, master window base of D000h, and no VXI Shared RAM. To change the current settings, or to view the configuration options, run VXIEDIT and select the Configuration Editor from the main menu.

You can use VXIEDIT to edit the description of the AT-MXI or any other device that is installed in the system. In this program, you can easily modify the configuration tables required for VXIbus and MXIbus operation. You can also use this program to configure interrupts, triggers, and the utility bus for single- or multiple-mainframe system configurations. For more details on how to use the VXIEDIT program, refer to the *NI-VXI DOS Utilities Reference Manual*.

Running VXIEDIT

VXIEDIT.EXE is the VXI resource editor program. You can use this program to configure the system, edit the manufacturer name and ID numbers, and edit the model names of VXI and non-VXI devices in the system, as well as the system interrupt configuration information. This program also displays the system configuration information generated by the Resource Manager.

To run VXIEDIT from any directory, make sure that the PATH environment variable has the destination directory of the NI-VXI software added to it. This program uses the different configuration files (*.CFG), table files (*.TBL), and help files (*.HLP) in its execution. Be sure that the environment variable NIVXIPATH is set to the destination directory of the NI-VXI software for proper execution. The default destination directory pathname used by the program is C:\NIVXI.

Figure 3-1 shows the functions available under VXIEDIT.

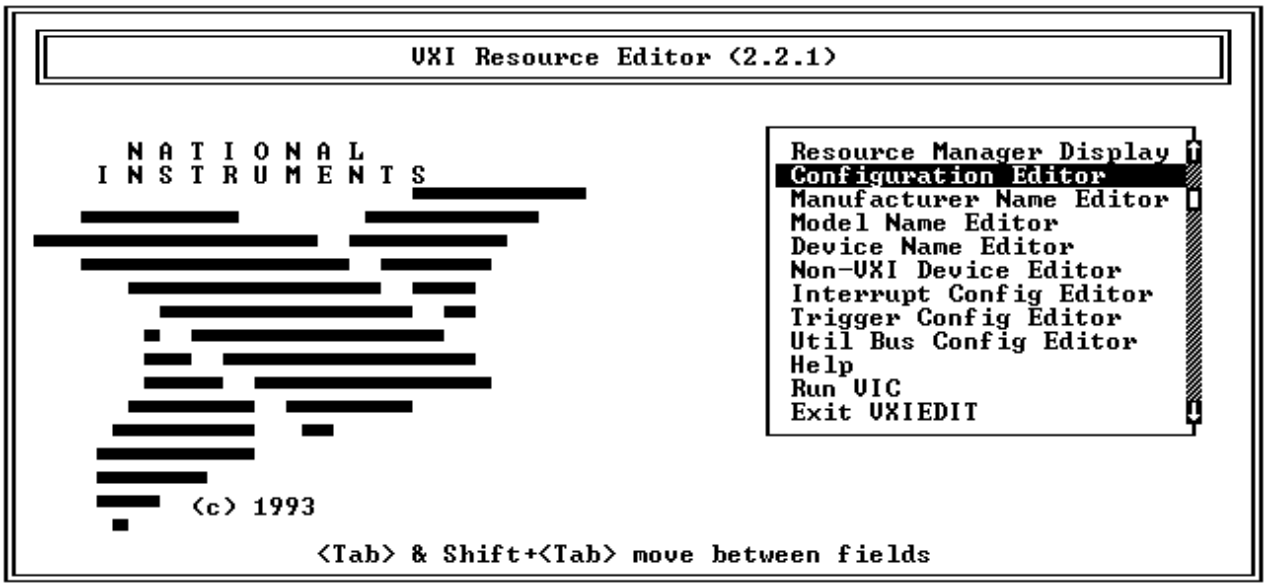


Figure 3-1. VXIEDIT Main Menu

When you select the Configuration Editor from the main menu, the Logical Address Configuration Editor menu (shown in Figure 3-2) is displayed. The following sections describe the various configuration options available under the Logical Address, Bus, and Device Configuration menus.

Select **Next** and **Previous** to move among the three configuration editors. You can change the default settings to any value within the range shown to the right of each item by using the left and right arrow keys.

You can save your changes by selecting **Save**. Saving the changes updates files `VXILA.CFG`, `VXIBUS.CFG`, `VXIDEV.CFG`, and `DVXI.CFG`. These files are used by `VXIINIT.EXE` to update the soft-configured settings, including board interrupts, shared RAM size, VXI register contents, and bus interface. You can exit the program at any time without saving any changes you have made by selecting **Abort**.

Logical Address Configuration

Figure 3-2 shows the Logical Address Configuration Editor (VXIla) menu.

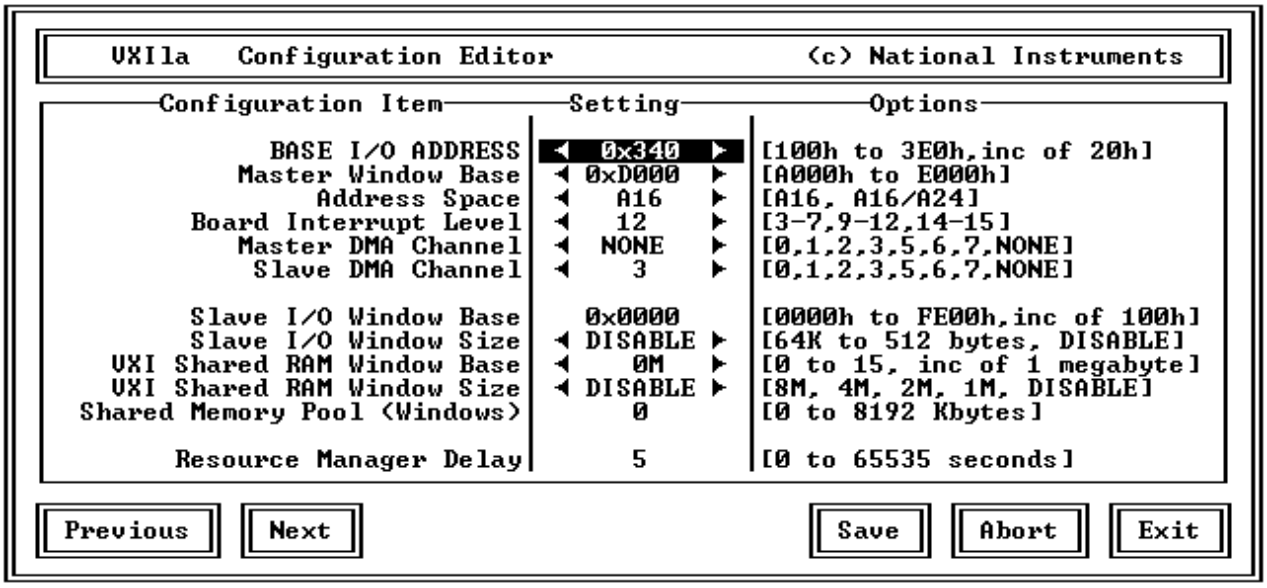


Figure 3-2. AT-MXI Logical Address Configuration Editor

Table 3-1 describes the characteristics of the options available under the Logical Address Configuration menu.

Table 3-1. Logical Address Configuration Characteristics

Characteristic	Description	Default Value
AT-MXI Base I/O Address	Indicates the I/O Address of the AT-MXI configuration registers. This value must correspond to the selected jumper settings on the board. Range = 100h to 3E0h in increments of 20h (hex)	0x340
Master Window Base	A 64 KB memory-mapped I/O window, which the AT-MXI board uses to access the VXIbus. Range = A000h to E000h in increments of 1000h (hex)	0xD000
Address Space	Indicates the address spaces used by the AT-MXI. A16 only A16/A24	A16 only
AT-MXI Board Interrupt Level	Indicates the interrupt level used by the board to interrupt the processor. This value must correspond to the jumper settings on the AT-MXI board. Range = 3, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15	12
Master DMA Channel	Indicates the DMA channel that the AT-MXI uses to perform master mode block transfers onto the VXIbus. This value must correspond to the jumper settings on the AT-MXI board. The NONE option can be selected with any jumper settings. Range = 0, 1, 2, 3, 5, 6, 7, NONE **Note:** ***This field is currently disabled.***	NONE

(continues)

Table 3-1. Logical Address Configuration Characteristics (Continued)

Characteristic	Description	Default Value
Slave DMA Channel	This indicates the slave DMA channel to be used in all slave accesses to the VXI Shared RAM in A24 space or the PC I/O in A16 space. This value must correspond to jumper settings on the AT-MXI board. The NONE option can be selected with any jumper settings. Range = 0, 1, 2, 3, 5, 6, 7, NONE **Note:** ***If the* NONE *option is selected, slave accesses to VXI Shared RAM and to PC I/O space will not succeed. Accesses to VXI-defined registers on the AT-MXI board, however, remain unaffected.***	3
Slave I/O Window Base	The I/O space in the PC with the AT-MXI can be accessed in A16 space over the VXIbus. This field sets up the base address for these accesses. Range = 0000h to FE00h in increments of 100h (hex) **Note:** ***Never select a base address above C000h. Selecting an address above C000h can conflict with the existing VXI and VME devices in the system. Because the VXIbus specification does not address automatic configuration of the lower 48 KB of A16 space,*** RESMAN ***does not handle any device requesting memory in A16 space, including the AT-MXI.*** RESMAN ***does not give a warning in the event of an address conflict in A16 space. Also, the opening of A16 windows on frame extenders in the system for A16 accesses depends only on the logical addresses of the devices in the system.***	0x0000
Slave I/O Window Size	Indicates the size of the window in A16 space for accesses to the PC I/O space over the VXIbus. Range = 64 KB, 32 KB, 16 KB, 8 KB, 4 KB, 2 KB, 1 KB, 512 bytes, DISABLE	DISABLE

(continues)

Table 3-1. Logical Address Configuration Characteristics (Continued)

Characteristic	Description	Default Value
Shared RAM Window Base	Indicates the offset in the local RAM above which the RAM is shared over the VXIbus in A24 space. If the **Address Space** selection for the AT-MXI is A16 only, this field is ignored. Range = 0 to 15, in increments of 1MB	0 MB
Shared RAM Window Size	Indicates the size of VXI Shared RAM in the A24 space. If the **Address Space** selection for the AT-MXI is A16 only, this field is ignored. Range = 8 MB, 4 MB, 2 MB, 1 MB, DISABLE **Note: *If the* Address Space *selection is* A16/A24*, you need to select a value other than* DISABLE *for this field. You must also ensure that the Slave DMA channel is set correctly.***	DISABLE
Shared Memory Pool (Windows)	Indicates the size of memory in kilobytes that is allocated on Windows startup to be used exclusively by `VXImemAlloc` function calls from both DOS and Windows NI-VXI applications. If you do not have Microsoft Windows installed on your system, or if you will not be running DOS NI-VXI applications under Windows, set this field to 0 KB. Range = 0 to 8192 KB	0 KB
Resource Manager Delay	Time in seconds that the Resource Manager waits before accessing the configuration registers of any other device in the system. Range = 0 s to 65535 s	5 s

Bus Configuration

Figure 3-3 shows the Bus Configuration Editor (VXIbus) menu.

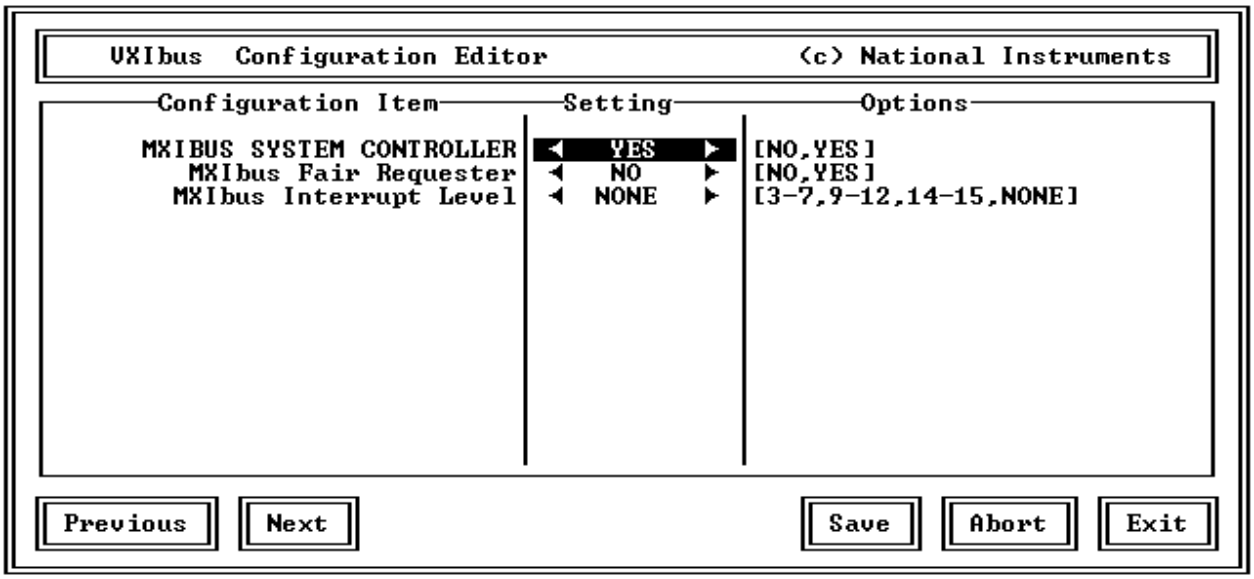


Figure 3-3. AT-MXI Bus Configuration Editor

Table 3-2 describes the characteristics of the options available under the Bus Configuration menu.

Table 3-2. Bus Configuration Characteristics

Characteristic	Description	Default Value
MXIbus System Controller	A MXIbus link must have a single device that is responsible for MXIbus interrupt and bus arbitration as well as bus timeouts. This device is referred to as the MXIbus System Controller and is always the first device in the MXIbus daisy-chain. The AT-MXI is always designated as the MXIbus System Controller when used in this kit and should *not* be changed. NO = Not MXIbus System Controller YES = MXIbus System Controller	YES
MXIbus Fair Request	MXIbus fair requesters give all MXIbus devices equal opportunity to become bus masters and transfer data, regardless of their position within the MXIbus daisy-chain. MXIbus devices that are not fair requesters have a fixed priority scheme characterized by their relative position within the MXIbus daisy-chain. Devices closest to the MXIbus System Controller have the highest priority. The default configuration programs the AT-MXI to be an unfair requester and should only be changed if additional MXIbus devices are added to the system. Refer to the user manual included with your additional MXIbus devices for more information. NO = Not a MXIbus Fair Requester YES = MXIbus Fair Requester	NO
MXIbus Interrupt Level	Indicates the interrupt level used by the MXI IRQ to interrupt the processor. This value must correspond to jumper settings on the AT-MXI board; however, the NONE option can be selected with any jumper settings. If the NONE option is selected, the same interrupt level as used for AT-MXI board interrupts is used for this interrupt. Range = 3, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, or NONE	NONE

Device Configuration

Figure 3-4 shows the Device Configuration Editor (VXIdev) menu.

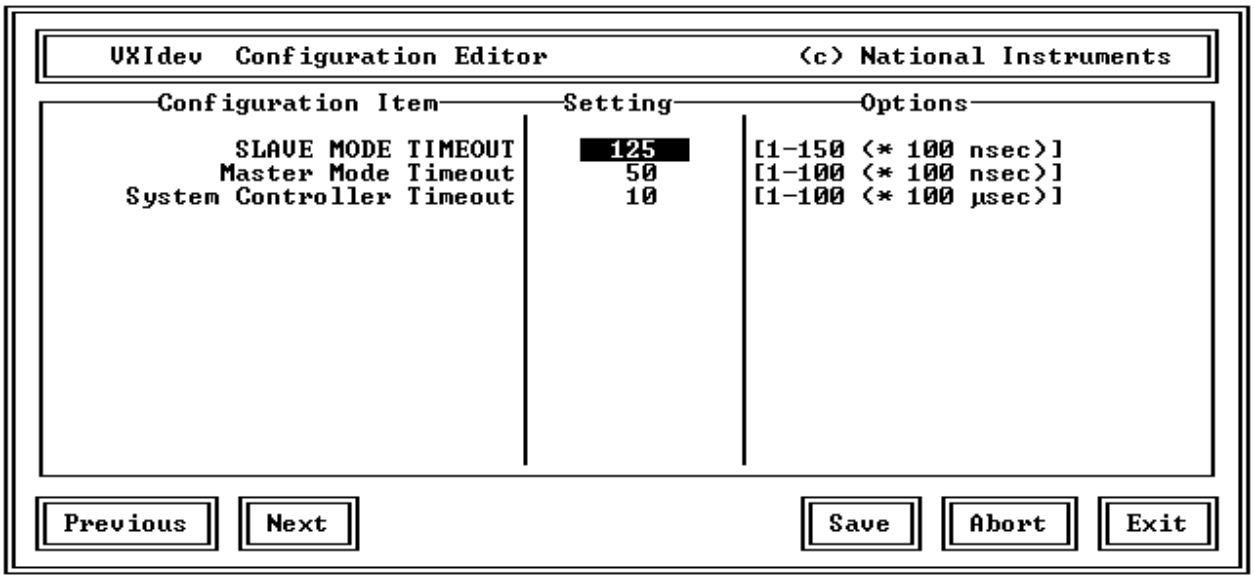


Figure 3-4. AT-MXI Device Configuration Editor

Table 3-3 describes the characteristics of the options available under the Device Configuration menu.

Table 3-3. Device Configuration Characteristics

Characteristic	Description	Default Value
Slave Mode Timeout	This field gives the maximum amount of time a slave access to the VXI Shared RAM may hold the PC bus. The units are in hundreds of nanoseconds.	125 (12.5 µs)
Master Mode Timeout	This field gives the maximum amount of time a master access from the PC to the MXIbus may wait until it has to be retried. The units are in hundreds of nanoseconds.	50 (5.0 µs)
System Controller Timeout	This field gives the maximum amount of time a master access from the PC to the MXIbus may be allowed to continue without being terminated as a bus error. The units are in hundreds of microseconds. **Note:** ***If the MXIbus System Controller field in the Bus Configuration Editor is set to NO, this field is ignored.***	10 (1.0 ms)

Exiting VXIEDIT and Reinitializing the Hardware

Select **Exit** or press the <Esc> key to quit the `VXIEDIT` program. If you changed any of the software configuration information, `VXIEDIT` prompts you to save your changes before exiting the configuration menu. Saving the configuration information updates the configuration files `VXILA.CFG`, `VXIBUS.CFG`, `VXIDEV.CFG`, and `DVXI.CFG`. Run `VXIINIT.EXE` to reinitialize the hardware according to the new settings.

If you changed any of the software configuration settings from the default, record the new setting on the *VXI-AT2000 Hardware and Software Configuration Form* in Appendix C.

Developing Your Application Program

The easiest way to learn how to communicate with your instruments is by controlling them interactively. Use the VXI interactive control program (`VIC` or `VICTEXT`) to write to and read from your instruments. Both programs display the status of your VXI transactions and inform you of any errors that occur. Refer to the *NI-VXI DOS Utilities Reference Manual* on how to use `VIC` and to learn about its features, and to the *NI-VXI Text Utilities Reference Manual* on how to use `VICTEXT` and to learn about its features.

`NIVXIDOS.LIB` is the NI-VXI Large Memory Model function library for the Microsoft C and Borland C Language interfaces. To use the NI-VXI software in your application program, you must compile your program for the large memory model, and include this library along with other libraries at link time. Make certain that the environment variables `LIB` and `INCLUDE` are set correctly as described in the *Installing the Software* section earlier in this chapter. The include files for the NI-VXI software are in the `INCLUDE` subdirectory.

Note: ***It is essential to include*** `"NIVXI.H"` ***in your application program.***

The `EXAMPLES` subdirectories contain various example programs along with makefiles that show how to use various functions in the NI-VXI software and how to develop application programs using these functions.

Note: ***When compiling NI-VXI applications, you must define the macro*** `VXIDOS` ***in your makefile/project. Refer to the example programs for details.***

`QBNIVXI.LIB` is the file that contains the NI-VXI function library for the Microsoft QuickBASIC interface. This is used to generate `QBNIVXI.QLB`, the Microsoft QuickBASIC library. The corresponding include files `*.INC` are in the `INCLUDE` subdirectory in the distribution software.

Appendix A
Specifications

This appendix lists various module specifications of the AT-MXI and VXI-MXI, such as physical dimensions and power requirements.

AT-MXI

The following pages list the specifications for the AT-MXI module.

Capability Codes

MXIbus

Capability Code	Description
MA32	Master Mode A32, A24 and A16 addressing
MBLT	Master Mode block transfers
SA24	Slave Mode A24 and A16 addressing
SBLT	Slave Mode block transfers
MD16	Master Mode D16 and D08 data sizes
SD16	Slave Mode D16 and D08 data sizes
SC	Optional MXIbus System Controller
FAIR	Can be a fair MXIbus requester
LOCK	Can lock the MXIbus for indivisible transfers
TERM	Can terminate the MXIbus

AT Bus

Capability Code	Description
AM	Can function as an AT Alternate Master
LOCK	Can lock the AT bus for indivisible transfers
DMA16	Supports D08 or D16 DMA transfers
INT	Can interrupt on the PC AT bus

Electrical

Source	Typical	Direct Current (max)
+5 VDC	3.3 A	4.4 A

Environmental

Component Temperature	0° to 70° C (32° to 158° F) operating -55° to 150° C (-67° to 302° F) storage
Emissions	FCC Class A
Relative Humidity	0% to 95% noncondensing; operating 0% to 100% noncondensing; storage
Safety	Not applicable
Shock and Vibration	Not applicable

Physical

Board Size	Standard full-length AT-height board 13.36 in. by 4.8 in. (339.72 mm by 121.92 mm)
Connectors	Single fully implemented MXIbus connector
Slot Requirements	Single AT (ISA) slot

Reliability

MTBF	Contact Factory

Requirements

Memory space required	64 KB
I/O space required	32 B

Timing

Master Mode

Transfer Type	Transfer Rate
Write	530 ns
Read	430 ns
Block Write	290 ns
Block Read	190 ns

Slave Mode

Transfer Type	Transfer Rate
Write	840 ns
Read	840 ns
Block Write	590 ns
Block Read	590 ns

Other

Daisy-Chain Delay 120 ns
(Passing GIN to GOUT or GOUT generation from System Controller)

VXI-MXI

The following pages list the specifications for the VXI-MXI module.

Capability Codes

VMEbus

Capability Code	Description
MA32, MA24, MA16	Master Mode A32, A24, and A16 addressing
SA32, SA24, SA16	Slave Mode A32, A24, and A16 addressing
MD32, MD16, MD08(EO)	Master Mode D32, D16, and D08 data sizes
SD32, SD16, SD08(EO)	Slave Mode D32, D16, and D08 data sizes
MBLOCK	Master Mode block transfers
SBLOCK	Slave Mode block transfers
MRMW	Master Mode Read/Modify/Write
SRMW	Slave Mode Read/Modify/Write
PRI	Prioritized arbitration
ROR	Release on Request bus requester
IH	Interrupt Handler
IR	Interrupt Requester
ROAK	Release on Acknowledge interrupter
BTO	Bus Timeout
SC	Optional VMEbus System Controller
IACK	IACK daisy-chain driver

VXIbus

Capability Code	Description
TRIG+1	Supports TTLTRIG0:7 and ECLTRIG0:1 trigger lines and full protocol operations for each. The VXI-MXI may participate in only one protocol operation at a time.

MXIbus

Capability Code	Description
MA32, MA24, MA16	Master Mode A32, A24, and A16 addressing
SA32, SA24, SA16	Slave Mode A32, A24, and A16 addressing
MD32, MD16, MD08(EO)	Master Mode D32, D16, and D08 data sizes
SD32, SD16, SD08(EO)	Slave Mode D32, D16, and D08 data sizes
MBLOCK	Master Mode block transfers
SBLOCK	Slave Mode block transfers
SC	Optional MXIbus System Controller
FAIR	Optional MXIbus fair requester
TERM	Can accept MXIbus termination resistors
IH	Interrupt Handler
IR	Interrupt Requester

Electrical

Source	DC Current Ratings		Dynamic Current
	Typical	Maximum	
+5 VDC	5.25 A	6.7 A	0.67 A
-5.2 VDC	300 mA	400 mA	50 mA
-2 VDC	100 mA	125 mA	20 mA

Environmental

Component temperature	0° to 70° C operating; -40° to 85° C storage
Airflow	3.5 liters/s for 10° rise
Relative humidity	10% to 90% noncondensing operating; 0% to 95% noncondensing storage
Emissions	FCC Class A
Safety	Not applicable
Shock and Vibration	Not applicable

Physical

Board size	Fully shielded VXI C-size board 9.187 in. by 13.386 in. (233.35 mm by 340 mm)
Connectors	Single fully implemented MXIbus connector Single INTX connector (on boards equipped with optional INTX daughter card)
Slot Requirements	Single VXI C-size slot
VXI Keying Class	Class 1 TTL

Fully compatible with VXI specification

Fully enclosed and shielded

Reliability

MTBF	Contact Factory

Requirements

A16 Space	64 B

Timing

Master Mode

Transfer Type	Transfer Rate
Write	675.5 ns
Read	625.5 ns
Block Write	320 ns
Block Read	270 ns

Slave Mode

Transfer Type	Transfer Rate
Write	381 ns
Read	381 ns
Block Write	238 ns
Block Read	238 ns

Other

Daisy-Chain Delay 120 ns
(Passing GIN to GOUT or GOUT generation from System Controller)

Appendix B
Troubleshooting

This appendix addresses certain problems you may encounter when using the NI-VXI bus interface software on the AT-MXI platform. This material covers the following issues:

- Running the `VXIINIT` initialization program results in an error message or causes the system to hang.
- Running the `RESMAN` Resource Manager program causes the system to hang or results in incorrect data.
- The mouse behaves erratically after you install the NI-VXI software.

If you encounter any of these problems, your system may have a conflict with one of the AT-MXI configuration settings or you may have a problem with the MXIbus cable(s). For proper operation, the AT-MXI requires the allocation of the following system resources:

- Thirty-two bytes of I/O register space
- At least one interrupt level that cannot be shared with another device
- A DMA channel (optional)
- A contiguous 64 KB block of memory space in the upper memory region of the PC AT.

The following sections discuss each of these system requirements along with the possible problems that may be encountered with a bad MXI cable.

If you are unable to resolve your problem, please fill out the appropriate forms in Appendix C, *Customer Communication*, and contact National Instruments.

Problems with VXIINIT

This section discusses what to do if running the `VXIINIT` initialization program results in an error message or causes the system to hang.

VXIINIT Error Messages

`VXIINIT` can give you error messages that inform you that it could not find the AT-MXI, that it could not find a specific file, or that an error occurred while writing a log file.

VXIINIT Could Not Find the AT-MXI

When you run `VXIINIT`, it attempts to locate the AT-MXI board by accessing the I/O registers that exist on the board. The AT-MXI board occupies 32 bytes of I/O space at a default base address of 340h (hex). The base I/O address of the AT-MXI is set in both hardware and software and the two settings must agree. If the hardware and software settings do not agree, you may receive an error message that reads **`VXI device not found`**.

In hardware, you use a set of DIP switches on the AT-MXI board itself if you need to change the setting of the base I/O address. Refer to the *Base I/O Address Selection* section of Chapter 2, *Hardware Configuration and Installation*, for more information about selecting a base I/O address for the AT-MXI. Keep in mind that if you change the base I/O address of the AT-MXI, you must make a corresponding change to the AT-MXI configuration software.

To change the I/O address in software, you need to run the VXI resource editor program, either `VXIEDIT` or `VXITEDIT`, and use the Logical Address Configuration Editor to make the change. Refer to the *Configuring the NI-VXI Software* section of Chapter 3, *NI-VXI Software Installation and Configuration*, for instructions on how to use the VXI resource editor program.

After you verify that the software settings correspond to the hardware setting, try the following methods to deal with this problem.

1. Ensure that you are using the proper `VXIINIT` program for your system. For example, the `VXIINIT` program distributed with the MC-MXI cannot be used to initialize the AT-MXI.

2. If the hardware and software settings match, ensure that the I/O registers settings of the AT-MXI do not conflict with any other hardware in the PC AT. If they do, change the settings of the AT-MXI or the other device.

3. If the hardware and software settings correspond and do not conflict with any other hardware in the PC AT, make sure the AT-MXI is securely seated in the ATbus slot or try another ATbus slot.

4. If the message persists, there is still some reason that the NI-VXI software cannot access the I/O registers of the AT-MXI. If possible, try the AT-MXI in another computer.

VXIINIT Could Not Find Specific Files

`VXIINIT` may inform you that it cannot find one or more of the configuration or table files, for example, **`File VXILA.CFG not found.`** Other files for which error messages are generated include `VXIBUS.CFG`, `VXIDEV.CFG`, `DVXI.CFG`, `MFNAMEID.TBL`, and `MODEL.TBL`. There are two possible causes for this error message.

1. The file(s) may have been deleted accidentally. If the file does not exist in your `TBL` directory after you installed your software, you can find it on your original NI-VXI distribution media and restore it manually.

2. The `NIVXIPATH` variable may be pointing to the wrong directory. The path should be set in the `AUTOEXEC.BAT` file to point to the root directory of the NI-VXI files. By default, this directory is `C:\NIVXI`.

Error Writing Log File

Another VXIINIT error message is **Error writing configuration to file.** This is only a warning message, and does not indicate a problem with the configuration. Either the log file could not be created, or only a partial log was written.

VXIINIT creates a file VXIINIT.OUT in the TBL subdirectory. This file is a text file that contains the same configuration information you see printed to the screen. The likely cause of this message is that the disk drive is full.

VXIINIT Causes System to Hang

If the system hangs when you run VXIINIT, first make sure that the I/O registers of the AT-MXI do not conflict with any other hardware in the PC AT, as discussed in the previous section. If this is not the case and the problem still occurs, the most likely reason is a DMA channel conflict.

In its default configuration, the AT-MXI uses one DMA channel, channel 3, for slave accesses. You can change this channel by using the Logical Address Configuration Editor of the VXIEDIT or VXITEDIT program and modifying the **Slave DMA Channel** field. Try setting this parameter to NONE, saving the new configuration, and running VXIINIT. If the system does not hang, the problem was due to a DMA channel conflict.

An application uses slave DMA when it needs to dual-port PC memory so that it can be accessed from the VXI/VME chassis. If the PC is simply going to read and write from devices, it does not need slave DMA and you can keep the parameter in the NONE setting. If your application needs to have slave accesses to the PC, you need to find an available DMA channel that you can set up successfully. Follow these steps to find a slave DMA channel that will work:

1. Determine if there are other devices that are configured to use DMA channels.

2. Choose a level that is not used in your system and set the AT-MXI to use this level. Refer to the *DMA Channel Selection* section of Chapter 2 for instructions on making this hardware change.

3. After you change the AT-MXI slave DMA channel jumper, use the Logical Address Configuration Editor of VXIEDIT or VXITEDIT to enter the new slave DMA channel.

4. Save the changes and run VXIINIT.

As mentioned previously in the *Master Mode Versus Slave Mode* section of Chapter 2, the NI-VXI software does not use master-mode DMA for block transfers because the movs instruction is faster on most PCs. The latest version of the NI-VXI software sets the default value for the **Master DMA Channel** field in the Logical Address Configuration Editor to NONE, and this value cannot be modified. If you are using a version of the NI-VXI software for the AT-MXI prior to Version 3.10, ensure that this value is set to NONE.

Problems with RESMAN

If the VXIINIT program runs successfully but you encounter problems with RESMAN, the Resource Manager program, the cause is probably the Master Window. The Master Window is a 64 KB block of contiguous memory in the PC AT upper memory space that the AT-MXI uses to access the VXI/VME bus. The upper memory space of a PC AT is the region from 640 KB (A000h) to 1024 KB (FFFFh). Several system resources, such as system ROM and video memory, reside in this area. By default, the Master Window occupies a memory region from a base address of D000h to DFFFh. You can change the Master Window base address by running the VXI resource editor program, either VXIEDIT or VXITEDIT, and using the Logical Address Configuration Editor to make the change.

A conflict in the Master Window of the AT-MXI can cause RESMAN to behave erratically. The following are likely symptoms of a conflict in the Master Window configuration.

- The RESMAN display shows multiple devices at Logical Address 0. (The AT-MXI should be the *only* device at Logical Address 0.)
- RESMAN detects nonexistent devices.
- The computer hangs when you run RESMAN.

The following paragraphs discuss the two main causes of a Master Window Base Address conflict.

Memory Area Used by Another Device

Your system may contain a device that already occupies all or some of the upper memory area that is allocated for the Master Window.

To solve this problem, first determine what area of upper memory your devices use. Then move either your device or the Master Window Base Address to an unused area of upper memory.

If you have a Super VGA monitor, your system is likely to use video RAM. Generally, any video RAM used by your PC AT occupies all or some of the upper memory from A000h to BFFFh. If you have Ethernet networking cards, be aware that many of them occupy upper memory. Many Ethernet cards have an upper memory base address of D000h or E000h.

Memory Area Used by Expanded-Memory Manager or Emulator

Your system may contain an expanded-memory manager or an expanded-memory emulator that uses a block of upper memory within the range that is allocated for the Master Window.

To solve this problem, verify which expanded-memory manager or emulator you are using, and prevent it from using upper memory within the Master Window address range. The following examples show how to prevent various expanded-memory managers or emulators from using upper memory within the default Master Window address range of D000h to DFFFh.

Note: ***If you have changed your Master Window address range, use it instead of the default range (D000 to DFFF) in the following examples.***

If you are using EMM386, which is included with MS-DOS, prevent it from using the default Master Window address range by editing the `CONFIG.SYS` file and appending the flag `X=D000-DFFF` to the line `DEVICE=EMM386.EXE`.

If you are using QEMM386 from Quarterdeck, prevent it from using the default Master Window address range by editing the `CONFIG.SYS` file and appending the flag `X=D000-DFFF` to the line `DEVICE=QEMM386.SYS`.

If you are using 386MAX from Qualitas, prevent it from using the default Master Window address range by editing the `386MAX.PRO` file located in the `386MAX` directory, and inserting the line `RAM=D000-DFFF`.

If you are using any other expanded-memory manager, refer to its documentation to learn how to prevent it from using the default Master Window address range of D000h to DFFFh.

Problems with Mouse

If you notice your mouse behaving erratically after you run `VXIINIT`, the problem is most likely an interrupt conflict. As stated earlier, the AT-MXI requires one interrupt line that it cannot share with another device in the system.

To correct an interrupt conflict, first verify that the AT-MXI board interrupt level (set by a jumper) matches the software setting in the Logical Address Configuration Editor of the VXI resource editor program, `VXIEDIT` or `VXITEDIT`. Then determine if any other devices are configured to use the AT-MXI interrupt level. The default AT-MXI interrupt level is 12.

If there is a conflict, move either the conflicting device or the AT-MXI to a different interrupt level. If you decide to change the AT-MXI interrupt level, you must change the interrupt jumper hardware setting, enter the new interrupt level in the Configuration Editor, save the changes, and run `VXIINIT`.

Problems with MXIbus Cable

If you have verified that you do not have a conflict with any of the AT-MXI configuration settings, your problem might be with the MXIbus cables in your system.

The following symptoms can indicate a problem with the MXIbus cable.

- `RESMAN` finds the AT-MXI board at Logical Address 0 but does not detect the VXI/VME chassis.
- `RESMAN` previously worked, but now produces errors.

Perform the following checks to determine the problem with your MXIbus cables.

1. Check the pins on your cable connectors. Sometimes the pins get bent and fail to provide the proper electrical connection.

2. Make sure the each end of the MXIbus cable is plugged into the proper connector. Certain MXIbus cables have a single-point connector on one end and a daisy-chain connector on the other end. With these cables, you must connect the single-point connector to the MXIbus device that is closer in the MXIbus chain to the MXIbus System Controller. The MXIbus System Controller determines who gains control of the MXIbus. By default, the AT-MXI is the MXIbus System Controller (set by the Bus Configuration Editor) and the VXI-MXI is not the System Controller (set by an onboard slide switch). If you are having problems, check that the AT-MXI and the VXI-MXI are set accordingly.

3. If the cabling problem is not apparent, try another MXIbus cable if you have one available. If this solves the problem, contact National Instruments for repair information.

Appendix C
Customer Communication

For your convenience, this appendix contains forms to help you gather the information necessary to help us solve technical problems you might have as well as a form you can use to comment on the product documentation. Filling out a copy of the *Technical Support Form* before contacting National Instruments helps us help you better and faster.

National Instruments provides comprehensive technical assistance around the world. In the U.S. and Canada, applications engineers are available Monday through Friday from 8:00 a.m. to 6:00 p.m. (central time). In other countries, contact the nearest branch office. You may fax questions to us at any time.

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Technical support fax: (800) 328-2203
(512) 794-5678

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Belgium	02/757.00.20	02/757.03.11
Denmark	45 76 26 00	45 76 71 11
Finland	(90) 527 2321	(90) 502 2930
France	(1) 48 14 24 00	(1) 48 14 24 14
Germany	089/741 31 30	089/714 60 35
Italy	02/48301892	02/48301915
Japan	(03) 3788-1921	(03) 3788-1923
Netherlands	03480-33466	03480-30673
Norway	32-848400	32-848600
Spain	(91) 640 0085	(91) 640 0533
Sweden	08-730 49 70	08-730 43 70
Switzerland	056/20 51 51	056/27 00 25
U.K.	0635 523545	0635 523154

Technical Support Form

Photocopy this form and update it each time you make changes to your software or hardware, and use the completed copy of this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

If you are using any National Instruments hardware or software products related to this problem, include the configuration forms from their user manuals. Use additional pages if necessary.

Name _____

Company _____

Address _____

_____

Fax (___)_____ Phone (___)_____

Computer brand _____ Model _____ Processor _____

Operating system _____

Speed _____MHz RAM _____MB Display adapter _____

Mouse _____yes _____no Other adapters installed _____

Hard disk capacity _____MB Brand _____

Instruments used _____

National Instruments hardware product model _____ Revision _____

Configuration _____

National Instruments software product _____ Version _____

Configuration _____

The problem is _____

_____

_____

_____

_____

List any error messages _____

_____

_____

_____

_____

The following steps will reproduce the problem _____

_____

_____

_____

VXI-AT2000 Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Complete a new copy of this form each time you revise your software or hardware configuration, and use this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

National Instruments Products

- NI-VXI Software Revision Number _____
  (Disk Labels: *NI-VXI Distribution Disks for the AT-MXI and MS-DOS*, disks 1 and 2)
- Application Programming Language _____
  (QuickBASIC or C)
- Programming Language Interface Revision _____
- AT-MXI Base I/O Address _____
- AT-MXI Master Window Base _____
- AT-MXI Address Space _____
- AT-MXI Master DMA Channel _____
- AT-MXI Slave DMA Channel _____
- AT-MXI Board Interrupt Level _____
- AT-MXI Slave I/O Window Base _____
- AT-MXI Slave I/O Window Size _____
- AT-MXI Shared RAM Window Base _____
- AT-MXI Shared RAM Window Size _____
- AT-MXI Shared Memory Pool (Windows) _____
- AT-MXI Resource Manager Delay _____
- AT-MXI is MXIbus System Controller? _____
- AT-MXI is Fair Requester? _____
- MXIbus Interrupt Level _____
- Slave Mode Timeout _____
- Master Mode Timeout _____
- System Controller Timeout _____

- VXI-MXI Installed in Slot 0? _____
- VXI-MXI Logical Address _____
- VXI-MXI VMEbus Request Level _____
- VXI-MXI Hardware Revision _____
- AT-MXI Hardware Revision _____

Other Products

- Computer Make and Model _____
- Microprocessor _____
- Clock Frequency (Bus and Microprocessor) _____
- Total Memory in System _____
- Type of Video Board Installed _____
- MS-DOS Version _____
- Programming Language Version _____
- Other Boards in System _____
- Base I/O Address of Other Boards _____
- DMA Channels of Other Boards _____
- Interrupt Level of Other Boards _____
- VXIbus Mainframe Make and Model _____
- Other VXIbus Devices in System _____
- Static Logical Addresses of Other VXIbus Devices _____

Documentation Comment Form

National Instruments encourages you to comment on the documentation supplied with our products. This information helps us provide quality products to meet your needs.

Title: **Getting Started with Your VXI-AT2000 and the NI-VXI™ Software for MS-DOS**

Edition Date: **October 1993**

Part Number: **320219-01**

Please comment on the completeness, clarity, and organization of the manual.

If you find errors in the manual, please record the page numbers and describe the errors.

Thank you for your help.

Name _____

Title _____

Company _____

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Glossary

Prefix	Meaning	Value
n-	nano-	10^{-9}
µ-	micro-	10^{-6}
m-	milli-	10^{-3}
K-	kilo-	10^{3}
M-	mega-	10^{6}
G-	giga-	10^{9}

Symbols

°	degrees
%	percent
±	plus or minus

A

A	amperes
A16 space	VXIbus address space equivalent to the VME 64 KB *short* address space. In VXI, the upper 16 KB of A16 space is allocated for use by VXI devices configuration registers. This 16 KB region is referred to as VXI configuration space.
A24 space	VXIbus address space equivalent to the VME 16 MB *standard* address space.
A32 space	VXIbus address space equivalent to the VME 4 GB *extended* address space.
address	Character code that identifies a specific location (or series of locations) in memory.
address modifier	One of six signals in the VMEbus specification used by VMEbus masters to indicate the address space in which a data transfer is to take place.
address space	A set of 2^n memory locations differentiated from other such sets in VXI/VMEbus systems by six addressing lines known as address modifiers. *n* is the number of address lines required to uniquely specify a byte location in a given space. Valid numbers for *n* are 16, 24, and 32. In VME/VXI, because there are six address modifiers, there are 64 possible address spaces.

address window	A portion of address space that can be accessed from the application program.
ANSI	American National Standards Institute
arbitration	A process in which a potential bus master gains control over a particular bus.
asynchronous	Not synchronized; not controlled by time signals.

B

B	bytes
backplane	An assembly, typically a printed circuit board, with 96-pin connectors and signal paths that bus the connector pins. A C-size VXIbus system will have two sets of bused connectors called J1 and J2. A D-size VXIbus system will have three sets of bused connectors called J1, J2, and J3.
binary	A numbering system with a base of 2.
block-mode transfer	An uninterrupted transfer of data elements in which the master sources only the first address at the beginning of the cycle. The slave is then responsible for incrementing the address on subsequent transfers so that the next element is transferred to or from the proper storage location. In VME, the data transfer may have no more than 256 elements; MXI does not have this restriction.
BTO unit	Bus Timeout Unit; a functional module that times the duration of each data transfer and terminates the cycle if the duration is excessive. Without the termination capability of this module, a bus master attempt to access a nonexistent slave could result in an indefinitely long wait for a slave response.
bus master	A device that is capable of requesting the Data Transfer Bus (DTB) for the purpose of accessing a slave device.

C

C	Celsius
CLK10	A 10 MHz, ± 100 ppm, individually buffered (to each module slot), differential ECL system clock that is sourced from Slot 0 and distributed to Slots 1 through 12 on P2. It is distributed to each slot as a single-source, single-destination signal with a matched delay of under 8 ns.
CMOS	Complementary Metal Oxide Semiconductor; a process used in making chips.
Commander	A Message-Based device which is also a bus master and can control one or more Servants.

D

DACK	DMA Acknowledge
daisy-chain	A method of propagating signals along a bus, in which the devices are prioritized on the basis of their position on the bus.
Data Transfer Bus	DTB; one of four buses on the VMEbus backplane. The DTB is used by a bus master to transfer binary data between itself and a slave device.
DIP	Dual Inline Package
DMA	Direct Memory Access; a method by which data is transferred between devices and internal memory without intervention of the central processing unit.
DRQ	DMA Request
DTB	See *Data Transfer Bus*.
dynamic configuration	A method of automatically assigning logical addresses to VXIbus devices at system startup or other configuration times.
dynamically configured device	A device that has its logical address assigned by the Resource Manager. A VXI device initially responds at Logical Address 255 when its MODID line is asserted. A MXIbus device responds at Logical Address 255 during a priority select cycle. The Resource Manager subsequently assigns it a new logical address, which the device responds to until powered down.

E

ECL	Emitter-Coupled Logic
embedded controller	An intelligent CPU (controller) interface plugged directly into the VXI backplane, giving it direct access to the VXIbus. It must have all of its required VXI interface capabilities built in.
EMI	Electromagnetic Interference
external controller	In this configuration, a plug-in interface board in a computer is connected to the VXI mainframe via one or more VXIbus extended controllers. The computer then exerts overall control over VXIbus system operations.

F

F	Fahrenheit
fair requester	A MXIbus master that will not arbitrate for the MXIbus after releasing it until it detects the bus request signal inactive. This ensures that all requesting devices will be granted use of the bus.

FCC	Federal Communications Commission

G

GIN	Daisy-chain Grant In signal
GOUT	Daisy-chain Grant Out signal
GPIB	General Purpose Interface Bus; the industry-standard IEEE 488 bus.

H

hex	Hexadecimal; the numbering system with base 16, using the digits 0 to 9 and letters A to F.
Hz	hertz; cycles per second.

I

IC	Integrated Circuit
IEEE	Institute of Electrical and Electronics Engineers
in.	inches
I/O	input/output; the techniques, media, and devices used to achieve communication between machines and users.
interrupt	A means for a device to request service from another device.
interrupt handler	A VMEbus functional module that detects interrupt requests generated by Interrupters and responds to those requests by requesting status and identify information.
interrupt level	The relative priority at which a device can interrupt.
INTX	Interrupt Timing and Extension
IRQ*	Interrupt signal
ISA	Industry Standard Architecture

K

KB	1,024; kilobytes of memory

L

LED	Light Emitting Diode
logical address	An 8-bit number that uniquely identifies each VXIbus device in a system. It defines the A16 register address of a device, and indicates Commander and Servant relationships.

M

MB	1,048,576; megabytes of memory
m	meters
master	A functional part of a MXI/VME/VXIbus device that initiates data transfers on the backplane. A transfer can be either a read or a write.
master-mode operation	A device is in master mode if it is performing a bus cycle which it initiated.
Message-Based device	An intelligent device that implements the defined VXIbus registers and communication protocols. These devices are able to use Word Serial Protocol to communicate with one another through communication registers.
MODID	Module Identification lines
`movs`	Move string command
MTBF	Mean Time Between Failure
MXIbus	Multisystem eXtension Interface Bus; a high-performance communication link that interconnects devices using round, flexible cables.
MXIbus System Controller	A functional module that has arbiter, daisy-chain driver, and MXIbus cycle timeout responsibility. Always the first device in the MXIbus daisy-chain.

N

NI-VXI	The National Instruments bus interface software for VME/VXIbus systems.
Non-Slot 0 device	A device configured for installation in any slot in a VXIbus mainframe other than Slot 0. Installing such a device into Slot 0 can damage the device, the VXIbus backplane, or both.

P

PC AT	Personal Computer Advanced Technology
propagation	The transmission of signal through a computer system.

R

Register-Based device	A Servant-only device that supports VXIbus configuration registers. Register-Based devices are typically controlled by Message-Based devices via device-dependent register reads and writes.
RESMAN	The name of the National Instruments Resource Manager in NI-VXI bus interface software. See *Resource Manager*.
Resource Manager	A Message-Based Commander located at Logical Address 0, which provides configuration management services such as address map configuration, Commander and Servant mappings, and self-test and diagnostic management.
RM	See *Resource Manager*.

S

s	seconds
Servant	A device controlled by a Commander; there are Message-Based and Register-Based Servants.
Shared Memory Protocol	A communication protocol that uses a block of memory that is accessible to both a client and a server. The memory block operates as a message buffer for communications.
slave	A functional part of a MXI/VME/VXIbus device that detects data transfer cycles initiated by a VMEbus master and responds to the transfers when the address specifies one of the device's registers.
slave-mode operation	A device is in slave mode it if is responding to a bus cycle.
Slot 0 device	A device configured for installation in Slot 0 of a VXIbus mainframe. This device is unique in the VXIbus system in that it performs the VMEbus System Controller functions, including clock sourcing and arbitration for data transfers across the backplane. Installing such a device into any other slot can damage the device, the VXIbus backplane, or both.
statically configured device	A device whose logical address cannot be set through software; that is, it is not dynamically configurable.
SYSFAIL	A VMEbus signal that is used by a device to indicate an internal failure. A failed device asserts this line.

T

trigger	Either TTL or ECL lines used for intermodule communication.
TTL	Transistor-Transistor Logic

V

V	volts
VDC	volts direct current
VIC	VXI Interactive Control Program, a part of the NI-VXI bus interface software package. Used to program VXI devices, and develop and debug VXI application programs. Called *VICTEXT* in text-based applications.
VME	Versa Module Eurocard or IEEE 1014
VMEbus System Controller	See *Slot 0 Device.*
VXIbus	VMEbus Extensions for Instrumentation
VXIINIT	A program in the NI-VXI bus interface software package that initializes the board interrupts, shared RAM, VXI register configurations, and bus configurations.
VXIEDIT	VXI Resource Editor program, a part of the NI-VXI bus interface software package. Used to configure the system, edit the manufacturer name and ID numbers, edit the model names of VXI and non-VXI devices in the system, as well as the system interrupt configuration information, and display the system configuration information generated by the Resource Manager. Called *VXITEDIT* in text-based applications.

W

Word Serial Protocol	The simplest required communication protocol supported by Message-Based devices in the VXIbus system. It utilizes the A16 communication registers to transfer data using a simple polling handshake method.

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