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DAQ

VXI-DIO-128
User Manual

Digital I/O Module for VXIbus

July 1996 Edition
Part Number 321247A-01

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About This Manual

This manual describes the mechanical and electrical aspects of the VXI-DIO-128 and contains information concerning its configuration, installation, and operation. The VXI-DIO-128 is designed to drive relays, read switch closures, and provide general purpose digital I/O. This module is designed for control applications in laboratory testing, production testing, and industrial process monitoring and control.

Organization of This Manual

The *VXI-DIO-128 User Manual* is organized as follows:

- Chapter 1, *Introduction*, describes the VXI-DIO-128, lists what you need to get started, describes software programming choices, optional equipment, and custom cables, and explains how to unpack the VXI-DIO-128.
- Chapter 2, *Configuration and Installation*, describes how to configure and install your VXI-DIO-128 module.
- Chapter 3, *Signal Connections*, provides connection instructions for the signals on the VXI-DIO-128 I/O connector.
- Chapter 4, *Theory of Operation*, contains a functional overview of the VXI-DIO-128 and explains the operation of each functional unit making up the module.
- Appendix A, *Specifications*, lists the VXI-DIO-128 specifications.
- Appendix B, *Common Questions*, contains commonly asked questions and their answers relating to usage and special features of your VXI-DIO-128 module.
- Appendix C, *Customer Communication*, contains forms you can use to request help from National Instruments or to comment on our products.
- The *Glossary* contains an alphabetical list and description of terms used in this manual, including abbreviations, acronyms, metric prefixes, mnemonics, symbols, and terms.

- The *Index* alphabetically lists the topics in this manual, including the page where you can find each one.

Conventions Used in This Manual

The following conventions are used in this manual:

< >	Angle brackets containing numbers separated by an ellipses represent a range of values associated with a bit or signal name. (For example, Port0_Line<7..0>.)
bold	Bold text denotes the names of menus, menu items, or dialog box buttons or options.
bold italic	Bold italic text denotes a note, caution, or warning.
italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
NI-DAQ	NI-DAQ is used throughout this manual to refer to the NI-DAQ software device driver.
PPI	PPI refers to one of the eight programmable peripheral interface chips on the VXI-DIO-128.

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

National Instruments Documentation

The *VXI-DIO-128 User Manual* is one piece of the documentation set for your VXI-data acquisition (VXI-DAQ) system. You could have any of several types of manuals, depending on the hardware and software in your system. Use the different types of manuals you have as follows:

- Your VXI-DAQ hardware user manuals—These manuals have detailed information about the VXI-DAQ hardware that plugs into or is connected to your computer. Use these manuals for hardware installation and configuration instructions, specification information about your VXI-DAQ hardware, and application hints.
- Software documentation—You may have both application software and driver software documentation. National Instruments application software includes ComponentWorks, LabVIEW, LabWindows®/CVI, Measure, and VirtualBench. National Instruments driver software includes NI-DAQ and VXI*plug&play* instrument drivers. After you set up your hardware system, use either your application or driver software documentation to help you write your application. If you have a large, complicated system, it is worthwhile to look through the software documentation before you configure your hardware.
- Accessory installation guides or manuals—If you are using accessory products, read the terminal block and cable assembly installation guides or accessory board user manuals. They explain how to physically connect the relevant pieces of the system. Consult these guides when you are making your connections.

Customer Communication

National Instruments wants to receive your comments on our products and manuals. We are interested in the applications you develop with 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-DIO-128, lists what you need to get started, describes software programming choices, optional equipment, and custom cables, and explains how to unpack the VXI-DIO-128.

About the VXI-DIO-128

Thank you for purchasing the National Instruments VXI-DIO-128. The VXI-DIO-128 is a 128-channel parallel digital I/O module for the VXIbus. The module uses eight 16-bit programmable peripheral interfaces (PPIs) that can be further divided into 16 8-bit ports. Four 82C55A PPI chips control 64 open-drain output channels. Four 82C55A PPI chips control 64 input channels with programmable threshold.

You can use the VXI-DIO-128 in a wide range of digital I/O applications. With the VXI-DIO-128, a VXIbus system can be interfaced to any of the following:

- Electromechanical relays
- LEDs
- Centronics-compatible printers and plotters
- Panel meters
- Instruments and test equipment with BCD readouts and/or controls
- Optically isolated, solid-state relays and I/O module mounting racks

With the VXI-DIO-128, your VXIbus system can serve as a digital I/O system controller for laboratory testing, production testing, and industrial process monitoring and control.

Detailed specifications for the VXI-DIO-128 are in Appendix A, *Specifications*.

What You Need to Get Started

To set up and use your VXI-DIO-128, you will need the following:

- ❑ VXI-DIO-128 module
- ❑ *VXI-DIO-128 User Manual*
- ❑ One of the following software packages and documentation:
  - ComponentWorks
  - LabVIEW for Windows
  - LabWindows/CVI for Windows
  - Measure
  - NI-DAQ for PC compatibles
  - VirtualBench
  - VXI*plug&play* instrument driver
- ❑ Your VXIbus system

Software Programming Choices

There are several options to choose from when programming your National Instruments VXI-DAQ hardware. You can use LabVIEW, LabWindows/CVI, Measure, ComponentWorks, VirtualBench, or other application development environments with either NI-DAQ or the VXI*plug&play* instrument driver. Both NI-DAQ and the VXI*plug&play* instrument driver access the VXI-DAQ hardware through the VISA driver software.

National Instruments Application Software

ComponentWorks contains tools for data acquisition and instrument control built on NI-DAQ driver software. ComponentWorks provides a higher-level programming interface for building virtual instruments through standard OLE controls and DLLs. With ComponentWorks, you can use all of the configuration tools, resource management utilities, and interactive control utilities included with NI-DAQ.

LabVIEW features interactive graphics, a state-of-the-art user interface, and a powerful graphical programming language. The LabVIEW Data Acquisition VI Library, a series of VIs for using LabVIEW with National Instruments DAQ hardware, is included with LabVIEW. The LabVIEW Data Acquisition VI Library is functionally equivalent to the NI-DAQ software.

LabWindows/CVI features interactive graphics, a state-of-the-art user interface, and uses the ANSI standard C programming language. The LabWindows/CVI Data Acquisition Library, a series of functions for using LabWindows/CVI with National Instruments DAQ hardware, is included with the NI-DAQ software kit. The LabWindows/CVI Data Acquisition Library is functionally equivalent to the NI-DAQ software.

VirtualBench features VIs that combine DAQ products, software, and your computer to create a standalone instrument with the added benefit of the processing, display, and storage capabilities of your computer. VirtualBench instruments load and save waveform data to disk in the same forms that can be used in popular spreadsheet programs and word processors. ComponentWorks features report generation and printing capabilities.

Using ComponentWorks, LabVIEW, LabWindows/CVI, or VirtualBench software will greatly reduce the development time for your data acquisition and control application.

NI-DAQ Driver Software

The NI-DAQ driver software is included at no charge with all National Instruments DAQ hardware. NI-DAQ is not packaged with accessory products. NI-DAQ has an extensive library of functions that you can call from your application programming environment. These functions include routines for analog input (A/D conversion), buffered data acquisition (high-speed A/D conversion), analog output (D/A conversion), waveform generation, digital I/O, counter/timer operations, SCXI, RTSI, self-calibration, messaging, and acquiring data to extended memory.

NI-DAQ has both high-level DAQ I/O functions for maximum ease of use and low-level DAQ I/O functions for maximum flexibility and performance. Examples of high-level functions are streaming data to disk or acquiring a certain number of data points. An example of a low-level function is writing directly to registers on the DAQ device. NI-DAQ does not sacrifice the performance of National Instruments

DAQ devices because it lets multiple devices operate at their peak performance.

NI-DAQ maintains a consistent software interface among its different versions so that you can change platforms with minimal modifications to your code.

VXI*plug&play* Instrument Driver

National Instruments distributes VXI*plug&play* instrument drivers free of charge. VXI*plug&play* instrument drivers are one level above the NI-DAQ device driver and contain high-level software functions whose architecture is specified by the VXI*plug&play* Systems Alliance. The VXI*plug&play* standards increase interoperability with other vendors, and ensure that drivers are designed and presented in a consistent fashion that facilitates ease of use. Refer to Figure 1-1 to see the relationship between your software components.

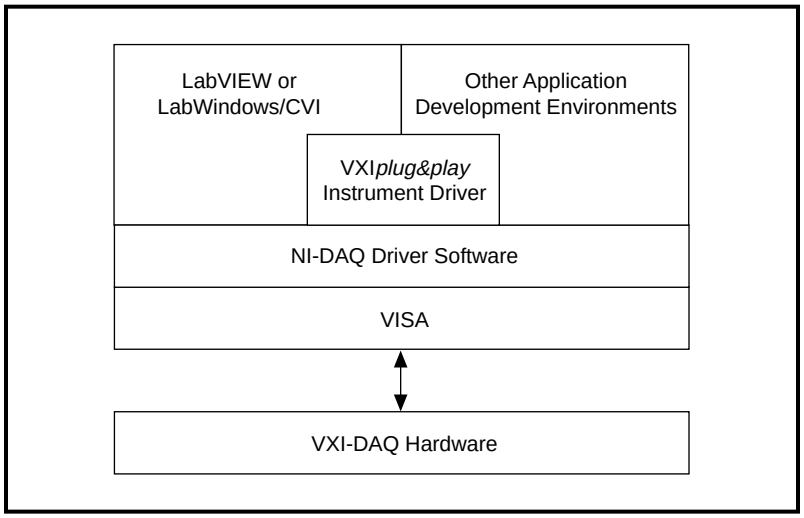


Figure 1-1. The Relationship between the Programming Environment, Your Instrument Driver, and Your Hardware

Optional Equipment

National Instruments offers a variety of products to use with your VXI-DIO-128 module, including cables, connector blocks, and other accessories, as follows:

- Cables and cable assemblies, shielded and ribbon
- Connector blocks, shielded and unshielded screw terminals

For more specific information about these products, refer to your National Instruments catalogue or call the office nearest you.

Custom Cabling

National Instruments offers cables and accessories for you to prototype your application or to use if you frequently change module interconnections.

You can interface the VXI-DIO-128 to a wide range of test instruments, I/O racks and modules, screw terminal panels, and almost any device with a parallel interface. The VXI-DIO-128 digital I/O connector is a standard, 96-pin DIN header connector. Adapters for this header connector expand the interface to four 50-pin ribbon cables. The pin assignments of the expansion cables are compatible with standard 24-channel I/O module mounting racks (such as those manufactured by Opto 22 and Gordos).

Refer to your National Instruments catalogue for specific information.

Unpacking

Your VXI-DIO-128 module is shipped in an antistatic package to prevent electrostatic damage to the module. Electrostatic discharge can damage several components on the module. To avoid such damage in handling the module, take the following precautions:

- Ground yourself via a grounding strap or by holding a grounded object.
- Touch the antistatic package to a metal part of your VXIbus chassis before removing the module from the package.
- Remove the module from the package and inspect the module for loose components or any other sign of damage. Notify National Instruments if the module appears damaged in any way. *Do not* install a damaged module into your VXIbus backplane.
- *Never* touch the exposed pins of connectors.

Configuration and Installation

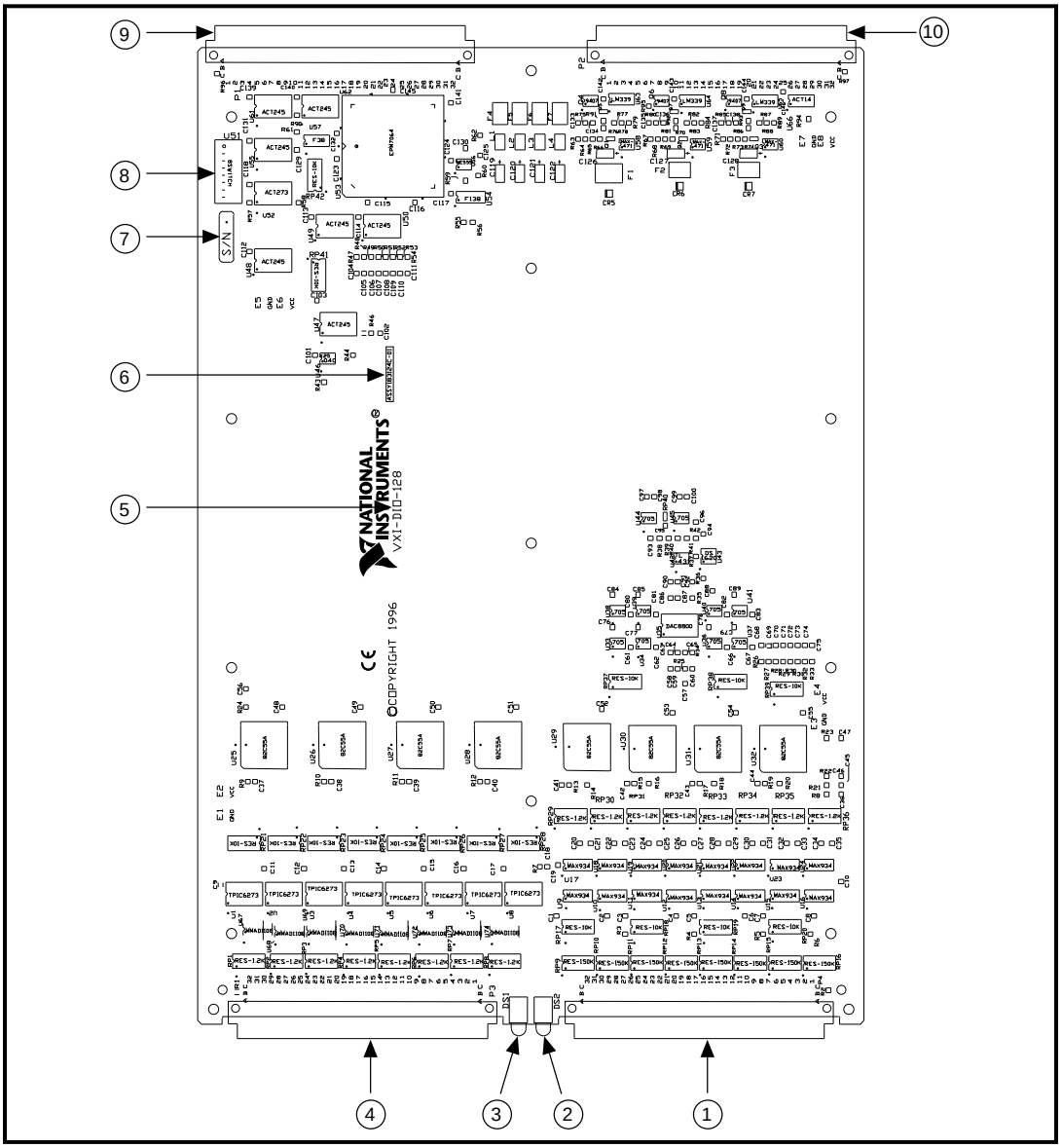
Chapter 2

This chapter describes how to configure and install your VXI-DIO-128 module.

Module Configuration

This section describes how to configure the VXIbus logical address on your VXI-DIO-128.

Figure 2-1 shows the VXI-DIO-128 as it appears with the component side facing you. The drawing shows the location of various module components, including the logical address switch.



1	Input Connector	4	Output Connector	7	Serial Number	9	P1 Connector
2	Status LED	5	Product Name	8	Logical Address Switch	10	P2 Connector
3	Access LED	6	Assembly Number				

Figure 2-1. VXI-DIO-128 Parts Locator Diagram

VXIbus Logical Address

Each module in a VXIbus system is assigned a unique number between 0 and 254. This 8-bit number, called the logical address, defines the base address for the VXIbus configuration registers located on the module. With unique logical addresses, each VXIbus module in the system is assigned 64 bytes of configuration space in the upper 16 KB of the A16 address space.

Logical address 0 is reserved for the Resource Manager in the VXIbus system. Because the VXI-DIO-128 cannot act as a Resource Manager, do not configure the VXI-DIO-128 with a logical address of 0. The factory-default logical address for the VXI-DIO-128 is 4.

Some VXIbus modules have dynamically configurable logical addresses. These modules have an initial logical address of hex FF or decimal 255, which indicates that they can be dynamically configured.

The VXI-DIO-128 supports dynamic configuration of its logical address. However, adding or removing modules can cause a different logical address to be assigned to the VXI-DIO-128. Tracking these changes in your application software can be troublesome.

In many cases, static configuration of the logical address is easier. Ensure that no other statically configurable VXIbus modules have a logical address of 4. If they do, change the logical address setting of either the VXI-DIO-128 or the other module so that every module in the system has a different logical address.

Change the VXI-DIO-128 logical address by modifying the setting of the 8-bit DIP switch labeled *Logical Address Switch* (see Figure 2-1 for the switch location). The *down* position of the DIP switch corresponds to a logic value of 0 and the *up* position corresponds to a logic value of 1. Verify that the VXI-DIO-128 does not have the same logical address as any other statically configured VXIbus module in your system.

☞ **Note:** ***Logical address 0 is NOT allowed for the VXI-DIO-128.***

Figure 2-2 shows switch settings for logical addresses hex 4 and C0.

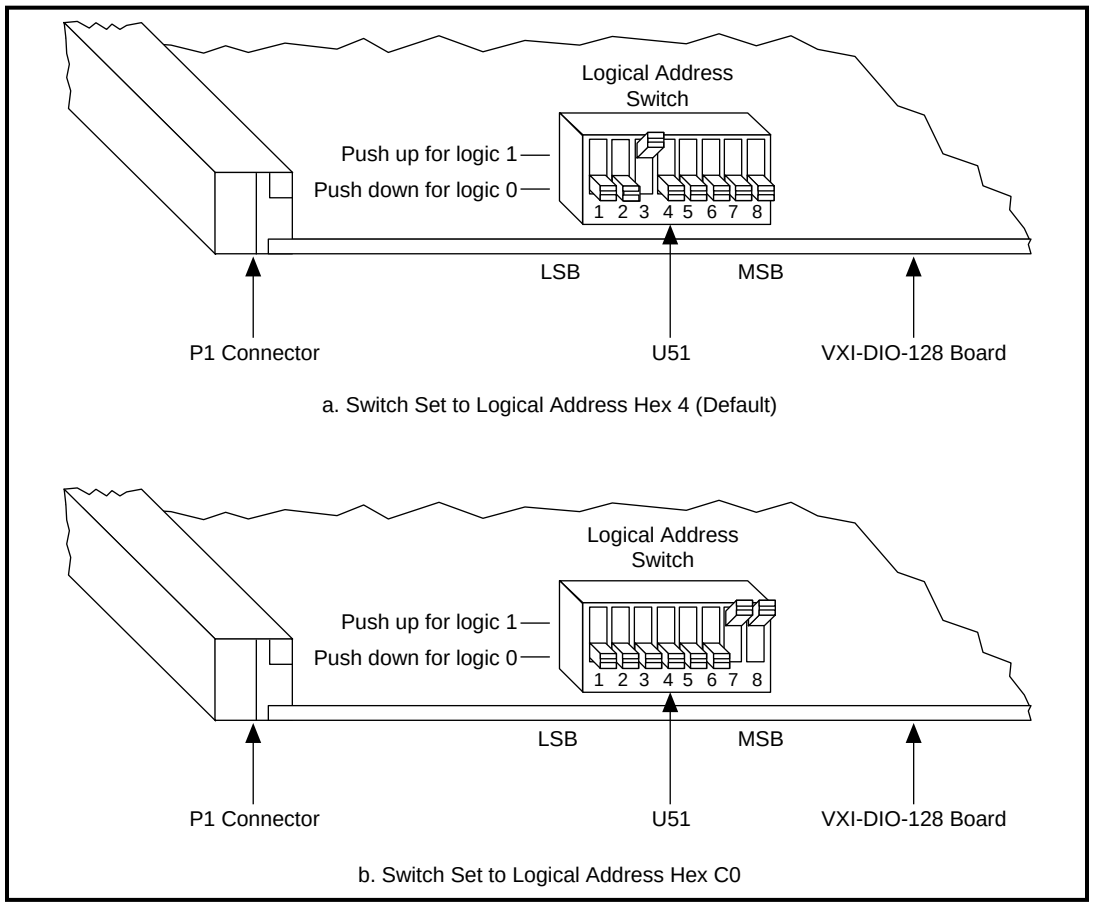


Figure 2-2. Logical Address Selection

Hardware Installation

This section contains general installation instructions for the VXI-DIO-128. Consult your VXIbus mainframe user manual or technical reference manual for specific instructions and warnings.

1. Plug in your mainframe before installing the VXI-DIO-128. The power cord grounds the mainframe and protects it from electrical damage while you are installing the module. *Do not* turn on the mainframe.

Warning: ***To protect both yourself and the mainframe from electrical hazards, DO NOT turn on the mainframe until you are finished installing the VXI-DIO-128 module.***

2. Remove or open any doors or covers blocking access to the mainframe slots.
3. If you are installing the VXI-DIO-128 into a D-size mainframe, first install an appropriate support for C-size modules in D-size mainframes.
4. Insert the VXI-DIO-128 in the slot you have selected:
   a. Align the top and bottom of the module with the card-edge guides inside the mainframe.
   b. Slowly push the VXI-DIO-128 straight into the slot until its plug connectors are resting on the backplane receptacle connectors.
   c. Using evenly distributed pressure, slowly press the VXI-DIO-128 straight in until it seats in the expansion slot.
   d. Make sure the front panel of the VXI-DIO-128 is even with the front panel of the mainframe.
5. Tighten the retaining screws on the top and bottom edges of the front panel.
6. Replace or close any doors or covers to the mainframe.

Software Installation

If you are using a VXI*plug&play* instrument driver, follow the instructions in the Setup Utility on the diskettes that were included with your VXI-DAQ hardware. This user manual assumes that the VISA software is installed. If VISA is not installed, you must get the VISA software from the supplier of your VXIbus controller.

If you are using NI-DAQ, refer to your release notes. Find the installation section for your operating system and follow the instructions given there.

If you are using LabVIEW, refer to your LabVIEW release notes to install your application software. After you have installed LabVIEW, refer to the NI-DAQ release notes and follow the instructions given there for your operating system and LabVIEW.

If you are using LabWindows/CVI, refer to your LabWindows/CVI release notes to install your application software. After you have installed LabWindows/CVI, refer to the NI-DAQ release notes and follow the instructions given there for your operating system and LabWindows/CVI.

If you are using ComponentWorks, Measure, or VirtualBench application software, refer to your documentation for installation instructions.

Chapter 3

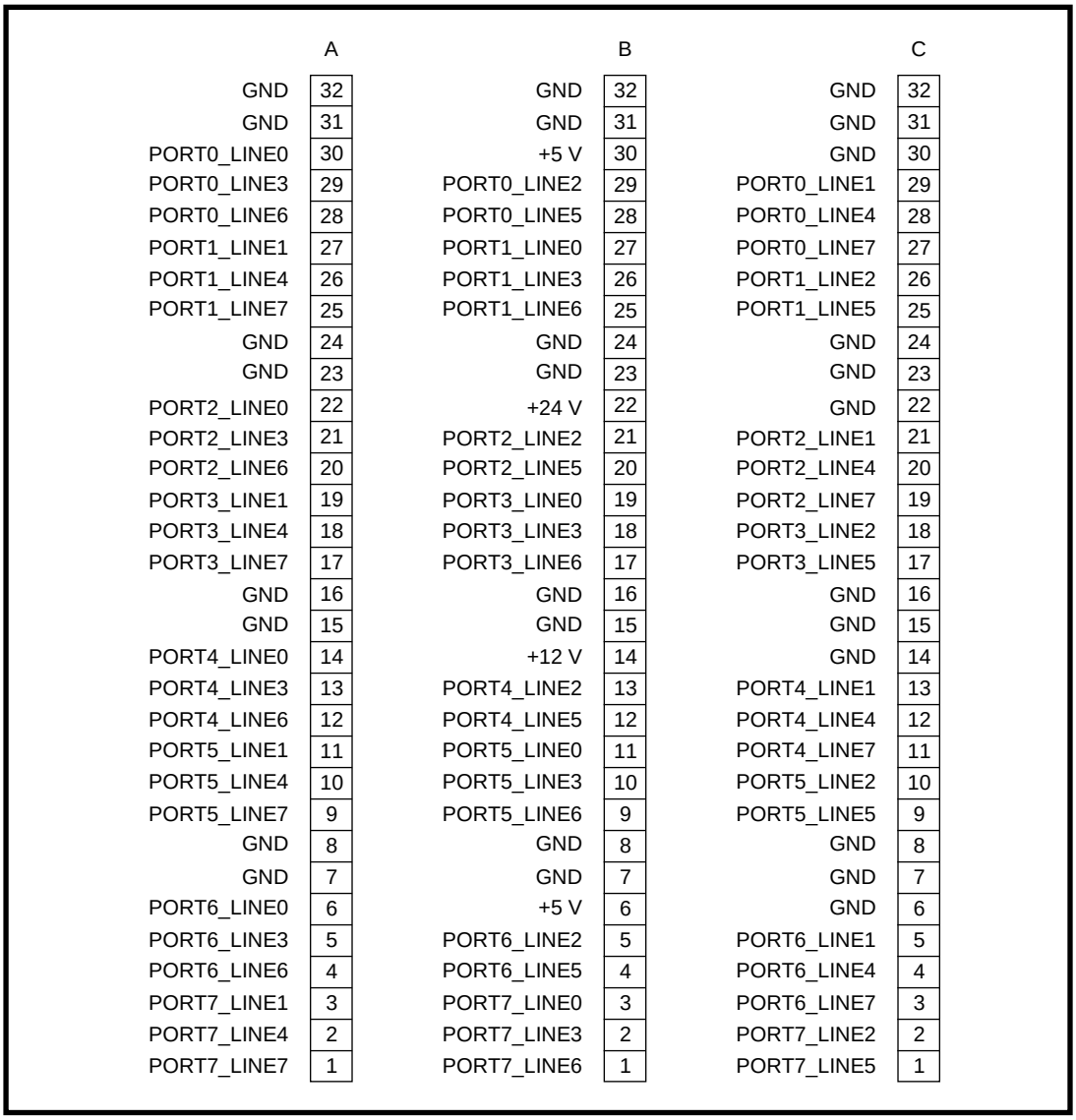
Signal Connections

This chapter provides connection instructions for the signals on the VXI-DIO-128 I/O connector.

Warning: ***Connections that exceed any of the maximum ratings of input or output signals on the VXI-DIO-128 can damage the VXI-DIO-128 module and the VXIbus system. Maximum input ratings for each signal are given in this chapter under the discussion of that signal. National Instruments is NOT liable for any damages resulting from any incorrect signal connections.***

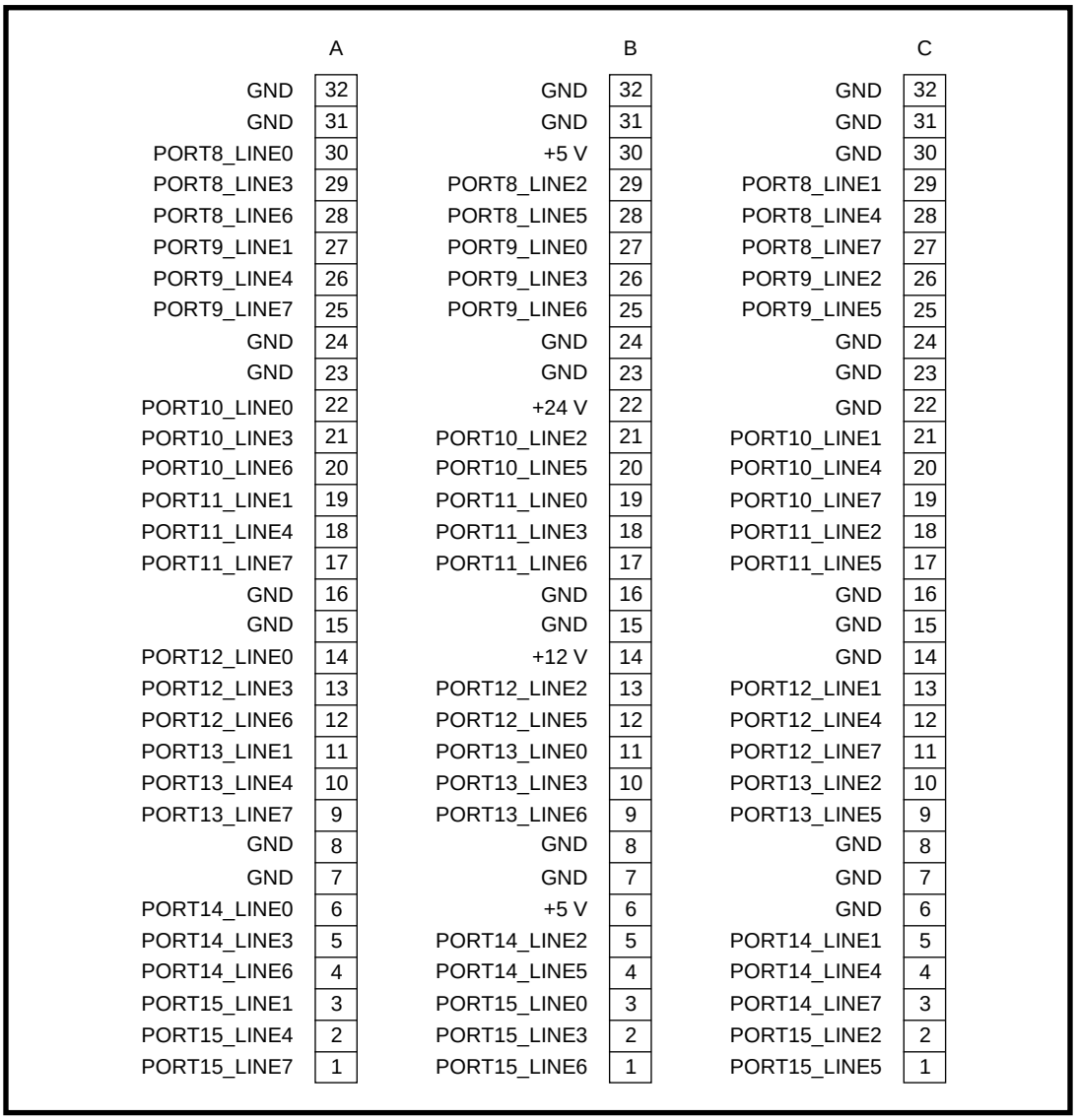
I/O Connector Pin Description

Figures 3-1 and 3-2 show the pin assignments for the VXI-DIO-128 digital I/O connectors.



	A		B		C
GND	32	GND	32	GND	32
GND	31	GND	31	GND	31
PORT0_LINE0	30	+5 V	30	GND	30
PORT0_LINE3	29	PORT0_LINE2	29	PORT0_LINE1	29
PORT0_LINE6	28	PORT0_LINE5	28	PORT0_LINE4	28
PORT1_LINE1	27	PORT1_LINE0	27	PORT0_LINE7	27
PORT1_LINE4	26	PORT1_LINE3	26	PORT1_LINE2	26
PORT1_LINE7	25	PORT1_LINE6	25	PORT1_LINE5	25
GND	24	GND	24	GND	24
GND	23	GND	23	GND	23
PORT2_LINE0	22	+24 V	22	GND	22
PORT2_LINE3	21	PORT2_LINE2	21	PORT2_LINE1	21
PORT2_LINE6	20	PORT2_LINE5	20	PORT2_LINE4	20
PORT3_LINE1	19	PORT3_LINE0	19	PORT2_LINE7	19
PORT3_LINE4	18	PORT3_LINE3	18	PORT3_LINE2	18
PORT3_LINE7	17	PORT3_LINE6	17	PORT3_LINE5	17
GND	16	GND	16	GND	16
GND	15	GND	15	GND	15
PORT4_LINE0	14	+12 V	14	GND	14
PORT4_LINE3	13	PORT4_LINE2	13	PORT4_LINE1	13
PORT4_LINE6	12	PORT4_LINE5	12	PORT4_LINE4	12
PORT5_LINE1	11	PORT5_LINE0	11	PORT4_LINE7	11
PORT5_LINE4	10	PORT5_LINE3	10	PORT5_LINE2	10
PORT5_LINE7	9	PORT5_LINE6	9	PORT5_LINE5	9
GND	8	GND	8	GND	8
GND	7	GND	7	GND	7
PORT6_LINE0	6	+5 V	6	GND	6
PORT6_LINE3	5	PORT6_LINE2	5	PORT6_LINE1	5
PORT6_LINE6	4	PORT6_LINE5	4	PORT6_LINE4	4
PORT7_LINE1	3	PORT7_LINE0	3	PORT6_LINE7	3
PORT7_LINE4	2	PORT7_LINE3	2	PORT7_LINE2	2
PORT7_LINE7	1	PORT7_LINE6	1	PORT7_LINE5	1

Figure 3-1. Digital Input Connector Pin Assignments



	A		B		C
GND	32	GND	32	GND	32
GND	31	GND	31	GND	31
PORT8_LINE0	30	+5 V	30	GND	30
PORT8_LINE3	29	PORT8_LINE2	29	PORT8_LINE1	29
PORT8_LINE6	28	PORT8_LINE5	28	PORT8_LINE4	28
PORT9_LINE1	27	PORT9_LINE0	27	PORT8_LINE7	27
PORT9_LINE4	26	PORT9_LINE3	26	PORT9_LINE2	26
PORT9_LINE7	25	PORT9_LINE6	25	PORT9_LINE5	25
GND	24	GND	24	GND	24
GND	23	GND	23	GND	23
PORT10_LINE0	22	+24 V	22	GND	22
PORT10_LINE3	21	PORT10_LINE2	21	PORT10_LINE1	21
PORT10_LINE6	20	PORT10_LINE5	20	PORT10_LINE4	20
PORT11_LINE1	19	PORT11_LINE0	19	PORT10_LINE7	19
PORT11_LINE4	18	PORT11_LINE3	18	PORT11_LINE2	18
PORT11_LINE7	17	PORT11_LINE6	17	PORT11_LINE5	17
GND	16	GND	16	GND	16
GND	15	GND	15	GND	15
PORT12_LINE0	14	+12 V	14	GND	14
PORT12_LINE3	13	PORT12_LINE2	13	PORT12_LINE1	13
PORT12_LINE6	12	PORT12_LINE5	12	PORT12_LINE4	12
PORT13_LINE1	11	PORT13_LINE0	11	PORT12_LINE7	11
PORT13_LINE4	10	PORT13_LINE3	10	PORT13_LINE2	10
PORT13_LINE7	9	PORT13_LINE6	9	PORT13_LINE5	9
GND	8	GND	8	GND	8
GND	7	GND	7	GND	7
PORT14_LINE0	6	+5 V	6	GND	6
PORT14_LINE3	5	PORT14_LINE2	5	PORT14_LINE1	5
PORT14_LINE6	4	PORT14_LINE5	4	PORT14_LINE4	4
PORT15_LINE1	3	PORT15_LINE0	3	PORT14_LINE7	3
PORT15_LINE4	2	PORT15_LINE3	2	PORT15_LINE2	2
PORT15_LINE7	1	PORT15_LINE6	1	PORT15_LINE5	1

Figure 3-2. Digital Output Connector Pin Assignments

Input Connector Signal Connection Descriptions

Pin	Signal Name	Description
C27, <C..A>28, <C..A>29, A30	Port0_Line<7..0>	Input Data Lines for Port 0—Line 7 is the MSB and Line 0 is the LSB.
<C..A>25, <C..A>26, <B..A>27	Port1_Line<7..0>	Input Data Lines for Port 1—Line 7 is the MSB and Line 0 is the LSB.
C19, <C..A>20, <C..A>21, A22	Port2_Line<7..0>	Input Data Lines for Port 2—Line 7 is the MSB and Line 0 is the LSB.
<C..A>17, <C..A>18, <B..A>19	Port3_Line<7..0>	Input Data Lines for Port 3—Line 7 is the MSB and Line 0 is the LSB.
C11, <C..A>12, <C..A>13, A14	Port4_Line<7..0>	Input Data Lines for Port 4—Line 7 is the MSB and Line 0 is the LSB.
<C..A>9, <C..A>10, <B..A>11	Port5_Line<7..0>	Input Data Lines for Port 5—Line 7 is the MSB and Line 0 is the LSB.
C3, <C..A>4, <C..A>5, A6	Port6_Line<7..0>	Input Data Lines for Port 6—Line 7 is the MSB and Line 0 is the LSB.
<C..A>1, <C..A>2, <B..A>3	Port7_Line<7..0>	Input Data Lines for Port 7—Line 7 is the MSB and Line 0 is the LSB.
B14	+12 V	+12 Volts—This pin is connected to the VXIbus system +12 VDC supply through a self-resetting circuit breaker.
B22	+24 V	+24 Volts—This pin is connected to the VXIbus system +24 VDC supply through a self-resetting circuit breaker.
B30, B6	+5 V	+5 Volts—These pins are connected to the VXIbus system +5 VDC supply through a self-resetting circuit breaker.
<C..A>32, <C..A>31, C30, <C..A>24, <C..A>23, C22, <C..A>16, <C..A>15, C14, <C..A>8, <C..A>7, C6	GND	Ground—These pins are connected to the VXIbus system ground signal.

Output Connector Signal Connection Descriptions

Pin	Signal Name	Description
C27, <C..A>28, <C..A>29, A30	Port8_Line<7..0>	Output Data Lines for Port 8—Line 7 is the MSB and Line 0 is the LSB.
<C..A>25, <C..A>26, <B..A>27	Port9_Line<7..0>	Output Data Lines for Port 9—Line 7 is the MSB and Line 0 is the LSB.
C19, <C..A>20, <C..A>21, A22	Port10_ Line<7..0>	Output Data Lines for Port 10—Line 7 is the MSB and Line 0 is the LSB.
<C..A>17, <C..A>18, <B..A>19	Port11_ Line<7..0>	Output Data Lines for Port 11—Line 7 is the MSB and Line 0 is the LSB.
C11, <C..A>12, <C..A>13, A14	Port12_ Line<7..0>	Output Data Lines for Port 12—Line 7 is the MSB and Line 0 is the LSB.
<C..A>9, <C..A>10, <B..A>11	Port13_ Line<7..0>	Output Data Lines for Port 13—Line 7 is the MSB and Line 0 is the LSB.
C3, <C..A>4, <C..A>5, A6	Port14_ Line<7..0>	Output Data Lines for Port 14—Line 7 is the MSB and Line 0 is the LSB.
<C..A>1, <C..A>2, <B..A>3	Port15_ Line<7..0>	Output Data Lines for Port 15—Line 7 is the MSB and Line 0 is the LSB.
B14	+12 V	+12 Volts—This pin is connected to the VXIbus system +12 VDC supply through a self-resetting circuit breaker.
B22	+24 V	+24 Volts—This pin is connected to the VXIbus system +24 VDC supply through a self-resetting circuit breaker.
B30, B6	+5 V	+5 Volts—These pins are connected to the VXIbus system +5 VDC supply through a self-resetting circuit breaker.
<C..A>32, <C..A>31, C30, <C..A>24, <C..A>23, C22, <C..A>16, <C..A>15, C14, <C..A>8, <C..A>7, C6	GND	Ground—These pins are connected to the VXIbus system ground signal.

Refer to Appendix A, *Specifications*, for detailed information.

Figure 3-3 shows signal connections for three typical digital I/O applications.

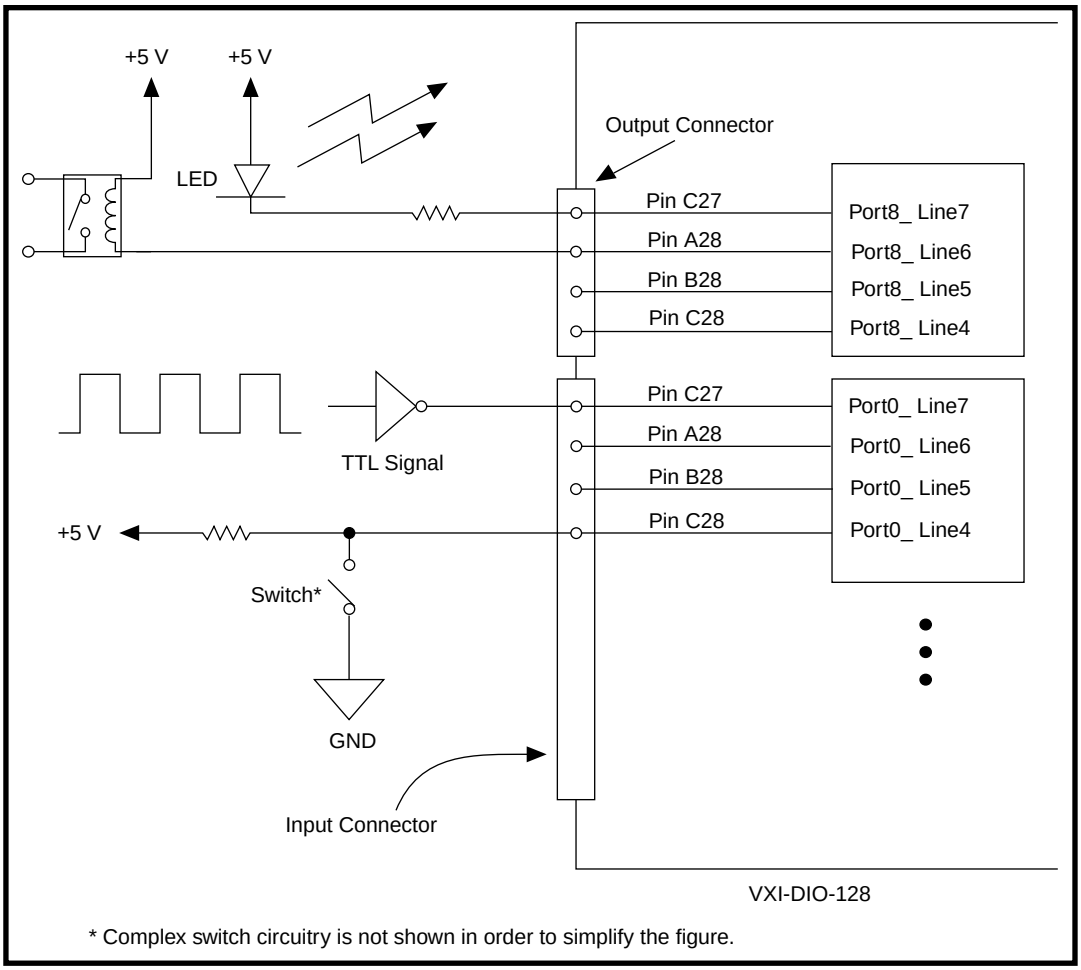


Figure 3-3. Digital I/O Connections

Power Connections

Pins B30, B22, B14, and B6 of the I/O connectors are connected to the +5, +12, and +24 V supplies from the VXIbus power supply. These pins are referenced to GND and can supply power to external circuitry. The +5 V supply has a total of 2 A available, and the +12 and +24 V supplies have a total of 1 A available. However, the current through each connector pin must be limited to 0.5 A.

Each power supply has a self-resetting protection circuit breaker in series. If the circuit breaker protection is activated, simply remove the circuit causing the heavy current load and the circuit breaker will reset itself. For more information on these output pins, see the *Digital Output* and *Power Connections* sections in Appendix A, *Specifications*.

Power rating	0.5 A per pin at +5, +12, and +24 V ±10%

Warning: ***Under no circumstances should you connect these +5, +12, or +24 V power pins directly to ground or to any other voltage source on the VXI-DIO-128 or any other device. Doing so can damage the VXI-DIO-128 and your VXIbus system. National Instruments is NOT liable for damage resulting from such a connection.***

Chapter 4

Theory of Operation

This chapter contains a functional overview of the VXI-DIO-128 and explains the operation of each functional unit making up the module.

The block diagram in Figure 4-1 illustrates the key functional components of the VXI-DIO-128 module.

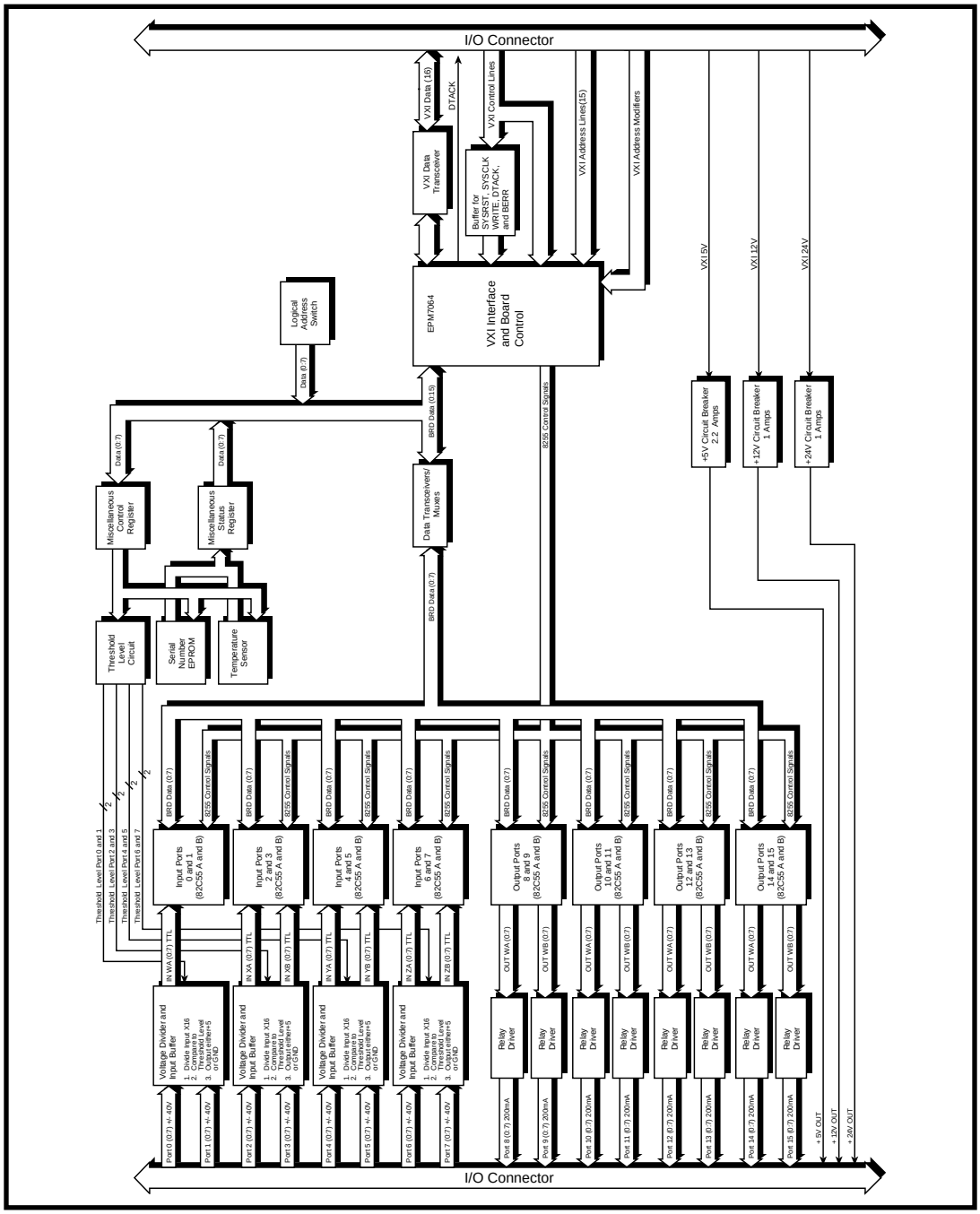


Figure 4-1. VXI-DIO-128 Block Diagram

The VXIbus I/O channel consists of an address bus, a data bus, interrupt lines, and several control and support signals.

Data Transceivers

The data transceivers control the sending and receiving of data to and from the VXIbus.

VXIbus Interface Circuitry

An onboard switch setting determines the VXI-DIO-128 logical address. The address decoder, which is part of the interface circuitry, monitors the address on the VXIbus. If the address on the VXIbus matches the module's selected I/O logical address, the module is enabled and the corresponding register on the VXI-DIO-128 is accessed.

In addition, the VXIbus interface circuitry monitors and transmits the VXIbus interface circuitry signals.

82C55A Programmable Peripheral Interface

The eight 82C55A PPI chips are the heart of the VXI-DIO-128. Each of these chips has 24 programmable I/O pins that represent three 8-bit ports: A, B, and C. However, the VXI-DIO-128 uses only ports A and B of each PPI. Although the 82C55A has three modes of operation, the VXI-DIO-128 uses only one of them, the simple I/O mode (mode 0).

Output Circuitry

The VXI-DIO-128 has 64 open-drain output drivers using the Texas Instruments TPIC6273DW chip. Each of the 64 output drivers can sink up to 250 mA at up to 42 V. Each output has built-in transient suppression diodes, which protect against the voltage spikes that are generated when relays turn off and on. It is possible to concurrently switch a total of 12 A (250 mA on 64 channels). Writing a *1* to a given line turns the relay driver *on*, which will ground the output pin. When using a line as a general-purpose output, an inversion occurs. You can independently program the eight 8-bit digital output banks using the NI-DAQ driver software or the VXI*plug&play* instrument driver. See Figure 4-2 for a diagram of the output circuitry.

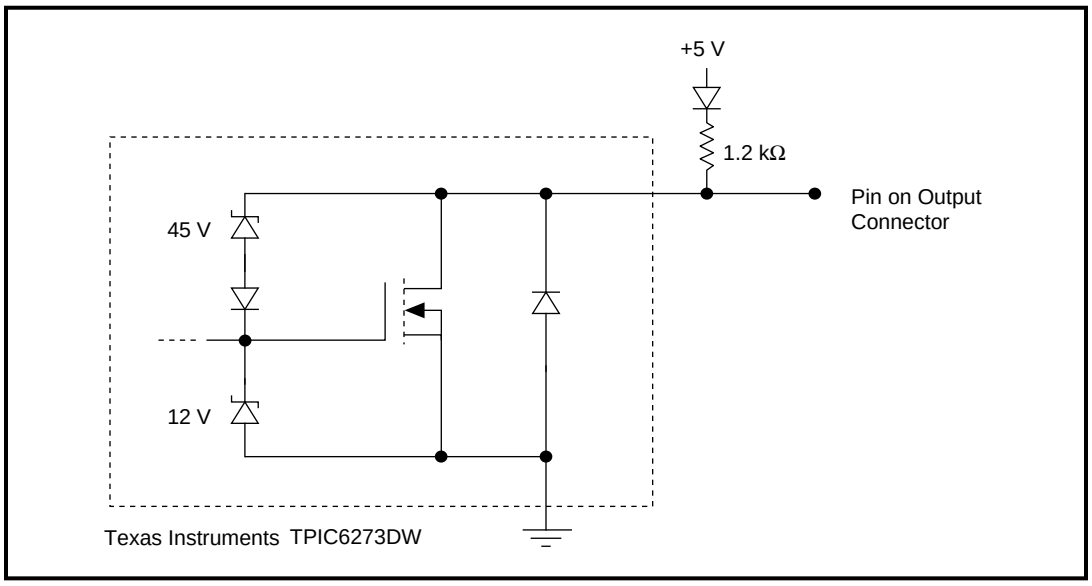


Figure 4-2. Output Circuitry

Input Circuitry

For digital input, you can set an input threshold voltage between -32 and +31.75 V in 250 mV steps. You can program the threshold voltage for each input port independently. By comparing the input digital signal to the threshold values, the module can translate input voltage levels above the threshold to active high readings and input voltage levels below the threshold to active low readings. The VXI-DIO-128 can accept input voltage levels ranging from ±42 V. By using either the NI-DAQ driver software or the VXI*plug&play* instrument driver, you can easily interface the VXI-DIO-128 to external devices such as VXI switches to read the current state.

See Figure 4-3 for a diagram of the input circuitry.

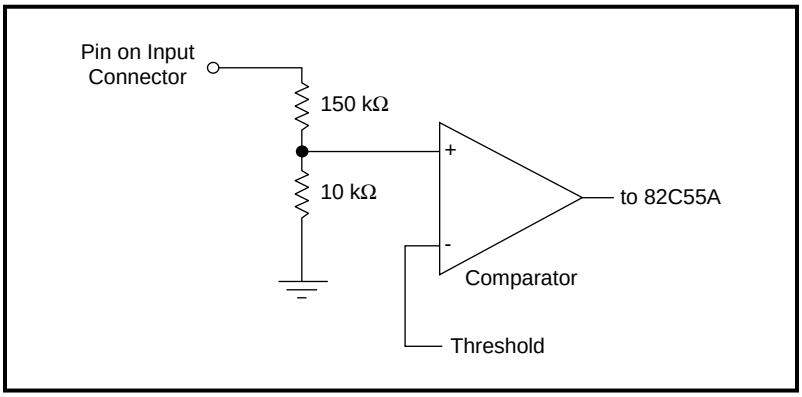


Figure 4-3. Input Circuitry

Digital I/O Connector

All digital I/O is transmitted through two standard, 96-pin, header connectors. Pins B30 and B6 are connected to +5 V through a protection circuit breaker (F1). This +5 V supply is often required to operate I/O module mounting racks. Pins <C..A>32, <C..A>31, C30, <C..A>24, <C..A>23, C22, <C..A>16, <C..A>15, C14, <C..A>8, <C..A>7, and C6 are connected to ground. See Chapter 2, *Configuration and Installation*, and Chapter 3, *Signal Connections* for additional information.

Serial Number EPROM

The serial number EPROM is a nonvolatile memory used to hold the serial number of the module as well as some other identification information used by the driver software.

Temperature Sensor

The onboard temperature sensor can measure the air temperature flowing over the module. This sensor is positioned near the input threshold circuitry, which can be affected by extreme temperatures. This sensor has a serial digital interface.

Specifications

Appendix
A

This appendix lists the VXI-DIO-128 specifications. These specifications are typical at 25° C, unless otherwise stated.

Digital Input

Number of channels	64
Compatibility	TTL, CMOS programmable
Voltage range	±42 V
Input logic threshold	-32 to +31.75 V
Input logic threshold resolution	250 mV
Input logic threshold accuracy	±250 mV ±5% of setting
Input impedance	160 kΩ
Power-on state	Inputs
Data transfers	Programmed I/O

Digital Output

Number of channels	64
Configuration	Open drain with pullups to ~+4 V
Max sink current per channel	250 mA
Max sink current total	
per 8-bit port	2.0 A at 25° C 1.4 A at 55° C
Drain-source voltage	0.5 V (IC = 250 mA at 55° C)
Max allowed voltage range	0 to +42 V

Power Connections

Total per module
- +5 V ..... 2 A
- +12 V ..... 1 A
- +24 V ..... 1 A

Max per pin ..... 0.5 A

Environment

Operating

Temperature ..... 0° to 55° C ambient
Relative humidity ..... 10% to 90% noncondensing

Storage

Temperature ..... -40° to 85° C ambient
Relative humidity ..... 0% to 95% noncondensing

Physical

Dimensions ..... VXI C-size single slot
I/O connector 96-pin

Power Requirement

Max power
- +5 V ..... 450 mA (up to 2.450 A with accessories)
- -5.2 V ..... 1 mA
- +12 V ..... 25 mA (up to 1.025 A with accessories)
- -12 V ..... 10 mA
- +24 V ..... 10 mA (up to 1.010 A with accessories)

☞ **Note:** ***These power usage figures do not include the power used by external devices that are connected to the fused supply present on the I/O connector.***

Common Questions

Appendix **B**

This appendix contains commonly asked questions and their answers relating to usage and special features of your VXI-DIO-128 module.

General Information

1. What if I short-circuit the power supply on the VXI-DIO-128 connector?

Pins B30, B22, B14, and B6 of the I/O connectors are connected to the +5, +12, and +24 V supplies from the VXIbus power supply. These pins are referenced to GND and can be used to power external circuitry. The +5 V supply has a total of 2 A available, and the +12 and +24 V supplies have a total of 1 A available. However, the current through each connector pin must be limited to 0.5 A.

Each power supply has a self-resetting protection fuse in series. If the fuse protection is activated, simply remove the circuit causing the heavy current load and the fuse will reset itself. For more information on these output pins, see the *Digital Output* and *Power Connections* sections in Appendix A, *Specifications*.

Installation and Configuration

2. What jumpers/switches should I be aware of when configuring my VXI-DIO-128 module?

The only switch you must configure is the logical address switch. Refer to the *VXIbus Logical Address* section of Chapter 2, *Configuration and Installation*, for this information.

3. Which National Instruments manual should I read first to get started using DAQ software?

The release notes document for your application or driver software is always the best starting place.

4. **What version of NI-DAQ must I have to program my VXI-DIO-128 module?**

   You must have NI-DAQ for PC compatibles version 4.9.0 or higher for your VXI-DIO-128 module.

5. **What is the best way to test my module without having to program the module?**

   The NI-DAQ Configuration Utility (formerly `WDAQCONF`) has a **Test** menu with some excellent tools for doing simple functional tests of the module, such as testing the digital I/O lines. Also, the **Test Configuration** option will verify that the logical address for the module is current.

6. **How can I select a VXI-DIO-128 module as my device type in the NI-DAQ Configuration Utility.**

   Refer to your *Release Notes: Using Your NI-DAQ 4.9.0 Software with Your VXI-Data Acquisition Module* document for specific instructions.

Timing and Digital I/O

7. **What are the power-on states of the DIO lines on the I/O connector?**

   At system power-on and reset, the output lines are *off* (high impedance) and are pulled up to ~4 V. The input lines are always configured as inputs. Refer to the *Output Circuitry* section and *Input Circuitry* section in Chapter 4, *Theory of Operation* for more information.

Customer Communication

Appendix
C

For your convenience, this appendix contains forms to help you gather the information necessary to help us solve your technical problems and a form you can use to comment on the product documentation. When you contact us, we need the information on the Technical Support Form and the configuration form, if your manual contains one, about your system configuration to answer your questions as quickly as possible.

National Instruments has technical assistance through electronic, fax, and telephone systems to quickly provide the information you need. Our electronic services include a bulletin board service, an FTP site, a FaxBack system, and e-mail support. If you have a hardware or software problem, first try the electronic support systems. If the information available on these systems does not answer your questions, we offer fax and telephone support through our technical support centers, which are staffed by applications engineers.

Electronic Services



Bulletin Board Support

National Instruments has BBS and FTP sites dedicated for 24-hour support with a collection of files and documents to answer most common customer questions. From these sites, you can also download the latest instrument drivers, updates, and example programs. For recorded instructions on how to use the bulletin board and FTP services and for BBS automated information, call (512) 795-6990. You can access these services at:

United States: (512) 794-5422 or (800) 327-3077
Up to 14,400 baud, 8 data bits, 1 stop bit, no parity

United Kingdom: 01635 551422
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

France: 1 48 65 15 59
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity



FTP Support

To access our FTP site, log on to our Internet host, `ftp.natinst.com`, as anonymous and use your Internet address, such as `joesmith@anywhere.com`, as your password. The support files and documents are located in the `/support` directories.



FaxBack Support

FaxBack is a 24-hour information retrieval system containing a library of documents on a wide range of technical information. You can access FaxBack from a touch-tone telephone at the following number:

(512) 418-1111



E-Mail Support (currently U.S. only)

You can submit technical support questions to the appropriate applications engineering team through e-mail at the Internet addresses listed below. Remember to include your name, address, and phone number so we can contact you with solutions and suggestions.

GPIB: `gpib.support@natinst.com`
DAQ: `daq.support@natinst.com`
VXI: `vxi.support@natinst.com`
LabWindows: `lw.support@natinst.com`
LabVIEW: `lv.support@natinst.com`
HiQ: `hiq.support@natinst.com`
VISA: `visa.support@natinst.com`

Fax and Telephone Support

National Instruments has branch offices all over the world. Use the list below to find the technical support number for your country. If there is no National Instruments office in your country, contact the source from which you purchased your software to obtain support.





	Telephone	Fax
Australia	03 9 879 9422	03 9 879 9179
Austria	0662 45 79 90 0	0662 45 79 90 19
Belgium	02 757 00 20	02 757 03 11
Canada (Ontario)	519 622 9310	
Canada (Quebec)	514 694 8521	514 694 4399
Denmark	45 76 26 00	45 76 26 02
Finland	90 527 2321	90 502 2930
France	1 48 14 24 24	1 48 14 24 14
Germany	089 741 31 30	089 714 60 35
Hong Kong	2645 3186	2686 8505
Italy	02 413091	02 41309215
Japan	03 5472 2970	03 5472 2977
Korea	02 596 7456	02 596 7455
Mexico	95 800 010 0793	5 520 3282
Netherlands	0348 433466	0348 430673
Norway	32 84 84 00	32 84 86 00
Singapore	2265886	2265887
Spain	91 640 0085	91 640 0533
Sweden	08 730 49 70	08 730 43 70
Switzerland	056 200 51 51	056 200 51 55
Taiwan	02 377 1200	02 737 4644
U.K.	01635 523545	01635 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. Include additional pages if necessary.

Name _____

Company _____

Address _____

_____

Fax (___)_____ Phone (___) _____

Computer brand _____ Model _____ Processor _____

Operating system (include version number)_____

Clock 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 reproduce the problem: _____

_____

_____

_____

_____

VXI-DIO-128 Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Also fill out the hardware and software configuration forms for all modules in the chassis, all relevant DAQ boards, and all other chassis in the application. By completing these forms accurately, our applications engineers will be able to answer your questions efficiently.

National Instruments Products

DAQ hardware _____

Logical address of hardware _____

Programming choice _____

NI-DAQ, LabVIEW, LabWindows/CVI, or ComponentWorks version _____

Other National Instruments boards in system _____

Logical address of other boards _____

DMA channels of other boards _____

Interrupt level of other boards _____

Other Products

Computer make and model _____

Microprocessor _____

Clock frequency or speed _____

Type of video board installed _____

Operating system version _____

Operating system mode _____

Programming language _____

Programming language version _____

Other boards in system _____

Base I/O address of other boards _____

DMA channels of other boards _____

Interrupt level of other boards _____

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: VXI-DIO-128 User Manual

Edition Date: July 1996

Part Number: 321247A-01

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

_____

_____

_____

_____

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_____

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

_____

_____

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Thank you for your help.

Name _____

Title _____

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

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

Symbols

~	approximately
°	degrees
-	negative of, or minus
Ω	ohms
/	per
%	percent
±	plus or minus
+	positive of, or plus

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 module's configuration registers. This 16 KB region is referred to as VXI configuration space.
A/D	analog-to-digital
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.

B

backplane	An assembly, typically a printed circuit board, with 96-pin connectors and signal paths that bus the connector pins. VXIbus systems will have two sets of bused connectors, called the J1 and J2 backplanes, or have three sets of bused connectors, called the J1, J2, and J3 backplane.
base address	A memory address that serves as the starting address for programmable registers. All other addresses are located by adding to the base address.
BCD	binary-coded decimal
bit	One binary digit, either 0 or 1.
bus	The group of conductors that interconnect individual circuitry in a computer. Typically, a bus is the expansion vehicle to which I/O or other devices are connected.
byte	Eight related bits of data, an eight-bit binary number. Also used to denote the amount of memory required to store one byte of data.

C

C	Celsius
channel	Pin or wire lead to which you apply or from which you read the analog or digital signal. Analog signals can be single-ended or differential. For digital signals, you group channels to form ports. Ports usually consist of either four or eight digital channels.
CMOS	complementary metal-oxide semiconductor
command	Any communication, from a Commander to a Message-Based-Servant, that consists of a write to the Servants Data Low register, possibly preceded by a write to the Data High or Data High and Data Extended registers.
commander	A message-based device that is also a bus master and can control one or more servants.
component software	An application that contains one or more component objects that can freely interact with other component software. Examples include OLE-enabled applications such as Microsoft Visual Basic and OLE Controls for virtual instrumentation in ComponentWorks.
Configuration Registers	(1) 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. (2) The A16 registers of a device that are required for the system configuration process.
crosstalk	An unwanted signal on one channel due to an input on a different channel.

D

D/A	digital-to-analog
DAQ	data acquisition—(1) Collecting and measuring electrical signals from sensors, transducers, and test probes or fixtures and inputting them to a computer for processing; (2) Collecting and measuring the same kinds of electrical signals with A/D and/or DIO boards plugged into a computer, and possibly generating control signals with D/A and/or DIO boards in the same computer.

default setting	A default parameter value recorded in the driver. In many cases, the default input of a control is a certain value (often 0) that means use the current default setting. For example, the default input for a parameter may be *do not change current setting*, and the default setting may be *no AMUX-64T boards*. If you do change the value of such a parameter, the new value becomes the new setting. You can set default settings for some parameters in the configuration utility or by manually using switches located on the device.
device	1)A plug-in data acquisition board, card, or pad that can contain multiple channels and conversion devices. Plug-in boards, PCMCIA cards, and devices such as the DAQPad-1200, which connects to your computer parallel port, are all examples of DAQ devices. 2)A component of a VXIbus system, normally one VXIbus board. However, multiple-slot devices and multiple-device modules can operate on a VXIbus system as a single device. Some examples of devices are computers, multimeters, multiplexers, oscillators, operator interfaces, and counters.
digital input group	A collection of digital input ports. You can associate each group with its own clock rates, handshaking modes, buffer configurations, and so on. A port cannot belong to more than one group.
digital output group	A collection of digital output ports. You can associate each group with its own clock rates, handshaking modes, buffer configurations, and so on. A port cannot belong to more than one group.
digital trigger	A TTL-level signal having two discrete levels—high and low.
DIN	Deutsche Industrie Norme
DIO	digital input/output
DIP	dual inline package
dithering	The addition of Gaussian noise to an analog input signal.
DLL	Dynamic Link Library—A software module in Microsoft Windows containing executable code and data that can be called or used by Windows applications or by other DLLs. Functions and data in a DLL are loaded and linked at run time when they are referenced by a Windows application or other DLLs.
DMA	direct memory access
DRAM	Dynamic RAM
drivers/driver software	Software that controls a specific hardware device such as a DAQ board.

DTB	Data Transfer Bus—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.
dual-access memory	Memory that can be sequentially, but not simultaneously, accessed by more than one controller or processor. Also known as shared memory.
dual-ported memory	Memory that can be simultaneously accessed by more than one controller or processor.
dynamic configuration	A method of automatically assigning logical addresses to VXIbus devices at system startup or other configuration times. Each slot can contain one or more devices. Different devices within a slot can share address decoding hardware.
dynamic range	The ratio of the largest signal level a circuit can handle to the smallest signal level it can handle (usually taken to be the noise level), normally expressed in dB.
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. The Resource Manager subsequently assigns it a new logical address, which the device responds to until powered down.

E

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.
EPROM	Erasable Programmable Read-Only Memory (ROM) that can be erased (usually by ultraviolet light exposure) and reprogrammed.
event	Signals or interrupts generated by a device to notify another device of an asynchronous event. The contents of events are device-dependent.
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.
external trigger	A voltage pulse from an external source that triggers an event such as A/D conversion.

F

floating signal sources — Signal sources with voltage signals that are not connected to an absolute reference or system ground. Also called nonreferenced signal sources. Some common example of floating signal sources are batteries, transformers, or thermocouples.

ft — feet

function — A set of software instructions executed by a single line of code that may have input and/or output parameters and returns a value when executed.

G

GND — ground signal or bit

group — A collection of digital ports, combined to form a larger entity for digital input and/or output. Groups can contain analog input, analog output, digital input, digital output, or counter/timer channels. A group can contain only one type of channel, however. You use a task ID number to refer to a group after you create it. You can define up to 16 groups at one time. To erase a group, you pass an empty channel array and the group number to the group configuration VI. You do not need to erase a group to change its membership. If you reconfigure a group whose task is active, LabVIEW clears the task and returns a warning. LabVIEW does not restart the task after you reconfigure the group.

H

hardware — The physical components of a computer system, such as the circuit boards, plug-in boards, chassis, enclosures, peripherals, cables, and so on.

hardware triggering — A form of triggering where you set the start time of an acquisition and gather data at a known position in time relative to a trigger signal.

hex — hexadecimal

Hz — hertz—A unit of frequency equal to one cycle per second.

I

IC	integrated circuit
in.	inches
INL	Integral Nonlinearity—A measure in LSB of the worst-case deviation from the ideal A/D or D/A transfer characteristic of the analog I/O circuitry.
input range	The difference between the maximum and minimum voltages an analog input channel can measure at a gain of 1. The input range is a scalar value, not a pair of numbers. By itself the input range does not uniquely determine the upper and lower voltage limits. An input range of 10 V could mean an upper limit of +10 V and a lower of 0 V or an upper limit of +5 V and a lower limit of -5 V. The combination of input range, polarity, and gain determines the input limits of an analog input channel. For some boards, jumpers set the input range and polarity, while you can program them for other boards. Most boards have programmable gains.
instrument driver	A set of high-level software functions that controls a specific VXI or RS-232 programmable instrument or a specific plug-in DAQ board.
interrupt	A computer signal indicating that the CPU should suspend its current task to service a designated activity.
interrupt level	The relative priority at which a device can interrupt.
interval scanning	Scanning method where there is a longer interval between scans than there is between individual channels comprising a scan.
I/O	Input/output—The transfer of data to/from a computer system involving communications channels, operator interface devices, and/or data acquisition and control interfaces.

K

KB	kilobytes—1,024 bytes when referring to memory
kS	1,000 samples

L

latched digital I/O	A type of digital acquisition/generation where a device or module accepts or transfers data after a digital pulse has been received. Also called handshaked digital I/O.

LED	light-emitting diode
logical address	An 8-bit number that uniquely identifies each VXIbus device in a system. It defines the A16 register addresses of a device, and indicates Commander and Servant relationships.
LSB	least significant bit

M

m	meters
mainframe	The chassis of a VXI system that mechanically contains VXI modules inserted into the backplane, ensuring that connectors fit properly and that adjacent modules do not contact each other. It also provides cooling airflow, and ensures that modules do not disengage from the backplane due to vibration or shock.
MANTIS	A National Instruments custom ASIC.
MB	megabytes of memory
memory device	A memory storage device that has configuration registers.
MITE	A National Instruments custom ASIC. A sophisticated dual-channel DMA controller that incorporates the Synchronous MXI and VME64 protocols to achieve high-performance block transfer rates.
module	Typically a board assembly and its associated mechanical parts, front panel, optional shields, and so on. A module contains everything required to occupy one or more slots in a mainframe.
MSB	most significant bit
multitasking	A property of an operating system in which several processes can be run simultaneously.

N

NC	Normally closed, or not connected
NI-DAQ	National Instruments driver software for DAQ hardware
node	Execution elements of a block diagram consisting of functions, structures, and subVIs

noise	An undesirable electrical signal – Noise comes from external sources such as the AC power line, motors, generators, transformers, fluorescent lights, soldering irons, CRT displays, computers, electrical storms, welders, radio transmitters, and internal sources such as semiconductors, resistors, and capacitors. Noise corrupts signals you are trying to send or receive.
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.

O

operating system	Base-level software that controls a computer, runs programs, interacts with users, and communicates with installed hardware or peripheral devices.
optical isolation	The technique of using an optoelectric transmitter and receiver to transfer data without electrical continuity, to eliminate high-potential differences and transients.
output limits	The upper and lower voltage or current outputs for an analog output channel. The output limits determine the polarity and voltage reference settings for a board.
output settling time	The amount of time required for the analog output voltage to reach its final value within specified limits.

P

PC	personal computer
port	(1) A communications connection on a computer or a remote controller. (2) A digital port, consisting of four or eight lines of digital input and/or output.
PPI	programmable peripheral interface

R

RAM	random access memory
RESMAN	The name of the National Instruments Resource Manager in NI-VXI bus interface software. See Resource Manager.

resolution	The smallest signal increment that can be detected by a measurement system. Resolution can be expressed in bits, in proportions, or in percent of full scale. For example, a system has 12-bit resolution, one part in 4,096 resolution, and 0.0244 percent of full scale.
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 diagnostics management
responses	Signals or interrupts generated by a device to notify another device of an asynchronous event. Responses contain the information in the Response register of a sender.
RTSI	Real-Time System Integration

S

s	seconds
S	sample
settling time	The amount of time required for a voltage to reach its final value within specified limits.
signal	Any communication between message-based devices consisting of a write to a Signal register.
SIMM	Single In-line Memory Module
slot	A position where a module can be inserted into a VXIbus backplane. Each slot provides the 96-pin J connectors to interface with the board P connectors. A slot can have one, two, or three connectors.
slot 0 device	A VXIbus device that provides basic resources to VXI Slots 1 through 12. For B and C-size systems, the resources provided are CLK10 and MODID. For a D-size system, the Slot 0 device also provides CLK100.
S/s	Samples per Second—Used to express the rate at which a DAQ board samples an analog signal.
statically configured device	A device whose logical address cannot be set through software; that is, it is not dynamically configurable.
system	A system consists of one or more mainframes that are connected, all sharing a common Resource Manager. Each device in a system has a unique logical address.

system RAM	RAM installed on a personal computer and used by the operating system, as contrasted with onboard RAM.

T

transfer rate	The rate, measured in bytes/s, at which data is moved from source to destination after software initialization and set up operations; the maximum rate at which the hardware can operate.
TTL	Transistor-transistor logic

U

update	The output equivalent of a scan. One or more analog or digital output samples. Typically, the number of output samples in an update is equal to the number of channels in the output group. For example, one pulse from the update clock produces one update which sends one new sample to every analog output channel in the group.
update rate	The number of output updates per second.

V

V	volts
VDC	volts direct current
VI	Virtual Instrument—(1) A combination of hardware and/or software elements, typically used with a PC, that has the functionality of a classic stand-alone instrument. (2) A LabVIEW software module (VI), which consists of a front panel user interface and a block diagram program.
VISA	A new driver software architecture developed by National Instruments to unify instrumentation software (GPIB, DAQ, and VXI). It has been accepted as a standard for VXI by the VXI*plug&play* Systems Alliance.
VXIbus	VMEbus eXtensions for Instrumentation
VXI*plug&play* Systems Alliance	A group of VXI developers dedicated to making VXI devices as easy to use as possible, primarily by simplifying software development.

W

waveform	Multiple voltage readings taken at a specific sampling rate
wire	Data path between nodes.
word serial	The simplest required communication protocol used by message-based devices in the VXIbus system. It uses the A16 communication registers to transfer data with a simple polling handshake method.

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