

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *National Instruments SB-MXI* at our website: ***Click HERE***

Getting Started with Your VXI-SB2020 and the NI-VXI™ Software for Solaris



February 1995 Edition

Part Number 320329-01

© Copyright 1990, 1995 National Instruments Corporation.
All Rights Reserved.

National Instruments Corporate Headquarters
6504 Bridge Point Parkway
Austin, TX 78730-5039
(512) 794-0100
Technical support fax: (800) 328-2203
(512) 794-5678

Branch Offices:
Australia (03) 879 9422, Austria (0662) 435986, Belgium 02/757.00.20, Canada (Ontario) (519) 622-9310,
Canada (Québec) (514) 694-8521, Denmark 45 76 26 00, Finland (90) 527 2321, France (1) 48 14 24 24,
Germany 089/741 31 30, Italy 02/48301892, Japan (03) 3788-1921, Mexico 95 800 010 0793,
Netherlands 03480-33466, Norway 32-84 84 00, Singapore 2265886, Spain (91) 640 0085, Sweden 08-730 49 70,
Switzerland 056/20 51 51, Taiwan 02 377 1200, U.K. 0635 523545

Limited Warranty

The National Instruments MXIbus boards and accessories are warranted against defects in materials and workmanship for a period of one year from the date of shipment, as evidenced by receipts or other documentation. National Instruments will, at its option, repair or replace equipment that proves to be defective during the warranty period. This warranty includes parts and labor.

The media on which you receive National Instruments software are warranted not to fail to execute programming instructions, due to defects in materials and workmanship, for a period of 90 days from date of shipment, as evidenced by receipts or other documentation. National Instruments will, at its option, repair or replace software media that do not execute programming instructions if National Instruments receives notice of such defects during the warranty period. National Instruments does not warrant that the operation of the software shall be uninterrupted or error free.

A Return Material Authorization (RMA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. National Instruments will pay the shipping costs of returning to the owner parts which are covered by warranty.

National Instruments believes that the information in this manual is accurate. The document has been carefully reviewed for technical accuracy. In the event that technical or typographical errors exist, National Instruments reserves the right to make changes to subsequent editions of this document without prior notice to holders of this edition. The reader should consult National Instruments if errors are suspected. In no event shall National Instruments be liable for any damages arising out of or related to this document or the information contained in it.

EXCEPT AS SPECIFIED HEREIN, NATIONAL INSTRUMENTS MAKES NO WARRANTIES, EXPRESS OR IMPLIED, AND SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S RIGHT TO RECOVER DAMAGES CAUSED BY FAULT OR NEGLIGENCE ON THE PART OF NATIONAL INSTRUMENTS SHALL BE LIMITED TO THE AMOUNT THERETOFORE PAID BY THE CUSTOMER. NATIONAL INSTRUMENTS WILL NOT BE LIABLE FOR DAMAGES RESULTING FROM LOSS OF DATA, PROFITS, USE OF PRODUCTS, OR INCIDENTAL OR CONSEQUENTIAL DAMAGES, EVEN IF ADVISED OF THE POSSIBILITY THEREOF. This limitation of the liability of National Instruments will apply regardless of the form of action, whether in contract or tort, including negligence. Any action against National Instruments must be brought within one year after the cause of action accrues. National Instruments shall not be liable for any delay in performance due to causes beyond its reasonable control. The warranty provided herein does not cover damages, defects, malfunctions, or service failures caused by owner's failure to follow the National Instruments installation, operation, or maintenance instructions; owner's modification of the product; owner's abuse, misuse, or negligent acts; and power failure or surges, fire, flood, accident, actions of third parties, or other events outside reasonable control.

Copyright

Under the copyright laws, this publication may not be reproduced or transmitted in any form, electronic or mechanical, including photocopying, recording, storing in an information retrieval system, or translating, in whole or in part, without the prior written consent of National Instruments Corporation.

Trademarks

LabVIEW® and NI-VXI™ are trademarks of National Instruments Corporation.

Product and company names listed are trademarks or trade names of their respective companies.

WARNING REGARDING MEDICAL AND CLINICAL USE OF NATIONAL INSTRUMENTS PRODUCTS

National Instruments products are not designed with components and testing intended to ensure a level of reliability suitable for use in treatment and diagnosis of humans. Applications of National Instruments products involving medical or clinical treatment can create a potential for accidental injury caused by product failure, or by errors on the part of the user or application designer. Any use or application of National Instruments products for or involving medical or clinical treatment must be performed by properly trained and qualified medical personnel, and all traditional medical safeguards, equipment, and procedures that are appropriate in the particular situation to prevent serious injury or death should always continue to be used when National Instruments products are being used. National Instruments products are NOT intended to be a substitute for any form of established process, procedure, or equipment used to monitor or safeguard human health and safety in medical or clinical treatment.

FCC/DOC Radio Frequency Interference Compliance

This equipment generates and uses radio frequency energy and, if not installed and used in strict accordance with the instructions in this manual, may cause interference to radio and television reception. This equipment has been tested and found to comply with the following two regulatory agencies:

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.

Contents

About This Manual ix
How to Use the Documentation Set ix
Organization of This Manual ix
Conventions Used in This Manual x
Related Documentation x
Customer Communication xi

Chapter 1
Introduction 1-1
What You Need to Get Started 1-1
Optional Equipment 1-2
Optional Software 1-3

Chapter 2
Hardware Configuration and Installation 2-1
Step 1. Unpack the SB-MXI and VXI-MXI 2-1
Step 2. Install the SB-MXI Hardware 2-2
Step 3. Configure the VXI-MXI Hardware 2-4
Front Panel Features 2-6
Removing the Metal Enclosure 2-6
VXIbus Slot 0 2-6
VMEbus BTO 2-9
VXI Logical Address 2-9
VMEbus Request Level Selection 2-11
Step 4. Install the VXI-MXI Hardware 2-12
Step 5. Connect the MXIbus Cable 2-13
Nonpolarized Cables 2-13
Polarized Cables 2-14

Chapter 3
NI-VXI Software Installation and Configuration 3-1
NI-VXI Software Overview 3-1
Main Programs and Files 3-1
Additional Programs and Files 3-2
Installing and Loading the NI-VXI Software for Solaris 1.x 3-3
Installing the NI-VXI Software for Solaris 1.x 3-3
Loading the NI-VXI Driver for Solaris 1.x 3-3
Unloading the NI-VXI Driver for Solaris 1.x 3-4
Installing and Loading the NI-VXI Software for Solaris 2.x 3-5
Upgrading from NI-VXI Version 1.0 for Solaris 2.x 3-5
Installing the NI-VXI Software for Solaris 2.x 3-6
Special Note for Users of Solaris 2.2 or Lower 3-6
Loading the NI-VXI Driver for Solaris 2.x 3-6
Unloading the NI-VXI Driver for Solaris 2.x 3-7

Using the NI-VXI Software 3-7
Using LabVIEW or LabWindows/CVI....3-8
Configuring the NI-VXI Software 3-8
Default Configurations 3-8
Using vxitedit 3-9
Logical Address Configuration 3-9
Bus Configuration 3-11
Exiting vxitedit and Reinitializing the Hardware 3-11
Developing Your Application Program 3-11

Appendix A
Specifications A-1

Appendix B
Troubleshooting B-1

Appendix C
Customer Communication....C-1

Glossary Glossary-1

Figures

Figure 2-1. SB-MXI Installed in a SPARCstation 1+ 2-3
Figure 2-2. VXI-MXI Parts Locator Diagram 2-4
Figure 2-3. VXI-MXI with INTX Parts Locator Diagram 2-5
Figure 2-4. VXIbus Slot 0 Configuration 2-7
Figure 2-5. VXIbus Non-Slot 0 Configuration....2-8
Figure 2-6. Logical Address Selection 2-10
Figure 2-7. VXI-MXI VMEbus Requester Jumper Settings 2-11
Figure 2-8. MXIbus Single-Ended Cable Configuration 2-13
Figure 2-9. MXIbus Dual-Ended Cable Configuration 2-14

Tables

Table 3-1. Logical Address Configuration Characteristics 3-9
Table 3-2. Bus Configuration Characteristics 3-11

About This Manual

This manual contains instructions for installing and configuring the National Instruments VXI-SB2020 interface kit and the NI-VXI software for Solaris. The VXI-SB2020 kit contains separate software distribution disks for the Solaris 1.x and 2.x platforms. Any differences between the two platforms are described specifically. This manual is meant to be used with the *NI-VXI Software Reference Manual for C* and the *NI-VXI Text Utilities Reference Manual.*

How to Use the Documentation Set

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. Refer to the *NI-VXI Text Utilities Reference Manual* to learn more about the `victext` and `vxitedit` programs.

Organization of This Manual

Getting Started with Your VXI-SB2020 and the NI-VXI Software for Solaris is organized as follows:

- Chapter 1, *Introduction*, describes the VXI-SB2020 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-SB2020 interface kit.
- Chapter 3, *NI-VXI Software Installation and Configuration*, lists all the programs and files located on the NI-VXI distribution diskettes, and contains instructions for installing and configuring the NI-VXI software. Select the proper distribution disk to install NI-VXI software for either Solaris 1.x or Solaris 2.x.
- Appendix A, *Specifications*, lists various module specifications of the SB-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 for Solaris.

- 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:

italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
bold italic	Bold italic text denotes a warning.
`monospace`	Text in this font denotes text or characters that are to be literally input from the keyboard, the proper names of directories, device drivers, programs, 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, <Enter>.

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

Related Documentation

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

- *Multisystem Extension Interface Bus Specification*, Version 1.2 (available from National Instruments Corporation)

- VXI-6, *VXIbus Mainframe Extender Specification*, Rev. 1.0, VXIbus Consortium (available from National Instruments Corporation)

- *VXI-MXI User Manual*, National Instruments Corporation

- *IEEE Standard for a Versatile Backplane Bus: VMEbus*, ANSI/IEEE Standard 1014-1987

- VXI-1, *VXIbus System Specification*, Rev. 1.4, VXIbus Consortium

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-SB2020 interface kit, lists the contents of your kit, and lists optional equipment and software.

The VXI-SB2020 is an interface kit that links any Sun workstation or compatible equipped with SBus expansion slots (hereafter referred to as the Sun) directly to the VXIbus. A Sun equipped with a VXI-SB2020 can function as a VXI Commander, Servant, and Resource Manager. The VXI-SB2020 makes the Sun appear as though it were plugged directly into the VXI backplane as an embedded CPU VXI module.

What You Need to Get Started

- ❑ SB-MXI interface board
- ❑ One of the following interface modules:

  Standard VXI-MXI interface module

  Enhanced VXI-MXI interface module with INTX option

  Standard VME-MXI interface module

  Enhanced VME-MXI interface module with INTX option

- ❑ NI-VXI distribution disk for the SB-MXI and Solaris 1.x

  or

  NI-VXI distribution disk for the SB-MXI and Solaris 2.x

  You received both disks and disks in your kit. Use only the disk that applies to your version of Solaris.

- ❑ Solaris version 1.x or 2.x installed on your computer

- ❑ 2 m Type M1 MXIbus cable

  Note: ***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.***

Optional Equipment

Contact National Instruments to order any of the following optional equipment.

- VXI-MXI Standard VXIbus Mainframe Extender
- VXI-MXI Enhanced VXIbus Mainframe Extender
- VME-MXI Standard VMEbus Chassis Extender
- VME-MXI Enhanced VMEbus Chassis Extender
- Type M1 MXIbus cable (straight-point to straight-point connectors)
- Type M2 MXIbus cable (straight-point to right-angle daisy-chain connectors)
- Type M3 MXIbus cable (right-angle-point to right-angle daisy-chain connectors)
- Type M4 MXIbus cable (straight-point to reverse-right-angle daisy-chain connectors)
- Type M5 MXIbus cable (right-angle-point to reverse-right-angle daisy-chain connectors)
- Type M6 MXIbus cable (right-angle-point to reverse-right-angle daisy-chain connectors)
- Type MB1 MXIbus Bulkhead cable (right-angle point to wall-mount Bulkhead exit)
- Type MB2 MXIbus Bulkhead cable (straight Bulkhead exit to straight Bulkhead entry)
- Type MB3 MXIbus Bulkhead cable (wall-mount Bulkhead entry to right-angle daisy-chain)
- Type MB4 MXIbus Bulkhead cable (right-angle point to straight Bulkhead entry)
- Type MB5 MXIbus Bulkhead cable (right-angle daisy-chain to straight Bulkhead)

The Type M1, M2, M3, M4, M5, and M6 MXIbus cables are available in 1 m, 2 m, 4 m, 8 m, and 20 m lengths. The Type MB1, MB2, MB3, MB4, and MB5 MXIbus Bulkhead cables are available in 2 m and other lengths.

Optional Software

Your VXI-SB2020 kit includes the NI-VXI bus interface software for Solaris. In addition, you can order the LabVIEW or LabWindows®/CVI software from National Instruments. These programs match the modular virtual instrument capability of VXI and can reduce your VXIbus software development time. LabVIEW is a complete programming environment that departs from the sequential nature of traditional programming languages and features a graphical programming environment. LabWindows/CVI is an interactive C development environment for building test and measurement and instrument control systems. It includes interactive code-generation tools and a graphical editor for building custom user interfaces.

Both LabVIEW and LabWindows/CVI include all the tools needed for instrument control, data acquisition, analysis, and presentation. When you order LabVIEW or LabWindows/CVI, you also get more than 300 complete instrument drivers, which are modular, source-code programs that handle the communication with your instrument so that you do not have to learn the programming details. You can use both programs with either Solaris 1.x or Solaris 2.x.

If you want to use LabVIEW with your VXI-SB2020, you must order the LabVIEW for Sun VXI Development System that corresponds to your Sun system. The following kits are available:

- LabVIEW for Sun VXI Development System 1 User
- LabVIEW for Sun VXI Development System 5 User
- LabVIEW for Sun VXI Development System 10 User
- LabVIEW for Sun VXI Development System 25 User

Each LabVIEW for Sun VXI Development System contains the following components:

- LabVIEW for Sun Full Development System
- LabVIEW for Sun VXI Library
- LabVIEW for Windows/Sun VXI Instrument Library

If you want to use LabWindows/CVI with your VXI-SB2020, you must order the LabWindows/CVI for Sun VXI Development System that corresponds to your Sun system. The following kits are available:

- LabWindows/CVI for Sun VXI Development System 1 User
- LabWindows/CVI for Sun VXI Development System 5 User
- LabWindows/CVI for Sun VXI Development System 10 User
- LabWindows/CVI for Sun VXI Development System 25 User

Each LabWindows/CVI for Sun VXI Development System contains the following components:

- LabWindows/CVI for Sun Full Development System
- LabWindows/CVI for Sun VXI Libraries
- LabWindows/CVI for Sun Instrument Library

Chapter 2
Hardware Configuration and Installation

This chapter contains the instructions to configure and install the VXI-SB2020 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 SB-MXI and VXI-MXI.
2. Install the SB-MXI hardware.
3. Configure the VXI-MXI hardware.
4. Install the VXI-MXI hardware.
5. Connect the MXIbus cable.

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

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

1. Before attempting to configure or install the SB-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. (See Chapter 1 of this manual.) *Do not* remove the boards from their plastic bags at this point.
3. Your SB-MXI board and VXI-MXI module are shipped packaged in antistatic plastic bags to prevent electrostatic damage. Some of the circuitry on the SB-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 SB-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. Install the SB-MXI Hardware

The SB-MXI does not have any jumpers or switches for configuring the hardware. The base address of the SB-MXI is determined by the geographic mechanism provided by the SBus. The SB-MXI uses SBus interrupt level 3, which it can share with other SBus boards.

Before you install the SB-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 SBus slots. Normally, this will be a problem only if the cable connector hoods for the adjacent slots are also oversized. When choosing an SBus slot in which to install the SB-MXI, verify that the MXIbus cable connector will not interfere with cables and connectors in other SBus slots. If necessary, reposition the boards in the system to prevent cabling conflicts. It may also help to install the SB-MXI in one of the end slots so that you will have to contend with the cable connectors of only one other board.

If you cannot configure the SB-MXI to co-exist in an existing SBus system by repositioning the boards, you can use one of the MXIbus cable options with a straight-point connector hood on the cable end that attaches to the SB-MXI. The straight-point 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 SB-MXI be the first device in the MXIbus daisy-chain because a cable with a straight-point connector end cannot accept another MXIbus cable to propagate the bus. Remember that you must configure the first device in the MXIbus daisy-chain to be the MXIbus System Controller.

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

1. Plug in your Sun workstation before installing the SB-MXI. The plug grounds the system unit and protects it from electrical damage while you are installing boards.

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

2. Remove the cover of the system unit.

3. Select any available SBus slot and remove the sheet-metal protector plate that covers the slot.

4. Before picking up the SB-MXI, 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.

5. Depending on the type of Sun workstation, you need to select one of the following methods for installing the SB-MXI. The difference is in regard to the mounting plate on the SB-MXI.

   a. For most older Sun workstations, slide the SB-MXI at an angle into the back panel of the system unit while making sure the mounting plate on the SB-MXI hooks into the holes on the back panel of the system unit.

   b. Most newer Sun workstations cannot accept the top part of the mounting plate on the SB-MXI. This piece has tabs on either end and is fastened to the mounting plate by two screws. Remove this piece before attempting to install the SB-MXI.

6. Align the SBus connector plug of the SB-MXI with the SBus socket and gently press the plug into the socket.
7. Check the installation.
8. Replace the cover to the system unit.

Figure 2-1 illustrates the installation of an SB-MXI into a SPARCstation 1+.

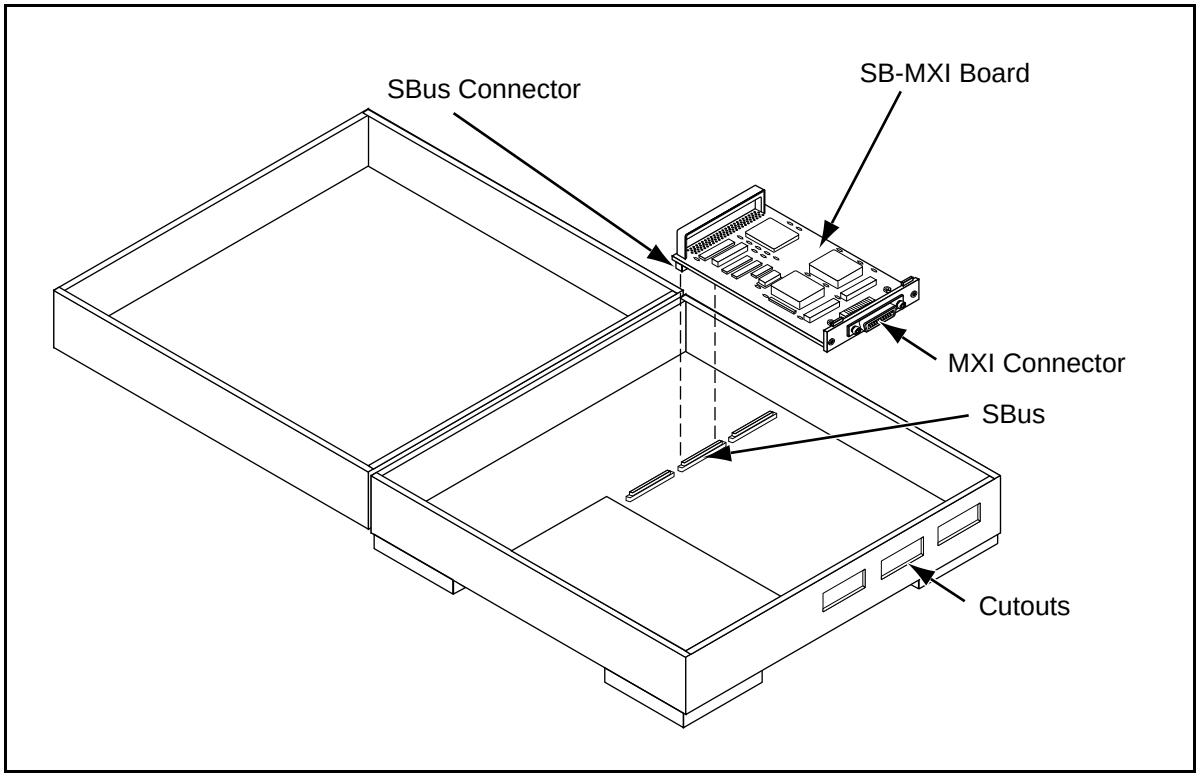


Figure 2-1. SB-MXI Installed in a SPARCstation 1+

Step 3. Configure the VXI-MXI Hardware

Figure 2-2 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.

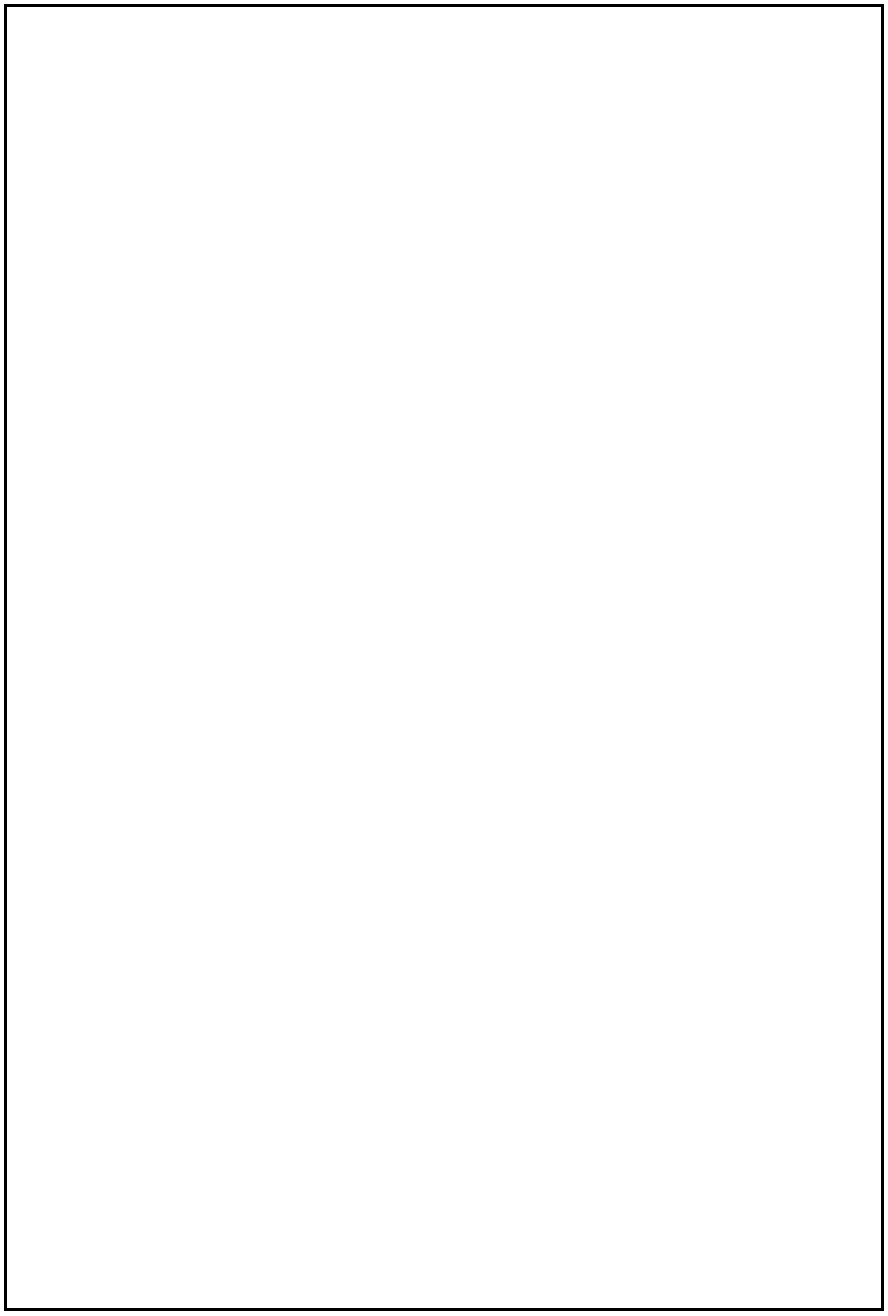


Figure 2-2. VXI-MXI Parts Locator Diagram

Figure 2-3 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*.

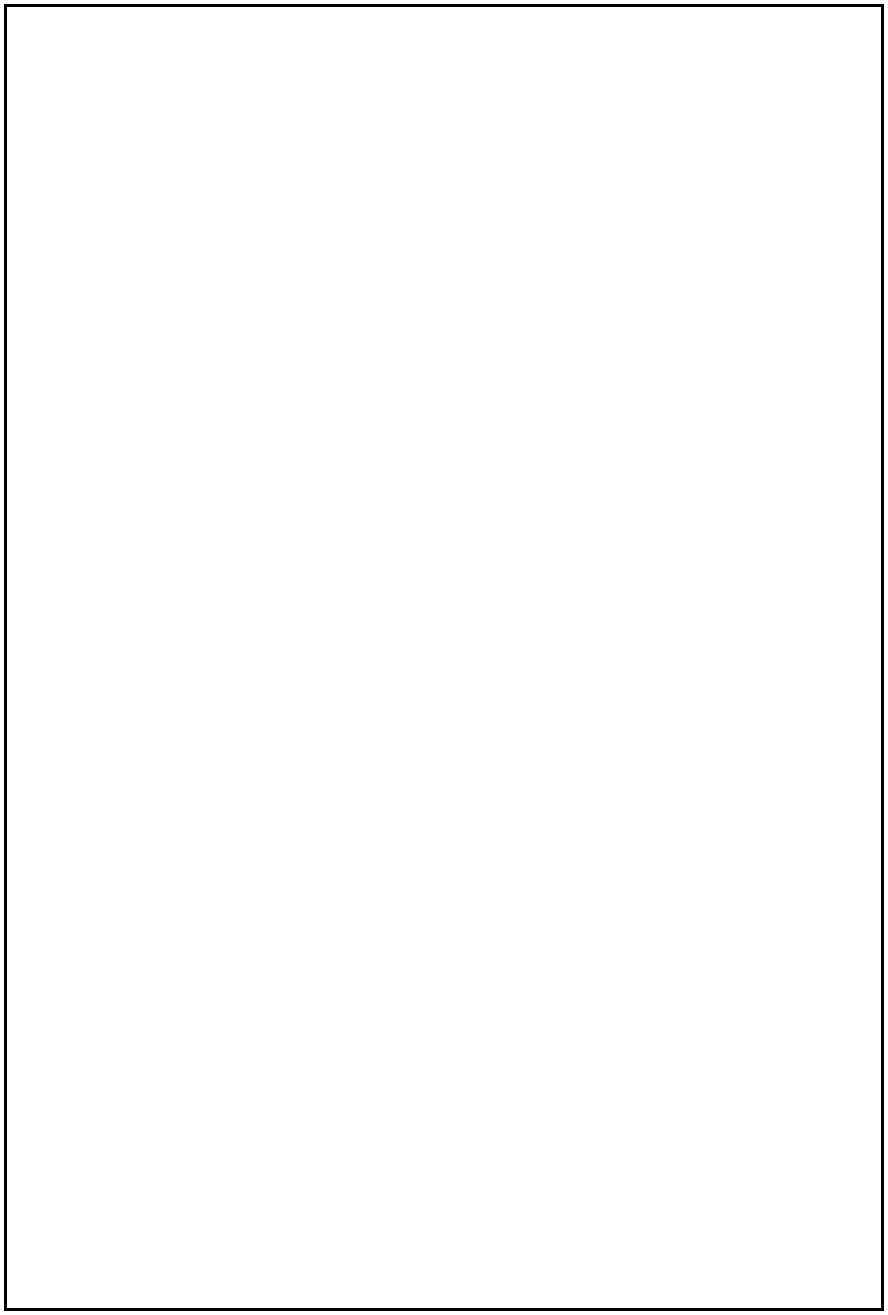


Figure 2-3. VXI-MXI with INTX Parts Locator Diagram

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 2-4 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 2-5.

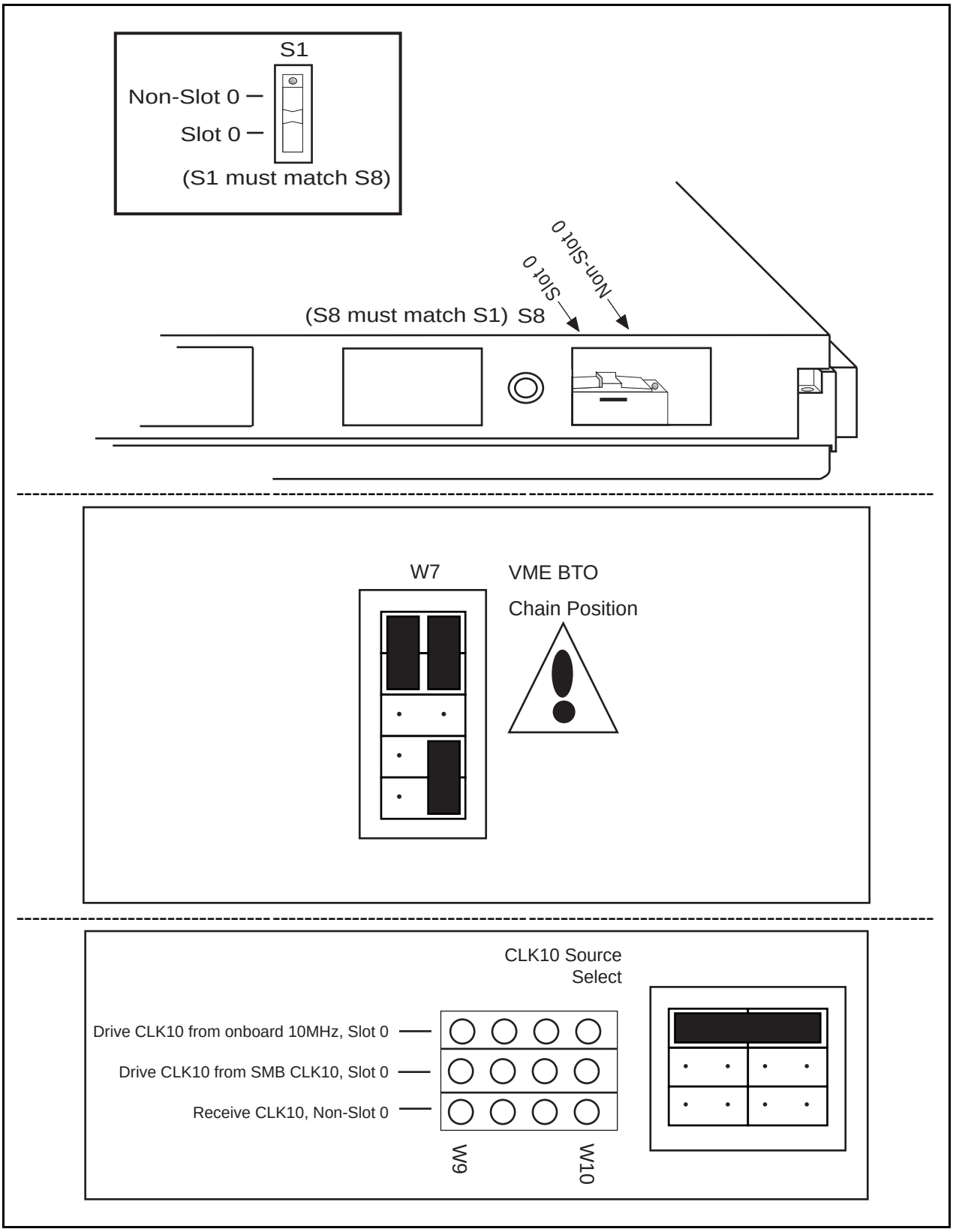


Figure 2-4. VXIbus Slot 0 Configuration

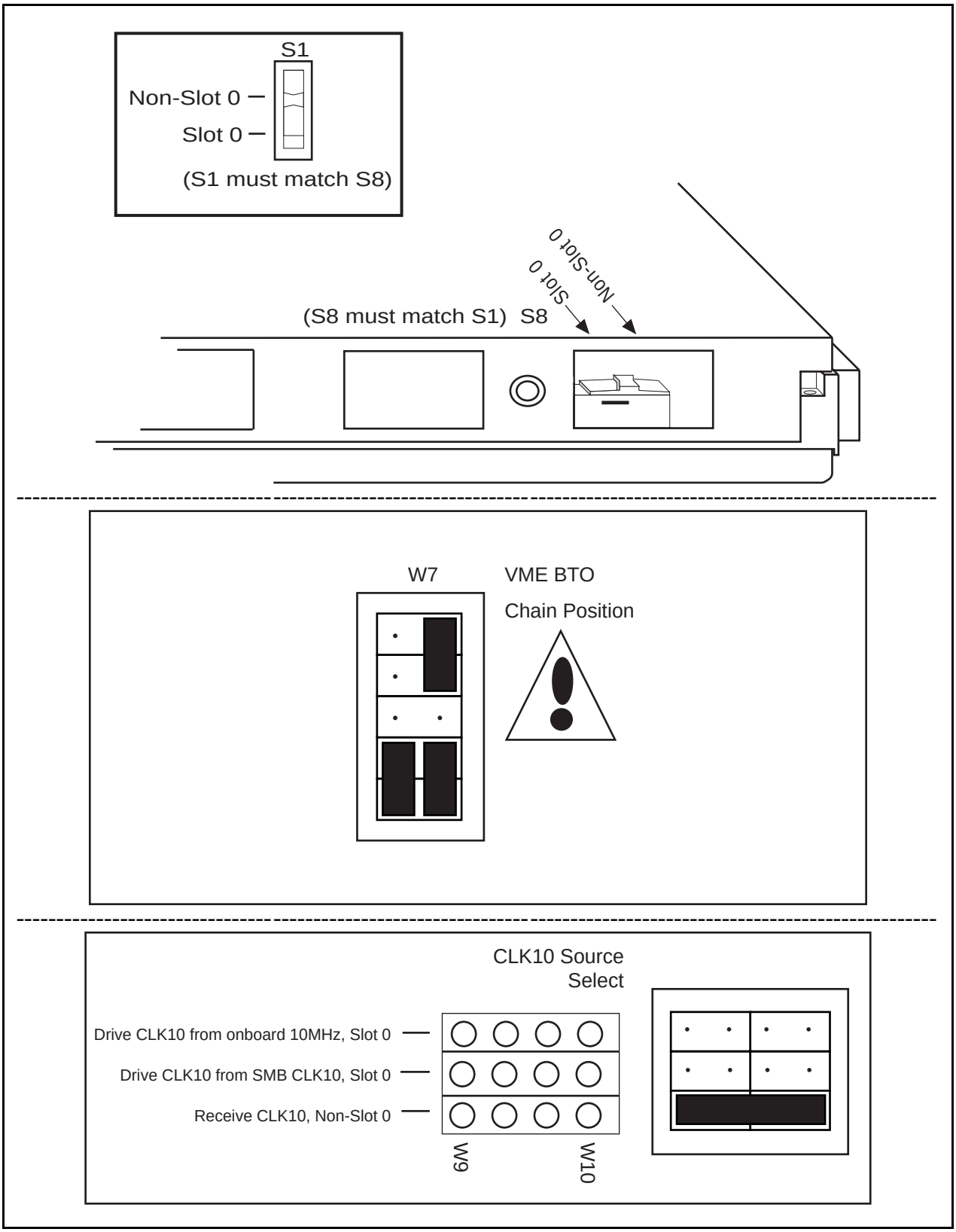


Figure 2-5. VXIbus Non-Slot 0 Configuration

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 SB-MXI is designated as the VXIbus Resource Manager (RM). The RM in a VXI system is defined to have a logical address of 0. The logical address of the SB-MXI is software configurable.

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 2-6 shows switch settings for logical address hex 1 and C0.

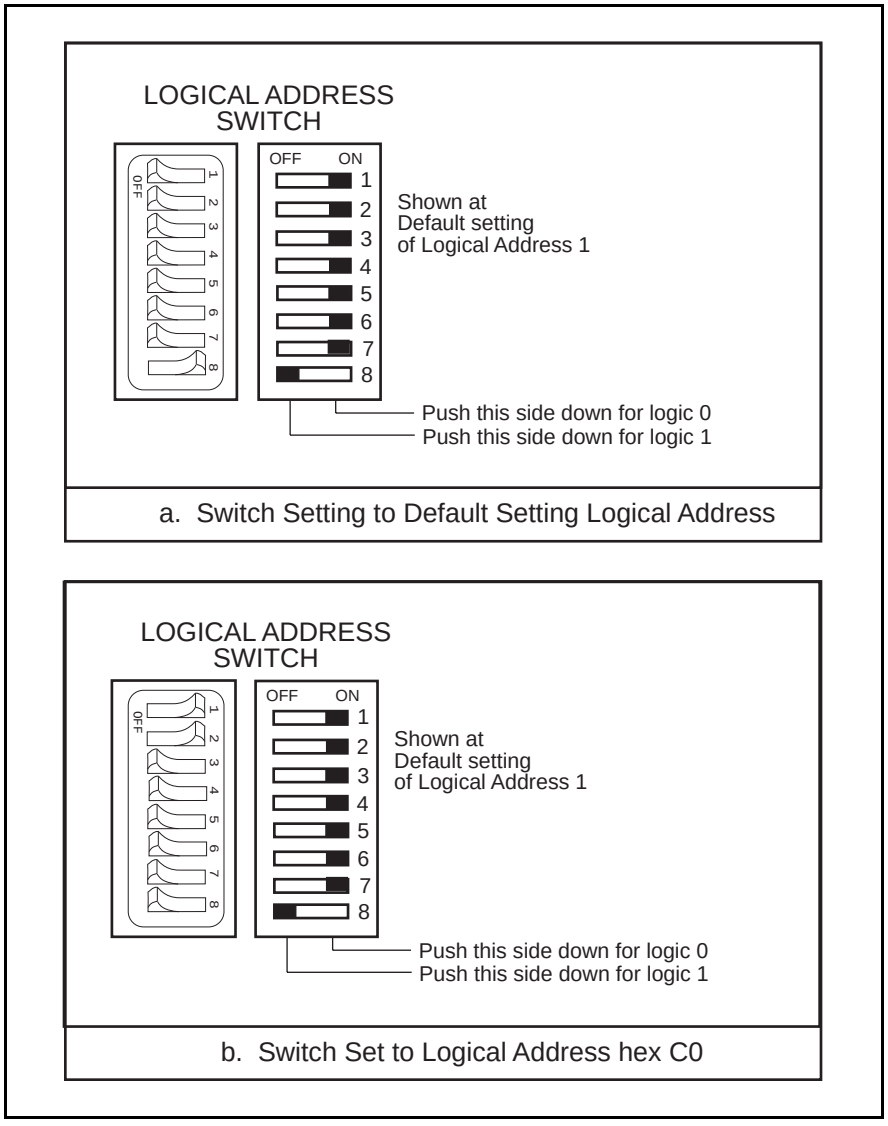


Figure 2-6. Logical Address Selection

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 Sun workstation with an SB-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 2-7.

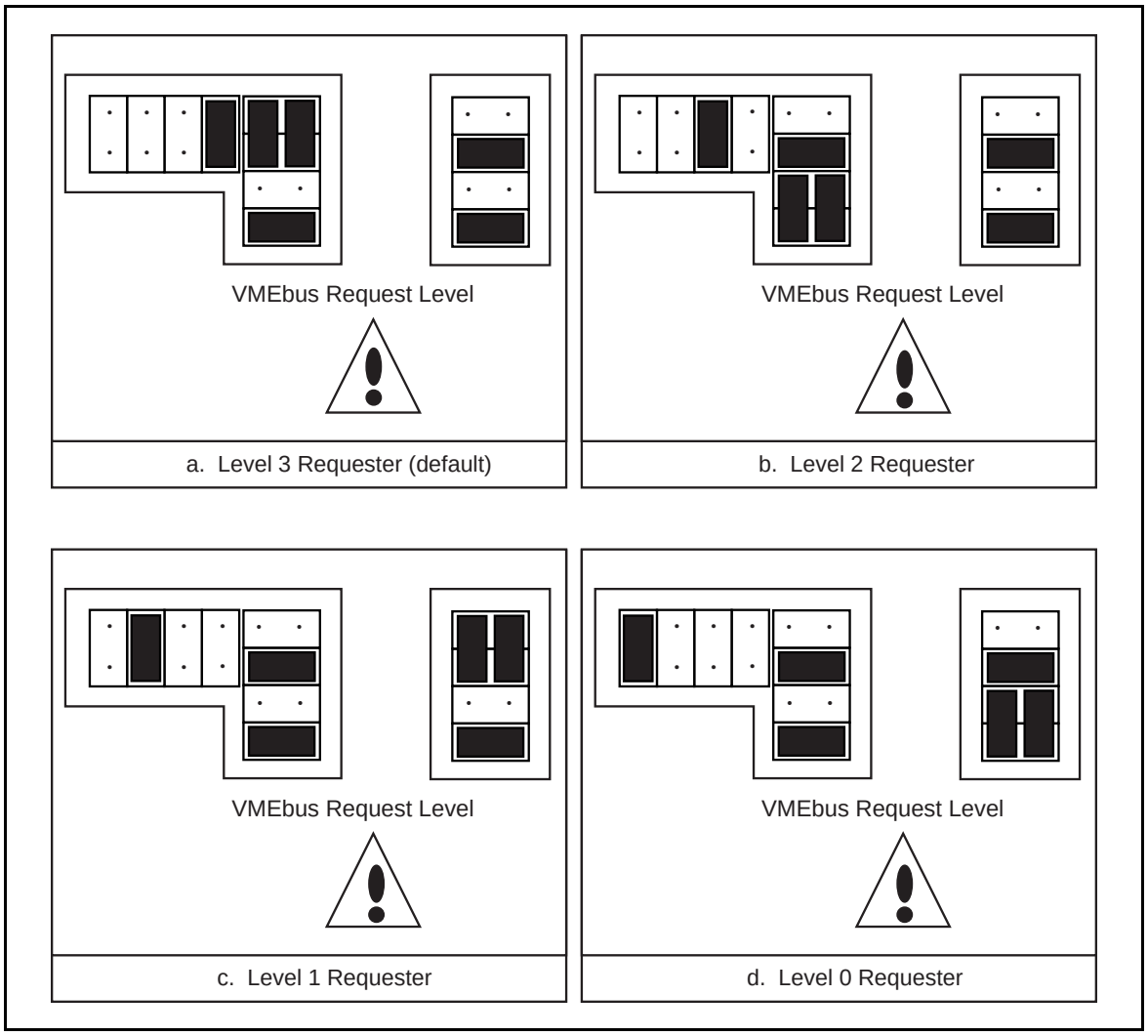


Figure 2-7. VXI-MXI VMEbus Requester Jumper Settings

Step 4. 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 5. 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-SB2020 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 2-8.

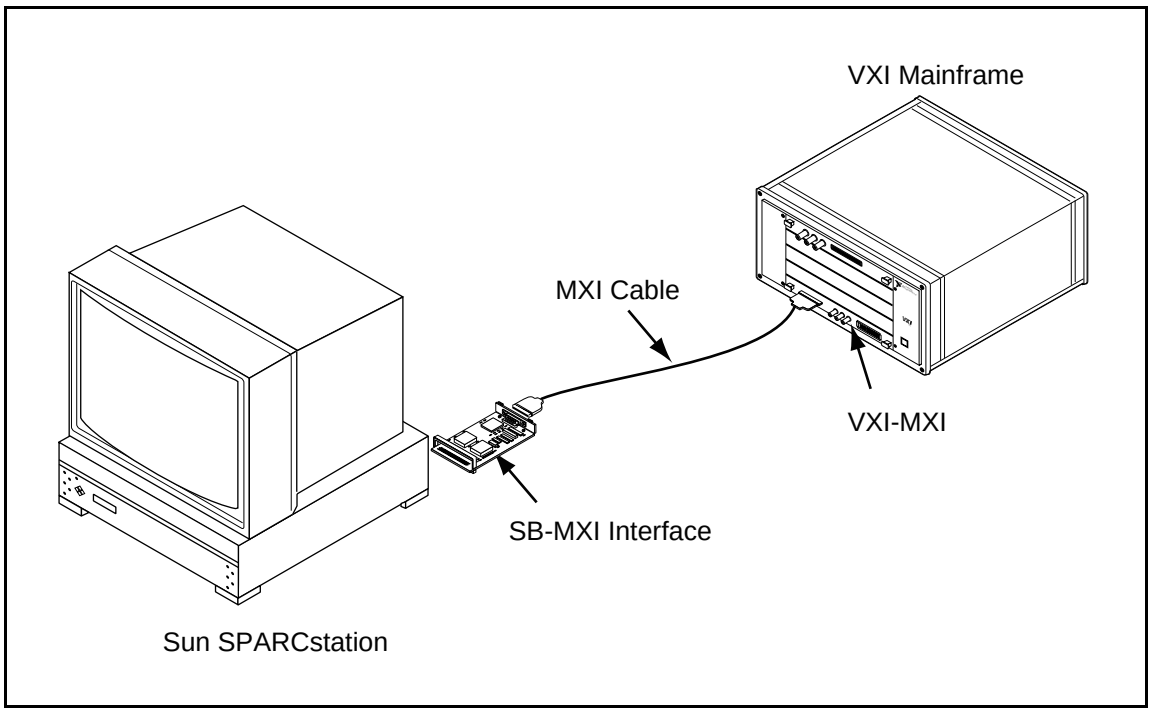


Figure 2-8. MXIbus Single-Ended Cable Configuration

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 SB-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 2-9.

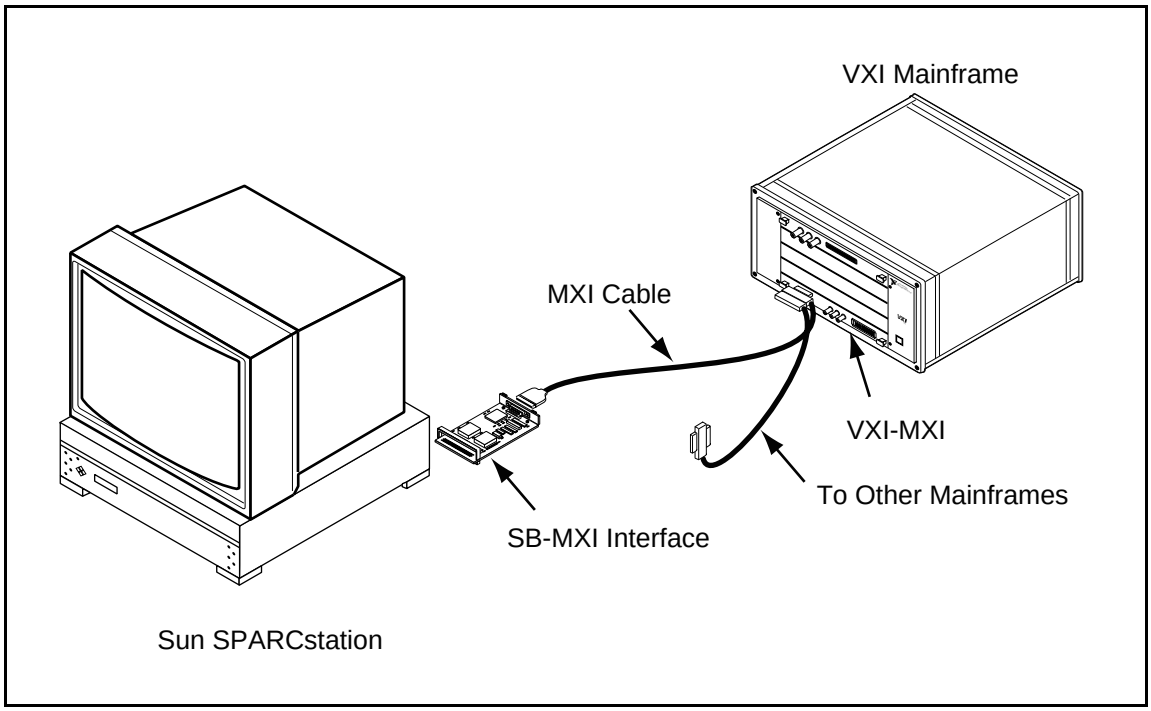


Figure 2-9. MXIbus Dual-Ended Cable Configuration

When you have properly connected the MXIbus cable, power on the VXI mainframe and the Sun workstation. After all devices are powered on and running properly, you can run the the VXI Resource Manager to configure the system.

Chapter 3
NI-VXI Software Installation and Configuration

This chapter lists all the programs and files located on the NI-VXI distribution diskettes and contains instructions for installing and configuring the NI-VXI software. Select the proper distribution disk to install NI-VXI software for either Solaris 1.x or Solaris 2.x. Some parts of this chapter contain material specific to either Solaris 1.x or Solaris 2.x. Be sure you are following the instructions relevant to the Solaris platform on your computer.

NI-VXI Software Overview

The following files make up the NI-VXI software.

Main Programs and Files

The following are the main programs and files of the NI-VXI software. Unless otherwise indicated in the descriptions, the NI-VXI software includes these programs and files for both Solaris 1.x and Solaris 2.x. Other files, as noted, are present for only one of the Solaris platforms.

- `README` contains the latest updates and corrections to the manual when appropriate.
- `vxiinit` is the MXIbus initialization program. This program initializes the SB-MXI board for operation. Run this program before using the NI-VXI software.
- `resman` is the National Instruments multiframe Resource Manager. Run this program after `vxiinit`.
- `nivxi.INSTALL` is the shell script for installing the NI-VXI device driver for Solaris 1.x.
- `victext` is the text-based interactive control program you use to communicate directly with VXI devices.
- `vxitedit` is the text-based VXI Resource Editor program you use to edit system and device information.
- `libnivxi*` contains the NI-VXI interface libraries for the NI-VXI device driver.

Additional Programs and Files

The `/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.
- `vxibus.cfg` contains the bus configuration information.
- `vxila.cfg` contains the logical address configuration information.

The `/include` directory contains include files for the C language interface.

- `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.

The `/hlp` directory contains the various help (`.hlp`) files used by `victext` and `vxitedit`.

The `/example` directory contains example programs showing you how to use the NI-VXI software.

The `/bin` directory contains copies of the executable files, as well as the `nivxi.{add, rem, uld, info}` shell scripts for manipulating the NI-VXI device driver for Solaris 2.x.

The `/lib` directory contains the code for the NI-VXI interface libraries.

The `/drv` directory contains copies of `nivxi.*.o` and `nivxi`, the loadable device drivers for Solaris 1.x and Solaris 2.x, respectively.

Installing and Loading the NI-VXI Software for Solaris 1.x

The instructions in this section are specific to users of the Solaris 1.x platform. If your Solaris platform is Solaris 2.x, skip over this material and continue with the section *Installing and Loading the NI-VXI Software for Solaris 2.x*.

Note: ***Upgrading from a previous version of NI-VXI requires no steps other than those listed in the following installation and loading sections. You do not need to remove any files from your current NI-VXI directory, because the installation steps will overwrite any old files. However, we recommend that you back up any files that you have added or modified.***

Installing the NI-VXI Software for Solaris 1.x

1. Log on as super-user (root privileges needed).
2. Use the `cd` command to change to the directory where you want to install the NI-VXI software.
3. Type the following command:

   ```
   bar xvfZ /dev/rfd0c
   ```

Loading the NI-VXI Driver for Solaris 1.x

The NI-VXI driver for Solaris 1.x is a loadable driver. You do *not* need to go through the process of linking the driver with the kernel's object files, rebuilding the kernel, and restarting the system, as you would have to do with a nonloadable driver.

Note: ***The SB-MXI must be installed in your computer before you can load the NI-VXI driver.***

Run `nivxi.INSTALL` in your working directory and follow the instructions in the shell script. Enter the following command:

```
./nivxi.INSTALL
```

You will receive the following prompt:

```
Should the driver be loaded during each reboot? [y/n] (y):
```

The default is `y` for yes. If you do not want the driver to be automatically loaded during a restart, type `n` and then <Enter>. If you later decide to have the driver load automatically during the boot sequence, or if you have removed the driver from the boot sequence and you now wish to return it, then simply rerun the `nivxi.INSTALL` script.

If the driver is installed correctly, the following message appears:

```
nivxi: module loaded; id=#
```

where # is an identification number that is returned by the operating system.

The following message appears on the console:

```
NI-VXI device driver loaded.
Copyright (c) 1994 National Instruments Corporation
All Rights Reserved.
```

If the driver is already loaded, the following message appears on the console:

```
Can't load this module:  No such device or address.
```

Note: ***If you want to load the driver for this session only, use the following script instead of the*** `INSTALL` ***script:***

```
/dev/nivxi.LOAD
```

Unloading the NI-VXI Driver for Solaris 1.x

To unload the driver, you must meet the following requirements:

- You must have super-user privilege.
- The driver must not be in use.

If the driver is in use and you try to unload it, the following message appears:

```
Cannot unload the module:  Device busy.
```

You can use the `modstat` utility if you want to check the status of the loaded drivers. It displays the module ID of the driver, the name of the device, and additional information about the module. Type the following command to use this utility:

```
/usr/etc/modstat
```

Unload the driver by entering the following command:

```
/dev/nivxi.UNLOAD
```

The following message appears on the console:

```
NI-VXI driver unloaded.
```

To prevent the driver from being reloaded automatically at startup, type the following command to remove the file:

```
rm /dev/nivxi.AUTOLOAD
```

Installing and Loading the NI-VXI Software for Solaris 2.x

The instructions in this section are specific to users of the Solaris 2.x platform. If your Solaris platform is Solaris 1.x, refer instead to the previous section *Installing and Loading the NI-VXI Software for Solaris 1.x*.

Upgrading from NI-VXI Version 1.0 for Solaris 2.x

If you are upgrading from NI-VXI Version 1.0, it is important to perform the following steps before installing the new version.

1. Log on as super-user (root privileges needed).

2. Back up any files from your current NI-VXI directory that you have modified and wish to keep. The following steps will remove any previously installed NI-VXI files.

3. Issue the following command to remove the old package:

   ```
   /usr/sbin/pkgrm NIvxi
   ```

4. Modify any environment variables or program paths to point to the new NI-VXI directory. Starting with NI-VXI Version 2.1, the default NI-VXI directory is `/opt/NICsbmxi`. Therefore, you will need to change any references to `/opt/NIvxi`, or whichever alternative directory you had chosen.

5. Continue with the installation as described in the following sections.

Installing the NI-VXI Software for Solaris 2.x

Log on as super-user (root privileges needed).

Use one of the following three commands as applies to your system:

- If you are *not* running volume management, type the following command:

  `/usr/sbin/pkgadd -d /dev/diskette`.

Caution: ***If you are running volume management, you will need to run*** `volcheck` ***to detect the disk in the floppy drive. Due to the manner in which the data is encoded on the disk,*** `volcheck` ***will warn you that the disk is unformatted. Do not select to format the disk. Simply cancel out of the warning.***

- If you *are* running volume management, and you have Version 2.3 or higher, type the following command:

  `/usr/sbin/pkgadd -d /vol/dev/rdiskette0/unlabeled`

- If you *are* running volume management, and you have Version 2.2 or lower, type the following command:

  `/usr/sbin/pkgadd -d /vol/dev/rfd0/unlabeled`

Note: ***During installation, you might be prompted for the base directory in which to install the NI-VXI software. We recommend you select*** `/opt`. ***This will put the software in*** `/opt/NICsbmxi`.

Special Note for Users of Solaris 2.2 or Lower

The `pkgadd` command might prompt you that it is about to replace the current `devlink.tab` file (and the `/usr/kernel/nivxi` driver if you are upgrading). The `devlink.tab` file is *not* going to be replaced, but merely updated. Choose `y` to allow the installer to continue.

Loading the NI-VXI Driver for Solaris 2.x

The NI-VXI driver for Solaris 2.x was added to the driver list automatically during installation. It is loaded the first time you open the driver (for example, running `vxiinit`). Because it is a loadable driver, you do *not* need to go through the process of linking the driver with the kernel's object files, rebuilding the kernel, and restarting the system, as you would have to do with a nonloadable driver.

Note: ***The SB-MXI must be installed in your computer before you can load the NI-VXI driver.***

If you have chosen to remove the NI-VXI driver from the driver list (as described in the following section), and you later wish to return the driver to the driver list, type the following command:

```
nivxi.add
```

Unloading the NI-VXI Driver for Solaris 2.x

To unload the driver, you must meet the following requirements:

- You must have super-user privilege.
- The driver must not be in use.

If the driver is in use and you try to unload it, the following message appears.

```
Cannot unload the module:  Device busy.
```

You can use the `nivxi.info` utility if you want to check the status of the loaded NI-VXI driver. It displays the module ID of the driver, the name of the device, and additional information about the module. Type the following command to use this utility:

```
nivxi.info
```

If you want to unload the driver, enter the following command:

```
nivxi.uld
```

To completely remove the NI-VXI driver from the driver list, type the following command:

```
nivxi.rem
```

Using the NI-VXI Software

The NI-VXI software expects to be loaded in the `/usr/nivxi` directory if you are using the Solaris 1.x platform. If you are using Solaris 2.x, the driver expects to be loaded in the `/opt/NICsbmxi` directory. If you have installed the software in another directory, you need to set the `NIVXIPATH` environment variable to your directory. For example, if you have installed NI-VXI in `/usr2/nivxi`, type the following command:

```
setenv NIVXIPATH /usr2/nivxi
```

You must always set the `LD_LIBRARY_PATH` environment variable to your directory. For example, if you have installed NI-VXI in `/usr/nivxi`, type the following command:

```
setenv LD_LIBRARY_PATH /usr/nivxi
```

Place these lines in your `.cshrc` (C shell) or `.profile` (Bourne or Korn shells).

Note: ***You must run*** `vxiinit` ***to configure the SB-MXI each time you start up or restart the computer, or if you have changed the configuration with the*** `vxitedit` ***program, as described in the configuration sections of this chapter.***

Using LabVIEW or LabWindows/CVI

For information on developing application programs using LabVIEW, refer to the *LabVIEW VXI VI Reference Manual*. To use LabVIEW to program your system, you must have a LabVIEW for Sun VXI Development System. Refer to the *Optional Software* section in Chapter 1, *Introduction*.

For information on developing application programs using LabWindows/CVI, refer to the *NI-VXI Software Reference Manual for C*. You can use the functions and the syntax as described in this software reference manual. To use LabWindows/CVI to program your system, you must have a LabWindows/CVI for Sun VXI Development System. Refer to the *Optional Software* section in Chapter 1, *Introduction*.

Note: ***You must have the ANSI C version of the*** `libnivxiio.so` ***file in the*** `/nivxi` ***directory to run either LabVIEW or LabWindows/CVI. Do NOT use the K&R C version of the file.***

Configuring the NI-VXI Software

Run the `vxitedit` device configuration utility if you need to make any changes to the default software configuration. You can also run `vxitedit` if you just want to examine the software configurations.

The following sections describe how to modify and/or view the configuration information for the SB-MXI board. To modify or view manufacturer names, model names, or device ID associations, or to obtain more information on non-VXI devices, refer to the *NI-VXI Text Utilities Reference Manual*.

Default Configurations

The NI-VXI software has factory default configurations. These default configurations match the factory default configurations of the hardware interface.

If you do not use `vxitedit` to make changes, the default characteristics of the software will remain in effect.

Using vxitedit

Run the `vxitedit` program. Select the Configuration Editor from the main menu. The three configuration options available under the Configuration Editor are Logical Address Configuration, Bus Configuration, and Device Configuration. The Device Configuration option is not used for the VXI-SB2020 kit.

Logical Address Configuration

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
Logical Address	An 8-bit number that uniquely identifies the SB-MXI. If it is set to 0, it is the VXIbus Resource Manager. Range = 0 to 254	0
Device Type	Indicates the classification of the SB-MXI. 0 = Memory 1 = Extended 2 = Message-Based 3 = Register-Based	2
Address Space	Indicates the addressing mode(s) of the SB-MXI's operational registers. 0 = A16/A24 1 = A16/A32 2 = Reserved 3 = A16 only	3
Resource Manager Delay	Time in seconds to wait before accessing any other VXIbus device's A16 configuration registers. Range = 0 s to 65535 s	5

(continues)

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

Characteristic	Description	Default Value
Servant Area Size	Servant area size is supplied when the SB-MXI receives the *Read Servant Area* command from the Resource Manager. The Servant area size is an 8-bit value (0 through 255) that indicates the SB-MXI Servant area. The Servant area begins at the logical address following the SB-MXI's logical address, and includes *N* contiguous logical addresses, where *N* is the value of the Servant area size. Range = 0 to 255	0
Protocol Register	Copy of the Protocol register, indicating which protocols the device supports. (Refer to the *VXIbus System Specification*.)	0x0ff0
Response for Servant-Side Word Serial *Read Protocol* query	The protocols that are supported, which are supplied when the SB-MXI receives the *Read Protocol* query from the Resource Manager. (Refer to the *VXIbus System Specification*.)	0x8448
Number of Handlers	The number of interrupt handlers that the application requires the SB-MXI to support. Range = 0 to 7	1
Number of Interrupters	The number of interrupters that the application requires the SB-MXI to support. Range = 0 to 7	0

Bus Configuration

Table 3-2 describes the characteristics of the MXIbus System Controller option 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 SB-MXI is always designated as the MXIbus System Controller when used in this kit and should *not* be changed. 0 = Not MXIbus System Controller 1 = MXIbus System Controller	1

Exiting vxitedit and Reinitializing the Hardware

To exit `vxitedit`, type `exit` when the main menu is displayed. If you have changed any information, the program prompts you to save your changes before exiting the menu. Saving the configuration information updates the configuration files `vxila.cfg` and `vxibus.cfg`. Run `vxiinit` to reinitialize the hardware according to the new settings.

If you changed any of the software configuration settings from the default settings, record the new settings on the *VXI-SB2020 Hardware and Software Configuration Form* in Appendix C.

Developing Your Application Program

After you have verified that the driver software has been installed successfully, you can proceed with development of your VXI application software.

Use the VXI Text Interactive Control (`victext`) program to communicate with VXI devices through commands you enter at the keyboard. This feature helps you learn how to communicate with devices, troubleshoot problems, and develop your application.

The `victext` command set includes the same capability of NI-VXI function calls in addition to auxiliary commands that are unique to `victext`. You can use this utility to send data and Word Serial commands to devices from the keyboard and to display data received from devices on the screen. After each function executes, `victext` displays the device's response and the status.

The `victext` utility is designed to help you learn how to use the NI-VXI functions to program devices. Once you develop a sequence of steps that works successfully for your system, you can easily incorporate the sequence into an application program using the appropriate language and syntax. Refer to the *NI-VXI Text Utilities Reference Manual* on how to use `victext` and to learn about its features.

When programming in C with NI-VXI, it is important to remember that you must call `InitVXIlibrary()` before calling any other NI-VXI function. Also, at the end of your session, you must call `CloseVXIlibray()` the same number of times that you had called `InitVXIlibrary()` (or until it returns 0). Refer to the `/example` directory for further development information.

Appendix A
Specifications

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

SB-MXI

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

Capability Codes

MXIbus

Capability Code	Description
MA32	Master Mode A32, A24, and A16 addressing
MBLT	Master Mode block transfers
MD32	Master Mode D32, D16, and D08 data sizes
SC	Optional MXIbus System Controller
LOCK	Can lock the MXIbus for indivisible transfers
TERM	Can terminate the MXIbus

SBus

Capability Code	Description
NBSD32	Slave D32, D16, and D08 data sizes
INT	Can interrupt the SBus

Electrical

Source	Typical	Direct Current (max)
+5 VDC	2.5 A	3.5 A

Environmental

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

Physical

Characteristic	Specification
Board Dimensions	Standard single-wide SBus board 146.7 mm by 83.82 mm (5.78 in. by 3.3 in.)
Connectors	Single fully implemented MXIbus connector
Slot Requirements	Single SBus slot
MTBF	Contact Factory

Requirements

Memory space required 32 MB

Timing

Master Mode

Transfer Type	Transfer Rate
Write	730 ns
Read	730 ns
Block Write	490 ns
Block Read	330 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

Requirements

Characteristic	Specification
A16 Space	64 B

Environmental

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

Physical

Characteristic	Specification
Board Dimensions	Fully enclosed, shielded VXI C-size board 233.35 mm by 340 mm (9.187 in. by 13.386 in.)
Connectors	Single fully implemented MXIbus connector Single INTX connector (on boards equipped with optional INTX daughter card)
Slot Requirements	Single VXI C-size slot
Compatibility	Fully compatible with VXI specification
VXI Keying Class	Class 1 TTL
MTBF	Contact Factory

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

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

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

Appendix B
Troubleshooting

This appendix addresses certain problems you may encounter when using the NI-VXI bus interface software for Solaris. If you are unable to resolve your problem, please fill out the appropriate forms in Appendix C, *Customer Communication*, and contact National Instruments.

Problems when Using vxiinit

vxiinit Cannot Find .cfg 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`, `mfnameid.tbl`, and `model.tbl`. There are three possible causes for this error message.

- Ensure that you are using the proper `vxiinit` program for your system. You cannot use the `vxiinit` program distributed with another National Instruments controller to initialize the SB-MXI.
- The file(s) may have been deleted accidentally. If the file does not exist in your `tbl` directory—`nivxi/tbl` for Solaris 1.x or `NICsbmxi/tbl` for Solaris 2.x— you will need to reinstall your software. Please refer to the appropriate installation section in Chapter 3.
- The `NIVXIPATH` environment variable may be pointing to the wrong directory. The path should be set in the `.cshrc` or `.profile` files, depending on the shell type you are using (Refer to the *Using the NI-VXI Software* section of Chapter 3). Set the correct path for the `NIVXIPATH` variable, for example, `/usr/nivxi` for Solaris 1.x, or `/opt/NICsbmxi` for Solaris 2.x.

vxiinit Cannot Find Device Driver

If you receive the message **`VXI device driver not found`**, `vxiinit` has been unable to communicate with the driver. This can be due to the driver either not being in memory or it has become corrupted.

First, verify that the driver is in memory. To do this, use the appropriate command associated with your Solaris platform:

- For Solaris 1.x, type `/usr/etc/modstat`.
- For Solaris 2.x, type `nivxi.info`.

If the driver is *not* in memory and you are using Solaris 1.x, use the command `nivxi.LOAD` to load the driver. If you are using Solaris 2.x, or if `nivxi.LOAD` did not load the driver, there is a problem with the system configuration. Check your installation and check with your system administrator.

If the driver *is* loaded in memory, the version may have become corrupted. Proceed by unloading and then reloading the driver as described in Chapter 3.

vxiinit Cannot Find libnivxi.so

When using `vxiinit`, you may receive the following error message:

```
ld.so.l: vxiinit: fatal: libnivxi.so: can't open file: errno = 2
```

This message is caused by the driver being unable to find the shared object file, `libnivxi.so`. Check to make sure the environment variable `LD_LIBRARY_PATH` is pointing to the directory containing the NI-VXI software. Refer to the *Using the NI-VXI Software* section of Chapter 3 for more information.

Note: ***This error message can also occur when using*** `resman` ***or*** `victext`.

Problems when Using resman

If you receive errors or warnings from `resman`, the problem could be in a number of areas. You may have resource conflicts between the SB-MXI and the VXI mainframes in your system. First make sure that you have used the non-VXI Device Editor in `vxitedit` to inform `resman` of the memory requirements of all the non-VXI devices in your system.

If you have a VME chassis in your system, you may receive a warning that `resman` cannot find a Slot 0 device, or that devices are not responding to MODID lines. You can ignore these warnings, as they apply only to VXI systems.

If you are using a multichassis system, and `resman` fails during system configuration, please consult Chapter 5, *Programming Considerations*, and Appendix E, *Configuring a Two-Frame System*, in the *VXI-MXI User Manual* for more information. These sections of the user manual describe certain rules that apply to assigning logical addresses and using shared memory.

Another cause of errors can be system conflicts with the SB-MXI configuration. If you have verified that you do not have a conflict with any of the SB-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 SB-MXI board at Logical Address 0 but does not detect the VXI mainframe.
- `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 SB-MXI is the MXIbus System Controller (set by the Bus Configuration Editor) and the VXI-MXI is *not* the MXIbus System Controller (set by an onboard slide switch). If you are having problems, check that the SB-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.

Corporate Headquarters
(512) 795-8248
Technical support fax: (800) 328-2203
(512) 794-5678

Branch Offices	Phone Number	Fax Number
Australia	(03) 879 9422	(03) 879 9179
Austria	(0662) 435986	(0662) 437010-19
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
Mexico	95 800 010 0793	95 800 010 0793
Netherlands	03480-33466	03480-30673
Norway	32-848400	32-848600
Singapore	2265886	2265887
Spain	(91) 640 0085	(91) 640 0533
Sweden	08-730 49 70	08-730 43 70
Switzerland	056/20 51 51	056/20 51 55
Taiwan	02 377 1200	02 737 4644
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-SB2020 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 Label: *NI-VXI Distribution Disk for the SB-MXI and Solaris*, for 1.x or 2.x)
- SB-MXI Logical Address _____
- SB-MXI Device Type _____
- SB-MXI Address Space _____
- SB-MXI Resource Manager Delay _____
- SB-MXI Servant Area Size _____
- SB-MXI Protocol Register _____
- SB-MXI Response for Servant-Side Word Serial Read Protocol Query _____
- Number of SB-MXI Handlers _____
- Number of SB-MXI Interrupters _____
- SB-MXI is MXIbus System Controller? _____
- VXI-MXI Installed in Slot 0? _____
- VXI-MXI Logical Address _____
- VXI-MXI VMEbus Request Level _____
- SB-MXI Hardware Revision _____
- VXI-MXI Hardware Revision _____

Other Products

- Computer Make and Model _____
- Microprocessor _____
- Clock Frequency (Bus and Microprocessor) _____
- Type of Video Board Installed _____
- Amount of RAM _____
- Hard Disk Capacity and Brand _____
- Solaris Platform and Version _____
- Programming Language Version _____
- Other Boards in System _____
- 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-SB2020 and the NI-VXI™ Software for Solaris**

Edition Date: **February 1995**

Part Number: **320329-01**

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 _____

Address _____

_____

Phone (_____) _____

Mail to: Technical Publications
National Instruments Corporation
6504 Bridge Point Parkway, MS 53-02
Austin, TX 78730-5039

Fax to: Technical Publications
National Instruments Corporation
MS 53-02
(512) 794-5678

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.

ANSI — American National Standards Institute

B

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.

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.

configuration registers	A set of registers through which the system can identify a module device type, model, manufacturer, address space, and memory requirements. In order to support automatic system and memory configuration, the VXIbus specification requires that all VXIbus devices have a set of such registers.

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

IACK	Interrupt Acknowledge
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

K

KB	1,024; kilobytes of memory

L

LabVIEW	Laboratory Virtual Instrument Engineering Workbench
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

m	meters
MB	1,048,576; megabytes of memory
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.
`modstat`	A utility that checks the status of the loaded drivers. It displays the module ID of the driver, the name of the device, and additional information about the module.
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

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.
shell	An interactive program for commands.
shell script	The commands used to perform batch processing.
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

VDC	volts direct current
`victext`	Text-based 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.
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. This program must be run at least once after rebooting your machine to initialize the system.
`vxitedit`	Text-based 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.

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.

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP