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SCXI-1162
User Manual

32-Channel Isolated Digital Input Module

March 1994 Edition

Part Number 320572-01

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About This Manual

This manual describes the electrical and mechanical aspects of the SCXI-1162 and contains information concerning its operation and programming. The SCXI-1162 is a member of the National Instruments Signal Conditioning eXtensions for Instrumentation (SCXI) Series modules for the National Instruments data acquisition plug-in boards. This module switches and controls low-level and power signals. The SCXI-1162 operates as 32 digital input channels, arranged as eight banks of four channels. Each bank is optically isolated.

This manual describes the installation, basic programming considerations, and theory of operation for the SCXI-1162.

Organization of This Manual

The *SCXI-1162 User Manual* is organized as follows:

- Chapter 1, *Introduction*, describes the SCXI-1162; lists the contents of your SCXI-1162 kit; describes the optional software, optional equipment, and custom cables; and explains how to unpack the SCXI-1162 kit.
- Chapter 2, *Configuration and Installation*, describes the SCXI-1162 jumper configurations, installation of the SCXI-1162 into the SCXI chassis, signal connections to the SCXI-1162, and cable wiring.
- Chapter 3, *Theory of Operation*, contains a functional overview of the SCXI-1162 module and explains the operation of each functional unit making up the SCXI-1162.
- Chapter 4, *Register Descriptions*, describes in detail the SCXI-1162 Address Handler, the Module ID Register, the Data Register, the Parking Registers, and the Slot 0 registers.
- Chapter 5, *Programming*, contains a functional programming description of the SCXI-1162 and Slot 0.
- Appendix A, *Specifications*, lists the specifications for the SCXI-1162.
- Appendix B, *Rear Signal Connector*, describes the pinout and signal names for the SCXI-1162 50-pin rear signal connector, including a description of each connection.
- Appendix C, *SCXIbus Connector*, describes the pinout and signal names for the SCXI-1162 SCXIbus connector, including a description of each connection.
- Appendix D, *SCXI-1162 Front Connector*, describes the pinout and signal names for the SCXI-1162 front connector, including a description of each connection.
- Appendix E, *SCXI-1162 Cabling*, describes how to use and install the hardware accessories for the SCXI-1162.
- Appendix F, *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, and symbols.

- The *Index* contains an alphabetical list of key terms and 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:

DIO board	DIO board refers to the National Instruments AT-DIO-32F, MC-DIO-24, MC-DIO-32F, NB-DIO-24, NB-DIO-96, NB-DIO-32F, PC-DIO 24, and PC-DIO-96 digital I/O data acquisition boards unless otherwise noted.
DIO-type board	DIO-type board refers to National Instruments data acquisition boards that have only digital inputs and outputs. These boards include the DIO-24, DIO-32F, and DIO-96 boards unless otherwise noted.
italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
Lab board	Lab board refers to the National Instruments Lab-LC, Lab-NB, Lab-PC, and Lab-PC+ boards unless otherwise noted.
MC	MC refers to the Micro Channel series computers.
MIO board	MIO board refers to the National Instruments AT-MIO-16, AT-MIO-16D, AT-MIO-16F-5, AT-MIO-16X, AT-MIO-64F-5, MC-MIO-16, NB-MIO-16, and NB-MIO-16X multichannel I/O data acquisition boards unless otherwise noted.
MIO-type board	MIO-type board refers to National Instruments data acquisition boards that have at least analog and digital inputs and outputs. These boards include the MIO boards, the Lab boards, and the PC-LPM-16 board unless otherwise noted.
`monospace`	Lowercase text in this font denotes text or characters that are to be literally input from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, variables, filenames, and extensions, and for statements and comments taken from program code.
NB	NB refers to the NuBus series computers.
PC	PC refers to the IBM PC/XT, the IBM PC AT, and compatible computers.
SCXIbus	SCXIbus refers to the backplane in the chassis. A signal on the backplane is referred to as the SCXIbus <signal name> line (or signal). The SCXIbus descriptor may be omitted when the meaning is clear. Descriptions of all SCXIbus signals are given in Appendix C, *SCXIbus Connector*.
Slot 0	Slot 0 refers to the power supply and control circuitry in the SCXI chassis.

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:

- *AT-DIO-32F User Manual* (part number 320147-01)
- *AT-MIO-16 User Manual* (part number 320476-01)
- *AT-MIO-16D User Manual* (part number 320489-01)
- *AT-MIO-16F-5 User Manual* (part number 320266-01)
- *AT-MIO-64F-5 User Manual* (part number 320487-01)
- *AT-MIO-16X User Manual* (part number 320488-01)
- *Lab-LC User Manual* (part number 320380-01)
- *Lab-NB User Manual* (part number 320174-01)
- *Lab-PC User Manual* (part number 320205-01)
- *Lab-PC+ User Manual* (part number 320502-01)
- *MC-DIO-24 User Manual* (part number 320129-01)
- *MC-DIO-32F User Manual* (part number 320128-01)
- *MC-MIO-16 User Manual*, Revisions A to C (part number 320130-01)
- *MC-MIO-16 User Manual*, Revision D (part number 320560-01)
- *NB-DIO-24 User Manual* (part number 320094-01)
- *NB-DIO-32F User Manual* (part number 320095-01)
- *NB-DIO-96 User Manual* (part number 320384-01)
- *NB-MIO-16 User Manual* (part number 320295-01)
- *NB-MIO-16X User Manual* (part number 320157-01)
- *PC-DIO-24 User Manual* (part number 320288-01)
- *PC-DIO-96 User Manual* (part number 320289-01)
- *PC-LPM-16 User Manual* (part number 320287-01)
- *SCXI-1000/1001 User Manual* (part number 320423-01)

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 F, *Customer Communication*, at the end of this manual.

Chapter 1
Introduction

This chapter describes the SCXI-1162; lists the contents of your SCXI-1162 kit; describes the optional software, optional equipment, and custom cables; and explains how to unpack the SCXI-1162 kit.

Figure 1-1 shows the SCXI-1162 module.

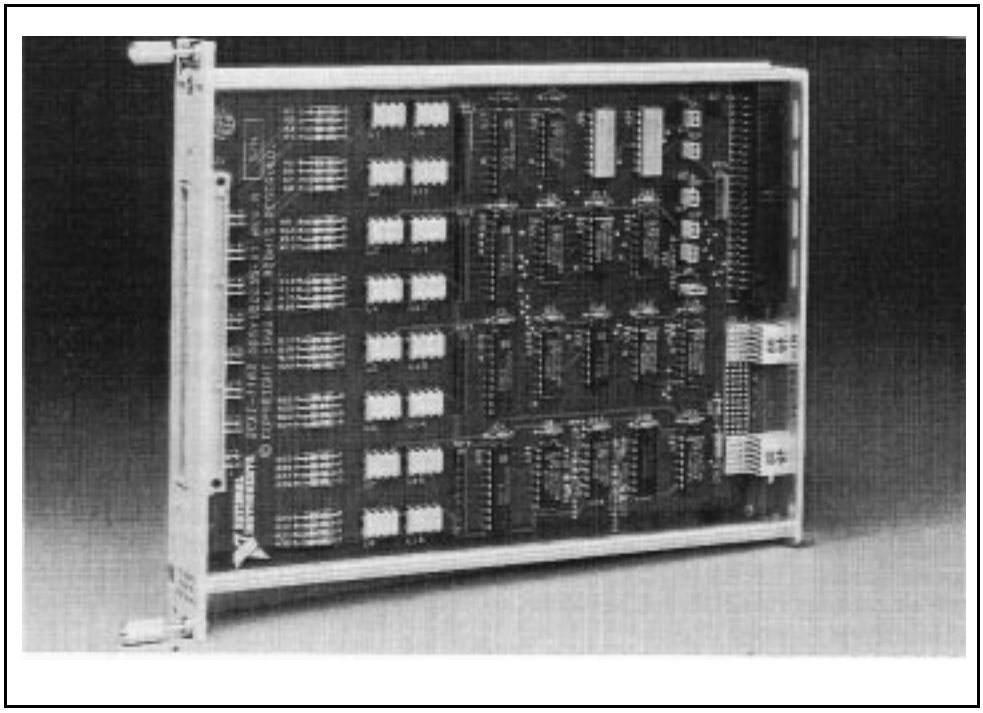


Figure 1-1. SCXI-1162 Digital Input Module

The SCXI-1162 module consists of 32 optically isolated digital inputs. The SCXI-1162 is a module for acquiring digital data where common-mode voltages may be present.

The SCXI-1162 operates with full functionality with National Instruments MIO-16 and AT-MIO-64F-5 boards; Lab-NB, Lab-PC, Lab-PC+, Lab-LC, and PC-LPM-16 boards; and with the DIO-24, DIO-32F, and DIO-96 boards. You can also use the SCXI-1162 with other systems that comply with the specifications given in Chapter 2, *Configuration and Installation.* You can control several SCXI-1162s in a single chassis with one data acquisition board.

An additional shielded terminal block, the SCXI-1326, has screw terminals for easy signal attachment to the SCXI-1162.

With the SCXI-1162, the SCXI chassis can serve as a digital signal monitor in laboratory testing, production testing, and industrial process monitoring.

What Your Kit Should Contain

The contents of the SCXI-1162 kit (part number 776572-62) are listed as follows.

Kit Component	Part Number
SCXI-1162 module *SCXI-1162 User Manual*	182246-01 320572-01

If your kit is missing any of the components, contact National Instruments.

Optional Software

This manual contains complete instructions for directly programming the SCXI-1162. You can order separate software packages for controlling the SCXI-1162 from National Instruments.

When you combine the PC, AT, and MC data acquisition boards with the SCXI-1162, you can use LabVIEW for Windows or LabWindows® for DOS. LabVIEW and LabWindows are innovative program development software packages for data acquisition and control applications. LabVIEW uses graphical programming, whereas LabWindows enhances Microsoft C and QuickBASIC. Both packages include extensive libraries for data acquisition, instrument control, data analysis, and graphical data presentation.

Your National Instruments data acquisition board is shipped with the NI-DAQ software. NI-DAQ has a library of functions that can be called 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, SCXI, RTSI, and self-calibration. NI-DAQ maintains a consistent software interface among its different versions so you can switch between platforms with minimal modifications to your code.

You can also use the SCXI-1162, together with the PC, AT, and MC data acquisition boards, with NI-DAQ software for DOS/Windows/LabWindows. NI-DAQ software for DOS/Windows/LabWindows comes with language interfaces for Professional BASIC, Turbo Pascal, Turbo C, Turbo C++, Borland C++, and Microsoft C for DOS; and Visual Basic, Turbo Pascal, Microsoft C with SDK, and Borland C++ for Windows. NI-DAQ software for DOS/Windows/LabWindows is on high-density 5.25 in. and 3.5 in. diskettes.

You can use the SCXI-1162, together with the NB Series data acquisition boards, with LabVIEW for Macintosh, a software system that 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 boards, is included with LabVIEW. The LabVIEW Data Acquisition VI Library is functionally equivalent to the NI-DAQ software for Macintosh.

You can also use the SCXI-1162, combined with the NB Series data acquisition boards, with NI-DAQ software for Macintosh. NI-DAQ software for Macintosh, which is shipped with all National Instruments Macintosh data acquisition boards, comes with language interfaces for MPW C, THINK C, Pascal, and Microsoft QuickBASIC. Any language that uses Device Manager Toolbox calls can access NI-DAQ software for Macintosh.

Part numbers for these software products are as follows:

Software	Part Number
LabVIEW for Windows	776670-01
LabWindows	
Standard package	776473-01
Advanced Analysis Library	776474-01
Standard package with Advanced Analysis Library	776475-01
NI-DAQ software for DOS/Windows/LabWindows	776250-01
LabVIEW for Macintosh	776141-01
NI-DAQ software for Macintosh	776181-01

Optional Equipment

Equipment		Part Number
SCXI-1326 front terminal block		776573-26
SCXI-1340 cable assembly		776574-40
SCXI-1341 Lab-NB/Lab-PC/Lab-PC+ cable assembly		776574-41
SCXI-1342 PC-LPM-16 cable assembly		776574-42
SCXI-1343 rear screw terminal adapter		776574-43
SCXI-1344 Lab-LC cable assembly		776574-44
SCXI-1350 multichassis adapter		776575-50
SCXI-1351 one slot extender cable		776575-51
SCXI-1348 DIO-32F cable assembly		776574-48
Standard ribbon cable	0.5 m	180524-05
	1.0 m	180524-10
NB5 cable	0.5 m	181304-05
	1.0 m	181304-10

Refer to the *Signal Connections* section in Chapter 2, *Configuration and Installation*, and to Appendix E, *SCXI-1162 Cabling*, for additional information on cabling, connectors, and adapters.

Custom Cables

The SCXI-1162 rear signal connector is a 50-pin male ribbon-cable header. The manufacturer part number National Instruments uses for this header is as follows:

- AMP Inc. (part number 1-103310-0)

The mating connector for the SCXI-1162 rear signal connector is a 50-position polarized ribbon-socket connector with strain relief. National Instruments uses a polarized or keyed connector to prevent inadvertent upside-down connection to the SCXI-1162. Recommended manufacturer part numbers for this mating connector are as follows:

- Electronic Products Division/3M (part number 3425-7650)
- T&B/Ansley Corporation (part number 609-5041CE)

Standard 50-conductor 28 AWG stranded ribbon cables that work with these connectors are as follows:

- Electronic Products Division/3M (part number 3365/50)
- T&B/Ansley Corporation (part number 171-50)

The SCXI-1162 front connector is a special 48-pin DIN C male connector. The manufacturer part number National Instruments uses for this connector is as follows:

- ERNI Components, Inc. (part number 033-273)

The mating connector for the SCXI-1162 front connector is a special 48-pin reversed DIN C female connector. National Instruments uses a polarized and keyed connector to prevent inadvertent upside-down connection to the SCXI-1162. The manufacturer part number National Instruments uses for this mating connector is as follows:

- ERNI Components, Inc. (part number 913-495)

These connectors were selected to meet UL 1244 for 450 Vrms working isolation.

Unpacking

Your SCXI-1162 module is shipped in an antistatic package to prevent electrostatic damage to the module. Several components on the module can be damaged by electrostatic discharge. To avoid such damage in handling the module, take the following precautions:

- Touch the antistatic package to a metal part of your SCXI 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 SCXI chassis.

Chapter 2
Configuration and Installation

This chapter describes the SCXI-1162 jumper configurations, installation of the SCXI-1162 into the SCXI chassis, signal connections to the SCXI-1162, and cable wiring.

Module Configuration

You can configure the SCXI-1162 rear connector to send data directly from the inputs in parallel, or to form a serial communication link with the SCXIbus. You can also configure the rear connector to connect to a DIO-type or an MIO-type data acquisition board. Set jumpers on the module to configure the rear connector.

When you are controlling the SCXI-1162 through the SCXIbus and are not using the rear connector, the positions of the configuration jumpers are irrelevant. However, the module in the chassis which is cabled to a data acquisition board must be configured to allow reads from module registers. (Specifically, the module must be configured to send data from the SCXIbus MISO line to the SERDATOUT pin of the module rear connector. Refer to the user manual for the SCXI module you are using for information on how to accomplish this.)

The SCXI-1162 includes six user-configurable jumpers and one reserved jumper that are shown in the parts locator diagram in Figure 2-1.

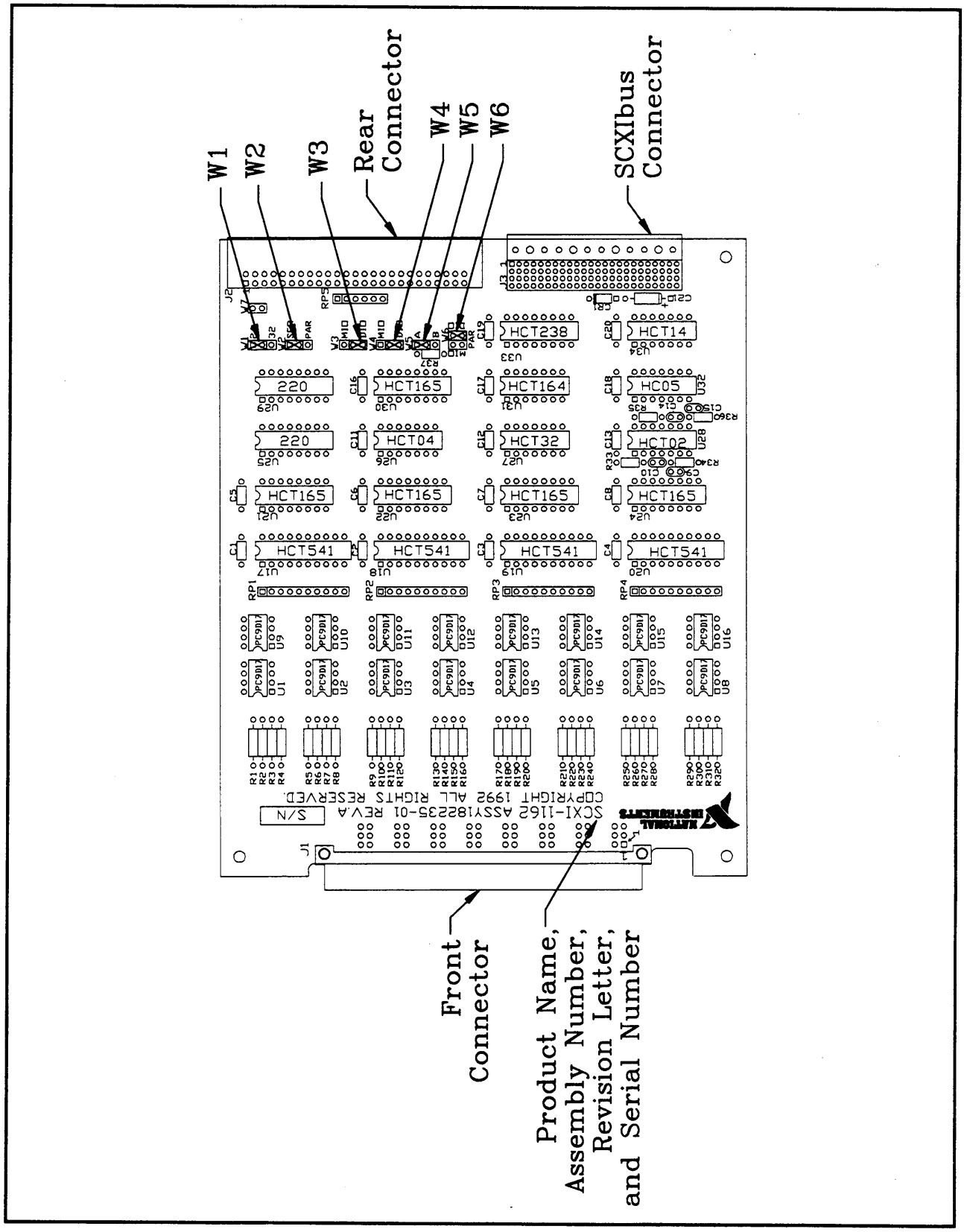


Figure 2-1. SCXI-1162 Parts Locator Diagram

The following warnings contain important safety information concerning hazardous voltages.

Warnings: *Keep away from live circuits.* Do not remove equipment covers or shields unless you are trained to do so. If signal wires are connected to the module or terminal block, dangerous voltages may exist even when the equipment is turned off. To avoid dangerous electrical shock, do not perform procedures involving cover or shield removal unless you are qualified to do so.

Do not operate damaged equipment. The safety protection features built into this module can become impaired if the module becomes damaged in any way. If it is damaged, turn the module off and do not use until service-trained personnel can check its safety. If necessary, return the module to National Instruments for service and repair to ensure that its safety is not compromised.

Do not substitute parts or modify equipment. Because of the danger of introducing additional hazards, do not install unauthorized parts or modify the module. Return the module to National Instruments for service and repair to ensure that its safety features are not compromised.

When using the terminal block with high common-mode voltages, your signal wires *must* be insulated appropriately. National Instruments is *not* liable for any damages or injuries resulting from inadequate signal wire insulation.

When connecting or disconnecting signal lines to the SCXI-1326 terminal block screw terminals, the lines must be powered off to avoid a shock hazard.

Connections, including power signals to ground and vice versa, that exceed any of the maximum signal ratings on the SCXI-1162 can result in damage to any or all of the boards connected to the SCXI chassis, to the host computer, and to the SCXI-1162 module. National Instruments *is not liable for any damages or injuries* resulting from incorrect signal connections.

If high voltages (≥42 Vrms) are present, the *safety earth ground must be connected to the strain relief tab*. This maintains compliance with UL 1244 and provides full protection against electric shock when the terminal block is not connected to the chassis. To connect the safety earth ground to the strain relief tab, run an earth ground wire in the cable from the signal source to the terminal block. National Instruments is *not* liable for any damages or injuries resulting from inadequate safety earth ground connections.

Jumper Use

All six user-configurable jumpers (W1-W6) on the SCXI-1162 are for digital communication through the rear connector between the data acquisition board and the SCXI-1162 module. If you are controlling the SCXI-1162 via the SCXIbus and are not using the rear connector, then the positions of these jumpers are irrelevant.

The jumpers are used as follows:

- User-configurable jumpers
  - Jumper W1 determines whether only 24 or all 32 lines of the rear connector are driven when the rear connector is configured for parallel operation. If the rear connector is configured for serial operation, this jumper is irrelevant.
  - Jumper W2 configures the rear connector to either send data in parallel to a DIO board or to allow serial communication between either a DIO or an MIO board.
  - Jumpers W3 and W4 select whether the SCXI-1162 is to be connected to a DIO-type board or to an MIO-type board. The MIO-type data acquisition boards are National Instruments boards that have analog inputs and digital inputs and outputs. These boards include MIO-16 boards and the AT-MIO-64F-5 board; Lab-NB, Lab-PC, Lab-PC+, and Lab-LC boards; and PC-LPM-16 boards. The DIO-type boards are National Instruments boards that have only digital inputs and digital outputs. These boards are the DIO-24, DIO-32F, and DIO-96 boards. If the SCXI-1162 module is controlled via the backplane the position of these jumpers is irrelevant.
  - Jumper W5 connects a pullup resistor to the SERDATOUT signal on the rear signal connector.
  - Jumper W6 carries the SCXIbus MISO line, after buffering, to the SERDATOUT signal on the rear signal connector.
- Reserved jumper
  - Jumper W7 is reserved and should not be connected.

To change the configuration of the module, use the following procedure:

1. Remove the grounding screw of the top cover.
2. Snap out the top cover of the shield by placing a screwdriver in the groove at the bottom of the module.
3. Remove the jumpers to be changed and replace them on the appropriate pins.
4. Record the new jumper settings on the *SCXI-1162 Hardware Configuration Form* in Appendix F.
5. Snap the top cover back in place.
6. Replace the grounding screw to ensure proper shielding.

Jumper W1

Jumper W1 determines the number of lines driven at the rear connector when jumper W2 configures the rear connector for parallel communication. The position of jumper W1 is only relevant when jumper W2 is set to PAR. Jumper W2 does not affect serial communication; therefore all 32 channels are always available through serial data transfers. When you connect the SCXI-1162 to a DIO-32F or to a DIO-96, all 32 lines may be driven. However, when you

connect to a DIO-24, only the first 24 of the lines may be driven, as the DIO-24 only accepts 24 inputs and grounds the additional lines. *Do not* connect the SCXI-1162 to a DIO-24 with the module configured to drive all 32 lines in parallel, as this will cause driver contention.

Using Jumper W1

To drive all 32 lines, set the jumper to position 32. To drive only the first 24 lines, set the jumper to position 24. Again, this jumper is only relevant when jumper W2 is set to PAR.

Jumper W2

Jumper W2 configures the rear connector for either serial or parallel communication. With the jumper set to parallel, the rear connector is configured to send the data from the module inputs directly to a DIO board in parallel. In this setting, it is important to properly set jumper W1. With the jumper set to serial, the rear connector is configured for serial communication between a data acquisition board and the SCXIbus. In this setting, the position of jumper W1 is irrelevant.

Using Jumper W2

To set the rear connector to parallel communication, set the jumper to the PAR position. In this mode, set jumper W6 to PAR to prevent the MISO line from inadvertently driving one of the parallel lines. To set the rear connector to serial communication, set the jumper to the SER position. If the SCXI-1162 is being controlled by the SCXIbus and its rear connector is not connected to anything, the position of this jumper is irrelevant.

Jumpers W3 and W4

These jumpers configure the rear connector to accept signals from either an MIO-type or a DIO-type data acquisition board. Both jumpers have labels indicating the DIO and the MIO configurations. As indicated previously, you can use two types of data acquisition boards–MIO-type and DIO-type–to communicate with the SCXI-1162. If you want to use the SCXI-1162 with a DIO-type board, place the jumpers in the DIO position. This position is the factory setting. If you want to use the SCXI-1162 with an MIO-type board, place the jumpers in the MIO position. If you are controlling the SCXI-1162 via the SCXI backplane and are not using the rear connector, the position of these jumpers is irrelevant.

Jumper W5

Position A connects a 2.2 kΩ pullup resistor to the SERDATOUT line. This is the factory-default setting. Position B does not connect the pullup resistor to the SERDATOUT line.

Jumper W6

Position DIO connects the SCXIbus MISO line, after buffering, to the SERDATOUT pin of the rear signal connector when used with a DIO-type board. Position MIO connects the SCXIbus MISO line, after buffering, to the SERDATOUT pin of the rear signal connector when used with an MIO-type board. In these settings, along with the proper setting of jumper W5, the data

acquisition board can read the Module ID Register or the Data Register of the SCXI-1162. See the *Timing Requirements and Communication Protocol* section later in this chapter, and Chapter 4, *Register Descriptions*, for information on reading the Module ID Register and the Data Register. See Appendix E, *SCXI-1162 Cabling*, for the pin equivalences of the SCXI-1162 rear signal connector and the data acquisition board I/O connector. The factory-default setting is position DIO.

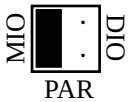
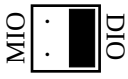
Position PAR disconnects SERDATOUT from the SCXIbus MISO line, and you should use it when the module is to be connected in parallel to a DIO board.

Using Jumpers W5 and W6

If a module is not connected to a data acquisition board, the positions of W5 and W6 are irrelevant. Jumpers W5 and W6 give the data acquisition board access to the MISO line on the backplane. You use the MISO line to read the values at the module inputs from the Data Register and to read the Module ID Register of modules. National Instruments software does not use the ability to read the Module ID register. You must indicate to the software which module is in which slot.

The SERDATOUT line is driven with an open-collector driver, which is a driver that actively drives low or goes to a high-impedance state, relying on a pullup resistor to make the signal line go high. When you use a single chassis, set W5 in position A on the SCXI-1162 that is connected to the data acquisition board and set W6 to DIO or MIO. In this setting, the module drives MISO to SERDATOUT and connects the necessary pullup resistor to the SERDATOUT line. When using multiple chassis, set jumper W6 to position DIO or MIO on all of the SCXI-1162s that are cabled to the data acquisition board. Only one of the SCXI-1162s that are cabled to the data acquisition board should have jumper W5 in position A. It does not matter which of the SCXI-1162s that are cabled to the data acquisition board has the pullup connected. All of the other SCXI-1162 modules that are cabled to the data acquisition board should have jumper W5 in position B. If too many pullup resistors are attached to the SERDATOUT line, the drivers cannot drive the line low.

Table 2-1. Digital Signal Connections, Jumper Settings

Jumper	Description	Configuration
W1	Factory setting–Drives only 24 lines when W2 is set to PAR. Used with DIO-24	
W1	Drives all 32 rear connector data lines when W2 is set to PAR. Used with DIO-32F or DIO-96	
W2	Factory setting–Configures rear connector for serial communication	
W2	Configures rear connector for parallel communication. DIO board only	
W3	Factory setting–Configures rear connector for a DIO board	
W3	Configures rear connector for an MIO board. Includes MIO series, Lab series, and PC-LPM-16	
W4	Factory setting–Configures rear connector for a DIO board	
W4	Configures rear connector for an MIO board. Includes MIO series, Lab series, and PC-LPM-16	
W5	Parking position	
W5	Factory setting–Connects pullup to SERDATOUT	
W6	Parking position–Removes MISO from SERDATOUT line	
W6	Connects MISO to SERDATOUT on an MIO-type board. Includes MIO series, Lab series, and PC-LPM-16	
W6	Factory setting–Connects MISO to SERDATOUT on a DIO-type board	

Hardware Installation

You can install the SCXI-1162 in any available SCXI chassis. After you have made any necessary changes and have verified and recorded the jumper settings on the form in Appendix F, *Customer Communication*, you are ready to install the SCXI-1162. The following are general installation instructions; consult the user manual or technical reference manual of your SCXI chassis for specific instructions and warnings.

1. Turn off the computer that contains the data acquisition board or disconnect it from your SCXI chassis.

2. Turn off the SCXI chassis. Do not insert the SCXI-1162 into a chassis that is turned on.

3. Insert the SCXI-1162 into the board guides. Gently guide the module into the back of the slot until the connectors make good contact. If a cable assembly has already been installed in the rear of the chassis, the module and cable assembly must be firmly engaged; however, do not *force* the module into place.

4. Screw the front mounting panel of the SCXI-1162 to the top and bottom threaded strips of your SCXI chassis.

5. If this module is to be connected to an MIO-16 or a DIO-24 data acquisition board, attach the connector at the metal end of the SCXI-1340 cable assembly to the rear signal connector on the SCXI-1162 module. Screw the rear panel to the rear threaded strip. Attach the loose end of the cable to the data acquisition board.

   Note: For installation procedures with other SCXI accessories and data acquisition boards, consult Appendix E, *SCXI-1162 Cabling.*

6. Check the installation.

7. Turn on the SCXI chassis.

8. Turn on the computer or reconnect it to your chassis.

The SCXI-1162 board is installed and ready for operation.

Signal Connections

This section describes the signal connections to the SCXI-1162 board via the SCXI-1162 front connector and rear signal connector, and includes specifications and connection instructions for the SCXI-1162 connector signals.

Warning: Connections that exceed any of the maximum ratings of input signals on the SCXI-1162 can result in damage to the SCXI-1162 module and to the SCXIbus. 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 such signal connections.

Front Connector

Figure 2-2 shows the pin assignments for the SCXI-1162 front connector.

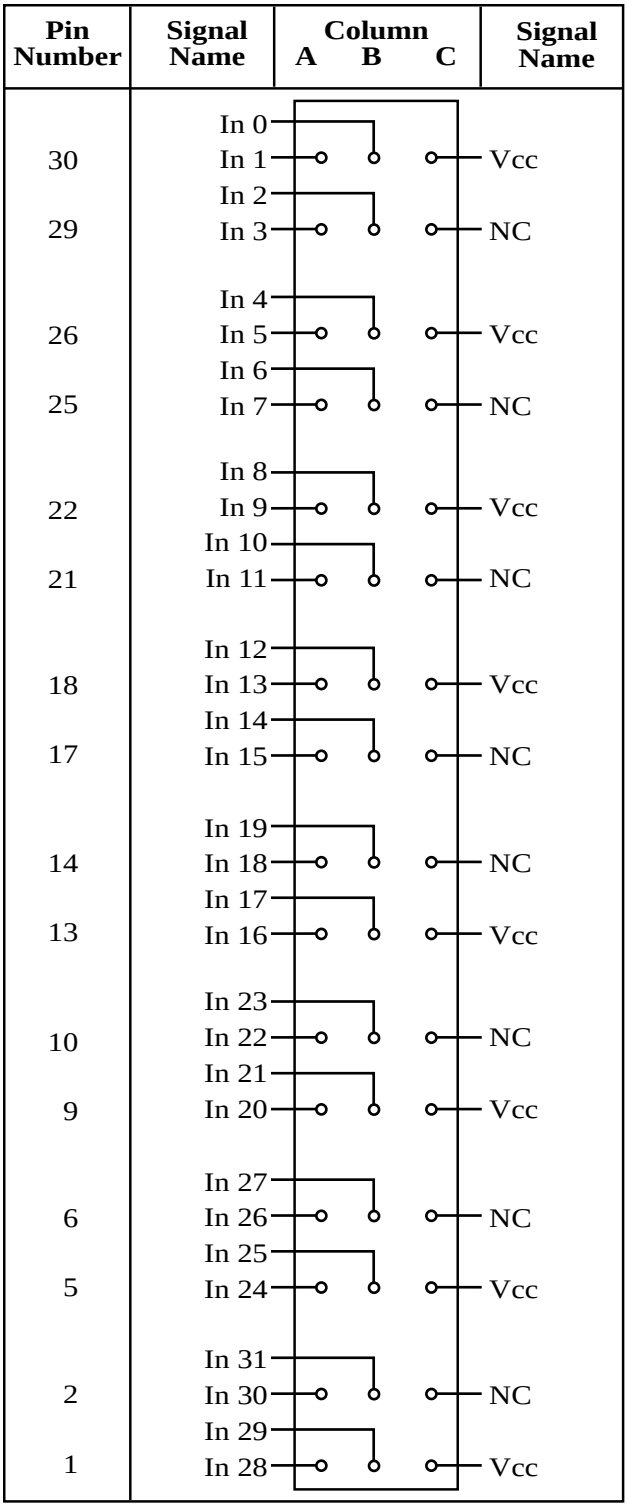


Figure 2-2. SCXI-1162 Front Connector Pin Assignment

Front Connector Signal Descriptions

Pin	Signal Name	Description
B30, A30, B29, A29, C30	In <0..3>, Vcc	Bank 0 input channels and Vcc
B26, A26, B25, A25, C26,	In <4..7>, Vcc	Bank 1 input channels and Vcc
B22, A22, B21, A21, C22	In <8..11>, Vcc	Bank 2 input channels and Vcc
B18, A18, B17, A17, C18	In <12..15>, Vcc	Bank 3 input channels and Vcc
A13, B13, A14, B14, C13	In <16..19>, Vcc	Bank 4 input channels and Vcc
A9, B9, A10, B10, C9	In <20..23>, Vcc	Bank 5 input channels and Vcc
A5, B5, A6, B6, C5	In <24..27>, Vcc	Bank 6 input channels and Vcc
A1, B1, A2, B2, C1	In <28..32>, Vcc	Bank 7 input channels and Vcc
C2, C6, C10, C14, C17, C21, C25, C29	NC (No Connect)	Unused pins

The optically isolated inputs of the SCXI-1162 consist of a light-emitting diode and a 360 Ω series current limiting resistor. When current is pulled through an input, the diode emits light which is sensed by a photosensitive circuit. When this circuit senses the light, it outputs a logic low digital signal.

The SCXI-1162 consists of eight banks of four of these optically isolated digital inputs. Each bank of inputs has a separate connection for the positive voltage (Vcc) of a 5 to 10 V supply. The four inputs of each bank are referenced to the Vcc of that bank; therefore, for any bank of inputs to work, a Vcc must be connected to that bank. An input will register a logic low when it is driven to at least 4 V below its Vcc. Each input requires at most 7 mA of current to drive it to this logic low state. An input will register a logic high when no current flows through it. Figure 2-3 shows examples of how the SCXI-1162 can be connected to different signals. Only bank 0 is shown; however, other banks are identical.

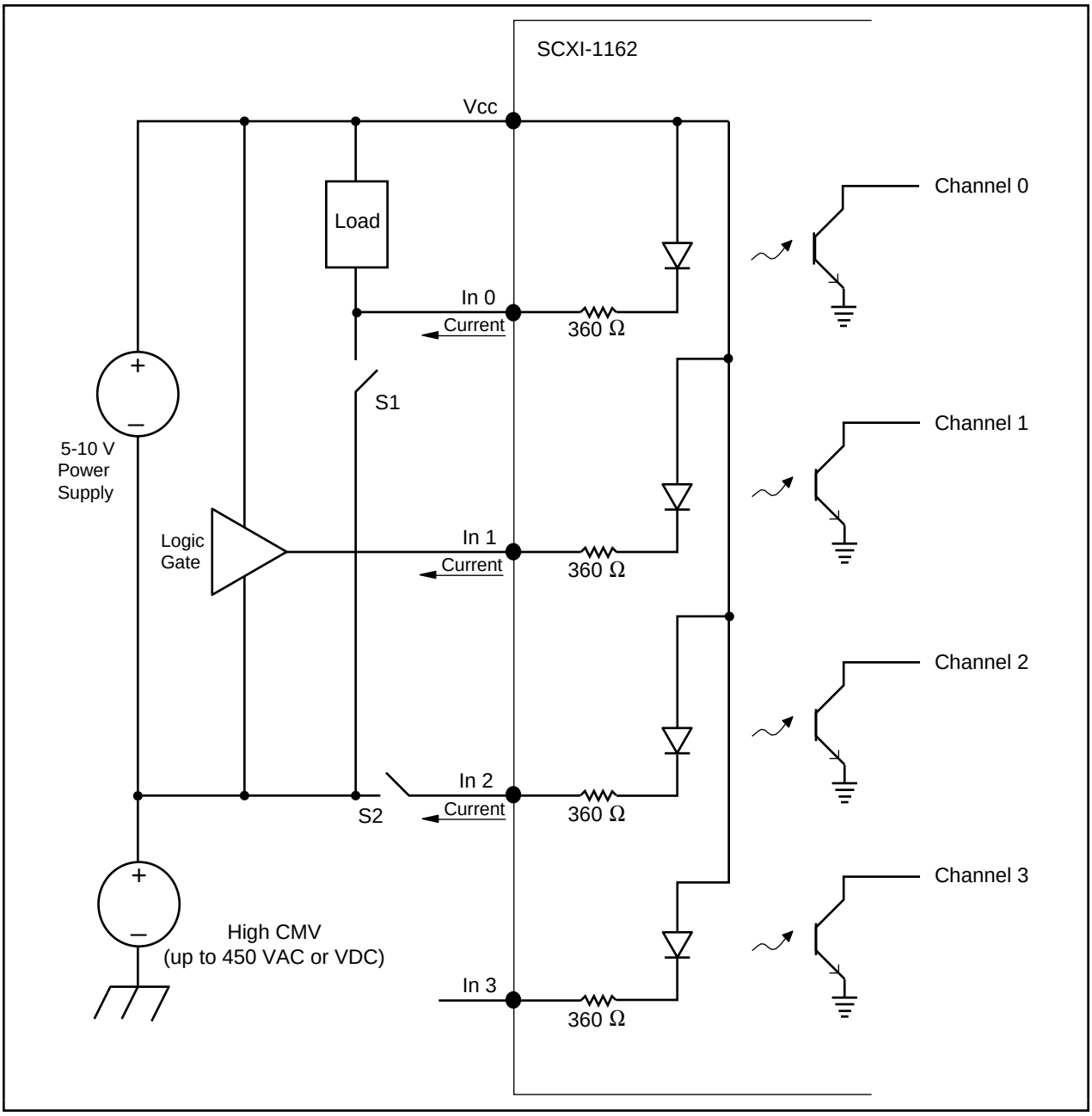


Figure 2-3. Signal Connection Examples

Figure 2-3 shows Vcc connected to the positive voltage of a 5 to 10 V power supply. An input senses a logic low when it is driven to the negative voltage of this supply. For example, In 0 is sensing whether a load is being powered. Closing switch S1 will connect In 0 and the negative terminal of the load to the negative supply voltage, thus powering the load and returning a logic low for channel 0. With switch S1 open, current does not flow through the load or through In 0, and a logic high is returned.

In 1 is shown driven by a logic gate that is powered by the 5 to 10 V power supply. This gate may be a TTL, CMOS, open-collector, or other logic gate capable of sinking at least 7 mA when it outputs a logic low. When the gate outputs a logic low, it sinks current from In 1, and channel 1 returns a logic low. When the gate outputs a logic high, no current flows through In 1 and channel 1 returns a logic high.

In 2 as shown is connected to the negative voltage of the 5 to 10 V power supply when switch S2 is closed and is disconnected when S2 is open. Thus, closing switch S2 will drive In 2 to 5 to 10 V below Vcc, causing channel 2 to return a logic low. Opening switch S2 will prevent current from flowing through In 2, causing channel 2 to return a logic high.

In 3 is shown as unconnected; thus, no current is available to drive it below Vcc, and channel 3 will return a logic high.

The Vcc and inputs of each bank are isolated from the Vcc and inputs of any other bank. In addition, all signals are isolated from the chassis earth ground and the internal circuitry of the module. These isolation barriers provide isolation for voltages up to 450 VAC or VDC. ***There is no isolation between signals of the same bank!*** The voltage at any input must never be driven more than 10 V below its Vcc, nor may it ever be allowed to go more than 5 V above its Vcc.

If a Vcc must be connected to a power supply of more than 10 V, you can add an additional series resistor to an input to limit the current through that input to below 25 mA. This additional resistor prevents the voltage at the input from being driven more than 10 V below Vcc. To select the proper amount of series resistance and the required power rating of the series resistor, use the following equations:

$$(Vcc - 10) / 24 < R_{series} < (V_{drop} - 4) / 7$$

$$P_{rated} > (Vcc)^2 / (1000 \times R_{series})$$

where Vcc = the maximum voltage of the power supply connected to the Vcc terminal

V_{drop} = the voltage drop below Vcc required to guarantee a logic low

R_{series} = the value of the series resistor in kΩ

P_{rated} = the power rating of the series resistor (in watts).

For example, if you are using a 24 V power supply, and you want the channel to return a logic low whenever the input is driven at least 20 V below Vcc, the first equation becomes:

$$(24 - 10) / 24 < R_{series} < (20 - 4) / 7$$

$$1.4 < R_{series} < 2.28$$

If a resistance of 1.5 kΩ is used, the power rating of the resistor must be at least $(24)^2 / (1500) = 0.38$ watts. Figure 2-4 shows one way to implement this example.

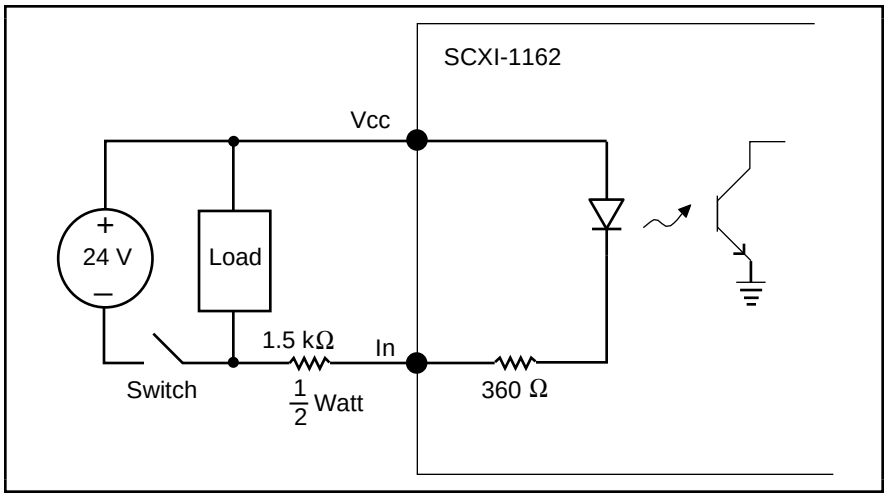


Figure 2-4. Adding Series Resistance

Terminal Block

A terminal block with screw terminals is available for easy signal connection to the SCXI-1162 inputs. This kit is listed in the *Optional Equipment* section in Chapter 1, *Introduction.*

SCXI-1326 Terminal Block

The SCXI-1326 terminal block consists of a shielded board with supports to connect it to the SCXI-1162 input connector. The SCXI-1326 has 48 screw terminals for easy signal connection. When connecting your signals to the SCXI-1326 for use with the SCXI-1162, follow the labeling as indicated in Figure 2-5, *SCXI-1326 Parts Locator Diagram*.

The following warnings contain important safety information concerning hazardous voltages.

Warnings:

- When using the terminal block with high common-mode voltages, your signal wires *must* be insulated appropriately. National Instruments is *not* liable for any damages or injuries resulting from inadequate signal wire insulation.
- When connecting or disconnecting signal lines to the SCXI-1326 terminal block screw terminals, the lines must be powered off to avoid shock hazard.
- Connections, including power signals to ground and vice versa, that exceed any of the maximum signal ratings on the SCXI-1162 can result in damage to any or all of the boards connected to the SCXI chassis, to the host computer, and to the SCXI-1162 module. National Instruments *is not liable for any damages or injuries* resulting from incorrect signal connections.
- If high voltages (≥42 Vrms) are present, the *safety earth ground must be connected to the strain relief tab*. This complies with UL 1244 and fully protects against electric shock when the terminal block is not connected to the chassis. To connect the safety earth ground to the strain-relief tab, run an earth ground wire in the cable from the signal source to the terminal block. National Instruments is *not* liable for any damages or injuries resulting from inadequate safety earth ground connections.

Signal Connection**.** To connect the signal to the terminal block, use the following procedure:

1. Remove the grounding screw of the top cover.
2. Snap out the top cover of the shield by placing a screwdriver in the groove at the bottom of the terminal block.
3. Slide the signal wires, one at a time, through the front panel strain relief. Additional insulation or padding may be added if necessary.
4. Connect the wires to the screw terminals, making sure to supply a Vcc for each bank used. No ground signal connection is required for the SCXI-1162.
5. Tighten the strain relief by tightening the larger screws.
6. Snap the top cover back in place.
7. Replace the grounding screw to ensure proper shielding.
8. Connect the terminal block to the SCXI-1162 front connector as explained in the *SCXI-1326 Installation* section, the next section in this chapter.

Figure 2-5 shows a parts locator diagram for the SCXI-1326 terminal block.

Warning: If high voltages (≥42 Vrms) are present, the *safety earth ground must be connected to the strain relief tab*. This complies with UL 1244 and fully protects against electric shock when the terminal block is not connected to the chassis. To connect the safety earth ground to the strain relief tab, run an earth ground wire in the cable from the signal source to the terminal block. National Instruments is *not* liable for any damages or injuries resulting from inadequate safety earth ground connections.

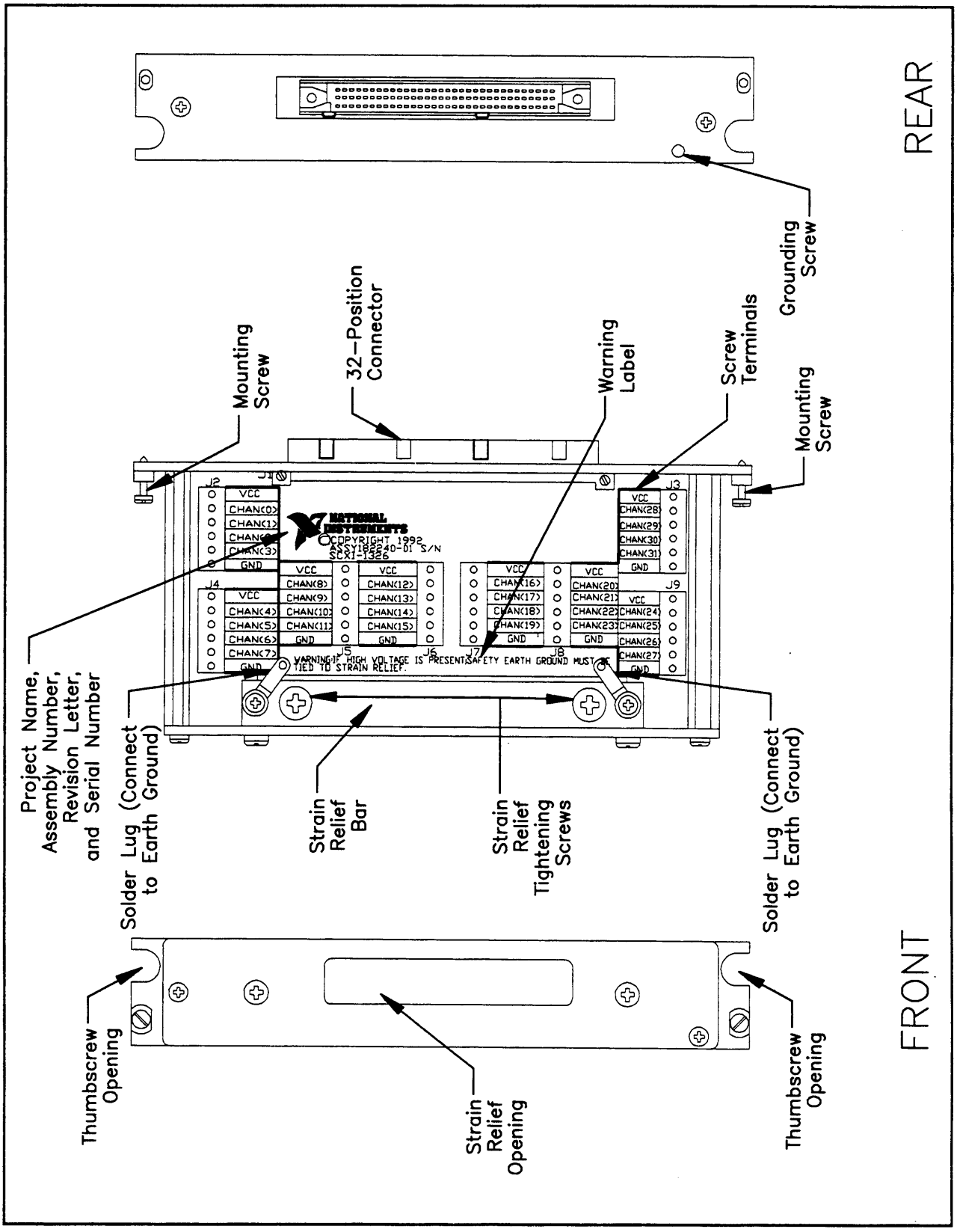


Figure 2-5. SCXI-1326 Parts Locator Diagram

SCXI-1326 Installation. To connect the terminal block to the SCXI-1162 front connector, follow these steps:

1. Connect the SCXI-1162 front connector to its mating connector on the terminal block.
2. Make sure that the SCXI-1162 top and bottom thumbscrews do not obstruct the rear panel of the terminal block.
3. Tighten the top and bottom screws on the back of the terminal block to hold it securely in place.

Rear Signal Connector

Note: If you will use the SCXI-1162 with a National Instruments data acquisition board and cable assembly, you do not need to read the remainder of this chapter. If you will also use the SCXI-1180 feedthrough panel, the SCXI-1343 rear screw terminal adapter, or the SCXI-1351 one-slot cable extender with the SCXI-1162, read this section.

The rear signal connector is configured based on the jumper settings described earlier in this chapter. Jumper W2 determines whether the rear connector will be used for serial or parallel communication. If jumper W2 is set to serial, then jumpers W3, W4, and W6 determine whether the rear connector is configured for an MIO-type connection or a DIO-type connection. If jumper W2 is set to parallel, then jumper W1 determines whether lines 0 through 23 or lines 0 through 31 are active.

Figure 2-6A shows the pin assignments for the SCXI-1162 rear signal connector configured for serial communication, and Figure 2-6B shows the pin assignments for the SCXI-1162 rear signal connector configured for parallel communication.

Figure 2-6 shows the pin assignments for the SCXI-1162 rear signal connector.

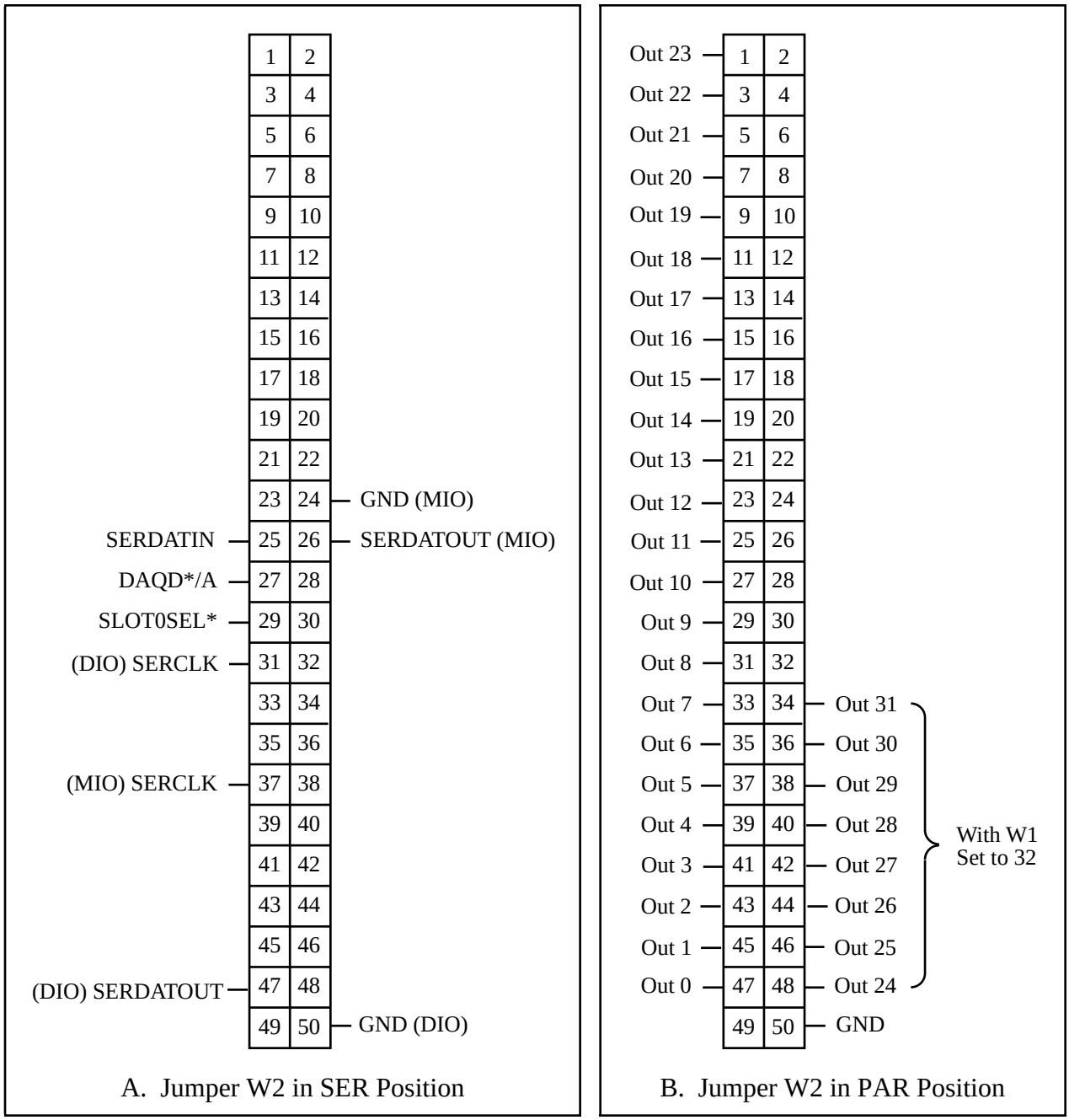


Figure 2-6. SCXI-1162 Rear Signal Connector Pin Assignments

Rear Signal Connector Signal Descriptions

With the rear connector configured for serial communication, the signals are as follows:

Pin	Signal	Description
24 or 50	DIG GND	Digital Ground – Supplies the reference for data acquisition board digital signals and is tied to the module digital ground. Pin 50 is for DIO boards. Pin 24 is for MIO boards and jumper W4 selects it.
25	SERDATIN	Serial Data In – Taps into the SCXIbus MOSI line to provide serial input data to a module or Slot 0.
26 or 47	SERDATOUT	Serial Data Out – Taps into the SCXIbus MISO line to accept serial output data from a module. Pin 47 is for DIO boards. Pin 26 is for MIO boards and jumper W6 selects it.
27	DAQD*/A	Data Acquisition Board Data/Address Line – Taps into the SCXIbus D*/A line to indicate to the module whether the incoming serial stream is data or address information.
29	SLOT0SEL*	Slot 0 Select – Taps into the SCXIbus INTR* line to indicate whether the information on MOSI is sent to a module or to Slot 0.
31 or 37	SERCLK	Serial Clock – Taps into the SCXIbus SPICLK line to clock the data on the MOSI and MISO lines. Pin 31 is for DIO boards. Pin 37 is for MIO boards and jumper W3 selects it.

* indicates active low.
All other pins are not connected.

With the rear connector configured for parallel communication, the signals are as follows:

Pin	Signal	Description
1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47	Out <23..0>	Parallel outputs driven to the logic levels seen at inputs 23 through 0.
34, 36, 38, 40, 42, 44, 46, 48	Out <31..24>	Parallel outputs driven to the logic levels seen at inputs 31 through 24 when jumper W1 is set to 32.
50	GND	Ground – Supplies ground reference for the parallel outputs.

All other pins are not connected.

See the *Timing Requirements and Communication Protocol* section later in this chapter for more detailed information on timing.

The signals on the rear signal connector are digital I/O signals. Signal connection guidelines for each of these groups are given in the following section.

Digital I/O Signal Connections

Pins 24 through 27, 29, 31, 37, 47, and 50 constitute the digital I/O lines of the rear signal connector when the connector is configured for serial communication. The lines are divided into three categories–the digital input signals, the digital output signals, and the digital timing signals.

The digital input signals are pins 24 or 50, 25, 27, 29, and 31 or 37. The data acquisition board uses these pins to configure the SCXI module that the data acquisition board controls. Each digital line emulates the SCXIbus communication signals as follows:

- Pin 25 is SERDATIN and is equivalent to the SCXIbus MOSI serial data input line.
- Pin 27 is DAQD*/A and is equivalent to the SCXIbus D*/A line. It indicates to the module whether the incoming serial stream on SERDATIN is data (DAQD*/A = 0) or address (DAQD*/A = 1) information.
- Pin 29 is SLOT0SEL* and is equivalent to the SCXIbus INTR* line. It indicates whether the data on the SERDATIN line is being sent to Slot 0 (SLOT0SEL* = 0) or to a module (SLOT0SEL* = 1).
- Pin 24 or 50 is the digital ground reference for the data acquisition board digital signals and is tied to the module digital ground via jumper W3. Pins 24 and 50 are *not* tied together.
    - Pin 24 is for MIO-type boards with jumper W4 in the MIO position.
    - Pin 50 is for DIO-type boards with jumper W4 in the DIO position.
- Pin 31 or 37 is SERCLK and is equivalent to the SCXIbus SPICLK line. These pins clock the serial data on the SERDATIN line into the module registers. Pins 31 and 37 are *not* tied together.
    - Pin 31 is for DIO-type boards with jumper W3 in the DIO position.
    - Pin 37 is for MIO-type boards with jumper W3 in the MIO position.

The digital output signal is pin 26 or 47:

- Pin 26 or 47 is SERDATOUT and is equivalent to SCXIbus MISO when jumper W5 is in position 1. Pins 26 and 47 are *not* tied together.
    - Pin 26 is for MIO-type boards with jumper W6 in the MIO position.
    - Pin 47 is for DIO-type boards with jumper W6 in the DIO position.

When you configure the SCXI-1162 for an MIO-type board, the digital I/O signals of the SCXI-1162 match the digital I/O lines of the MIO-16 board. When used with an SCXI-1341, SCXI-1342, or SCXI-1344 cable assembly, the SCXI-1162 signals match the digital lines of the Lab-NB/Lab-PC/Lab-PC+/Lab-LC boards and the PC-LPM-16 board, respectively. When you configure the SCXI-1162 for a DIO board, the digital I/O signals of the SCXI-1162 match the digital I/O lines of the DIO-24 and DIO-96 boards. When used with an SCXI-1348 cable assembly, the SCXI-1162 signals match the digital lines of the DIO-32F board.

Table 2-2 lists the pin equivalences. For more information, consult Appendix E, *SCXI-1162 Cabling*.

Table 2-2. SCXIbus to SCXI-1162 Rear Signal Connector to Data Acquisition Board Pin Equivalences

SCXIbus Line	SCXI-1162 Rear Signal Connector	MIO-16	Lab-NB/Lab-PC/ Lab-PC+/Lab-LC	PC-LPM-16	DIO-24	DIO-96	DIO-32F
MOSI	SERDATIN	ADIO0	PB4	DOUT4	PB3	APB3	DIOB3
D*/A	DAQD*/A	ADIO1	PB5	DOUT5	PB2	APB2	DIOB2
INTR*	SLOT0SEL*	ADIO2	PB6	DOUT6	PB1	APB1	DIOB1
SPICLK	SERCLK	EXTSTROBE*	PB7	DOUT7	PB0	APB0	DIOB0
MISO	SERDATOUT	BDIO0	PC1	DIN6	PA0	APA0	DIOA0

The following specifications and ratings apply to the digital I/O lines.

Absolute maximum voltage input rating — 5.5 V with respect to DIG GND

Digital input specifications (referenced to DIG GND):

V_{IH} input logic high voltage — 2 V minimum
V_{IL} input logic low voltage — 0.8 V maximum

I_I input current leakage — ±1 µA maximum

Digital output specifications (referenced to DIG GND):

V_{OH} output logic high voltage — 3.7 V minimum at 4 mA maximum
V_{OL} output logic low voltage — 0.4 V maximum at 4 mA maximum

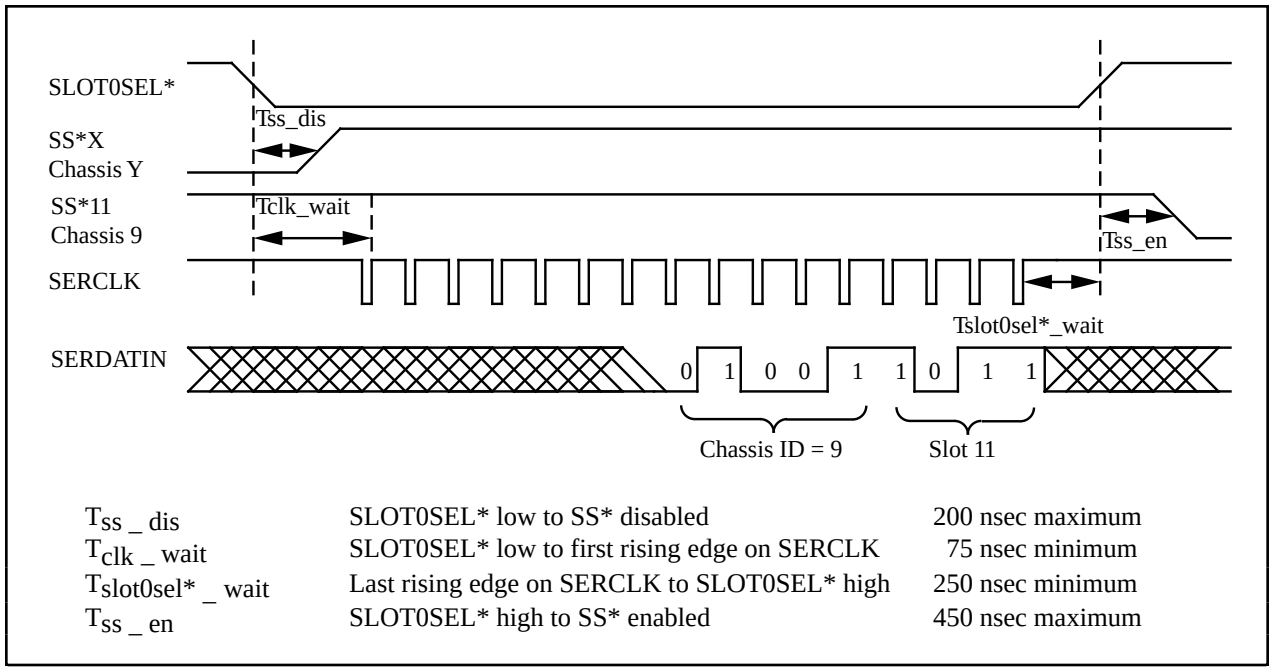
Timing Requirements and Communication Protocol

Communication Signals

This section describes the methods for communicating on the Serial Peripheral Interface (SPI) bus and their timing requirements. The communication signals are SERDATIN, DAQD*/A, SLOT0SEL*, SERDATOUT, and SERCLK. Furthermore, Slot 0 produces SS* according to data acquisition board programming; therefore SS* timing relationships will also be discussed. For information on the Slot 0 Slot-Select Register, consult Chapter 4, *Register Descriptions*.

The data acquisition board determines to which slot it will talk to by writing a slot-select number to Slot 0. In the case of an SCXI-1001 chassis, this write also determines to which chassis the data acquisition board will talk.

Use the following procedure for selecting a slot in a particular chassis. Figure 2-7 illustrates the timing of this procedure with the example of selecting Slot 11 in Chassis 9. Notice that the factory-default chassis address for the SCXI-1001 is address 0. For information on changing the address of your chassis, consult the *SCXI-1000/1001 User Manual*. An SCXI-1000 chassis will respond to any chassis number.



T_{ss_dis}	SLOT0SEL* low to SS* disabled	200 nsec maximum
T_{clk_wait}	SLOT0SEL* low to first rising edge on SERCLK	75 nsec minimum
$T_{slot0sel*_wait}$	Last rising edge on SERCLK to SLOT0SEL* high	250 nsec minimum
T_{ss_en}	SLOT0SEL* high to SS* enabled	450 nsec maximum

Figure 2-7. Slot-Select Timing Diagram

To write the 16-bit slot-select number to Slot 0, follow these steps:

1. Initial conditions:

   SERDATIN = don't care.
   DAQD*/A = 1.
   SLOT0SEL* = 1.
   SERCLK = 1.

2. Clear SLOT0SEL* to 0. This will deassert all SS* lines to all modules in all chassis.

3. For each bit, starting with the MSB, perform the following action:

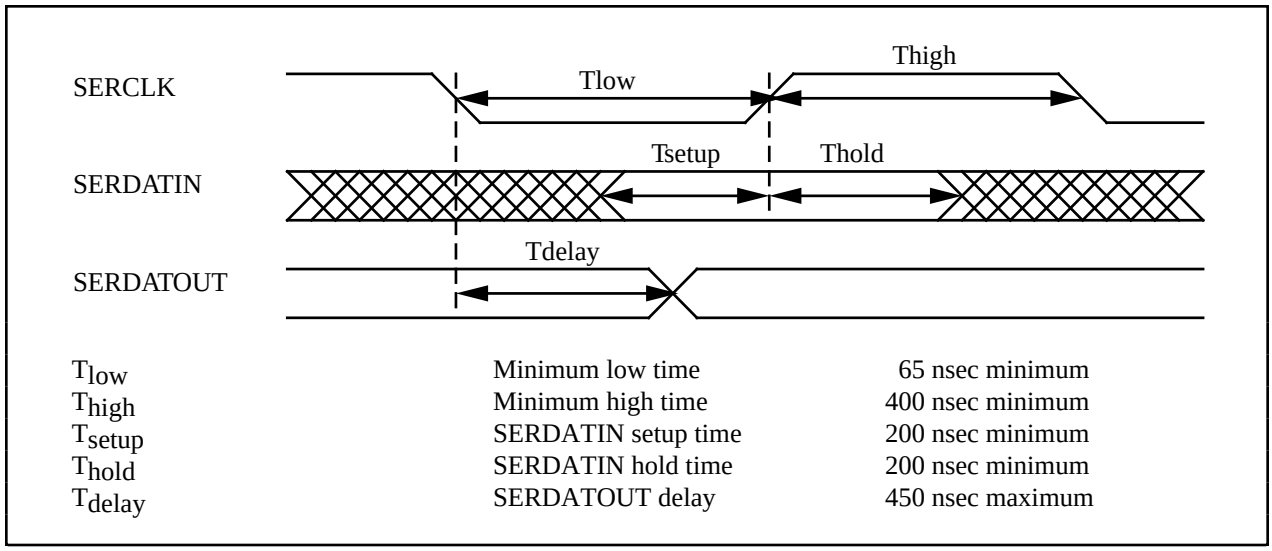
   a. Set SERDATIN = bit to be sent. These bits are the data that are being written to the Slot-Select Register.

   b. SERCLK = 0.

   c. SERCLK = 1. This rising edge clocks the data.

4. Set SLOT0SEL* to 1. This will assert the SS* line of the module whose slot number was written to Slot 0. If multiple chassis are being used, only the appropriate slot in the chassis whose address corresponds to the written chassis number will be selected. When no communication is taking place between the data acquisition board and any modules, write zero to the Slot-Select Register to ensure that no accidental writes occur.

Figure 2-8 shows the timing requirements on the SERCLK and SERDATIN signals. You must observe these timing requirements for all communications. T_{delay} is a specification of the SCXI-1162.



T_{low}	Minimum low time	65 nsec minimum
T_{high}	Minimum high time	400 nsec minimum
T_{setup}	SERDATIN setup time	200 nsec minimum
T_{hold}	SERDATIN hold time	200 nsec minimum
T_{delay}	SERDATOUT delay	450 nsec maximum

Figure 2-8. Serial Data Timing Diagram

After selecting the module slot as previously described, you must write first to the Address Handler, then to the register of interest, for each read cycle from the module.

To write to the Address Handler, follow these steps:

1. Initial conditions:

   SS* asserted low.
   SERDATIN = don't care.
   DAQD*/A = 1 (indicates data will be written to the Address Handler).
   SLOT0SEL* = 1.
   SERCLK = 1 (and has not transitioned since SS* went low).

2. For each bit, starting with the MSB, perform the following action:

   Establish the desired SERDATIN level corresponding to this bit.
   SERCLK = 0.
   SERCLK = 1. This rising edge clocks the data.

   These bits are the address of the register of interest.

3. Pull DAQD*/A low to deselect the Address Handler and select the register whose address was written to the Address Handler. This selects a register for writing to or reading from.

Figure 2-9 illustrates a write to the SCXI-1162 Address Handler of the binary pattern:

```
0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 1
```

This pattern is the address of the Data Register.

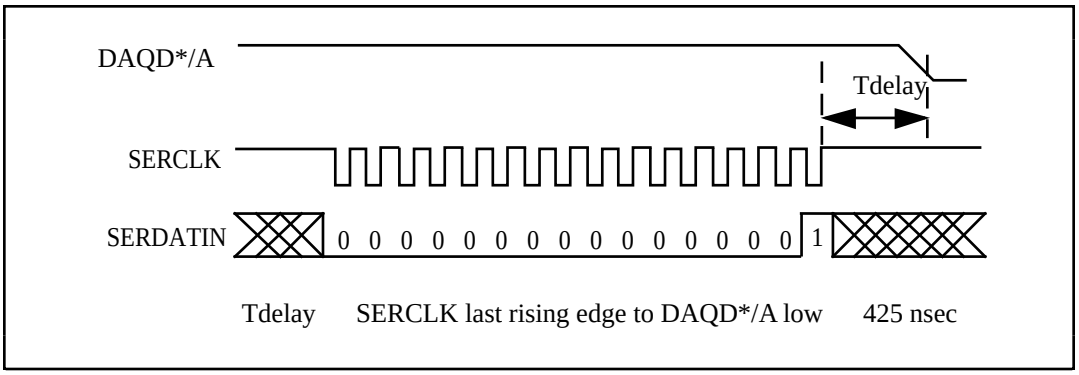


Figure 2-9. Address Handler Timing Diagram

After the Address Handler has been written to, an address line of a register has been asserted. At that stage you can read from the SCXI-1162 Data Register or Module ID Register using the following protocol. The contents of the Module ID Register are reinitialized by deasserting Slot-Select or by releasing DAQ D*/A high. After the 32 bits of data are read from the Module ID Register, further data will be zeros until reinitialization occurs. The Data Register latches in the digital values at the inputs when it is selected (that is, when D*/A goes low). After the 32 bits of data are read from the Data Register, further data will be invalid until a new pattern is latched in by reselecting the Data Register.

To read from the Module ID Register or the Data Register, follow these steps:

1. Initial conditions:

   SS* asserted low.
   SERDATIN = don't care.
   DAQD*/A = 0.
   SLOT0SEL* = 1.
   SERCLK = 1 (and has not changed since DAQD*/A went low).

2. For each bit to be read:

   Set SERCLK = 0.
   SERCLK = 1. This rising edge clocks the data.
   Read the level of the SERDATOUT line.

3. Pull DAQD*/A high. This disables further reads from the Register. If you wish, you can write address FFFF (hexadecimal) to the Address Handler. This selects the Parking Register and makes the module registers more immune to noise.

4. Pull SLOT0SEL* low to deassert the SS* line and establish conditions for writing a new slot-select number to the Slot 0 Slot-Select Register.

5. If you are not selecting another slot, write zero to the Slot 0 Slot-Select Register.

Figure 2-10 illustrates a read of the SCXI-1162 Module ID Register.

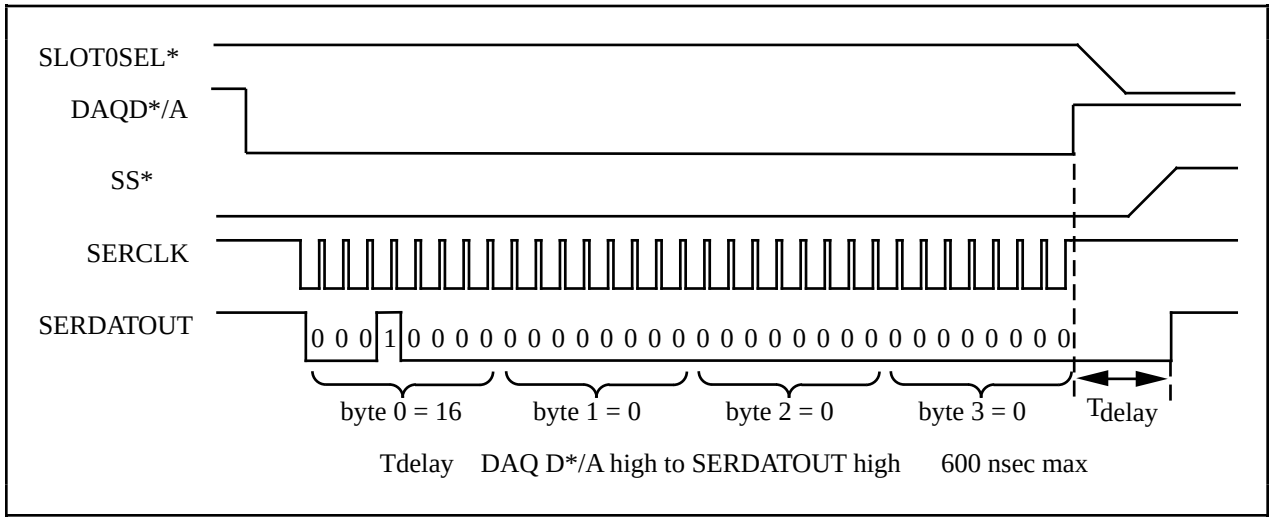


Figure 2-10. SCXI-1162 Module ID Register Timing Diagram

Figure 2-11 illustrates a read of the SCXI-1162 Data Register.

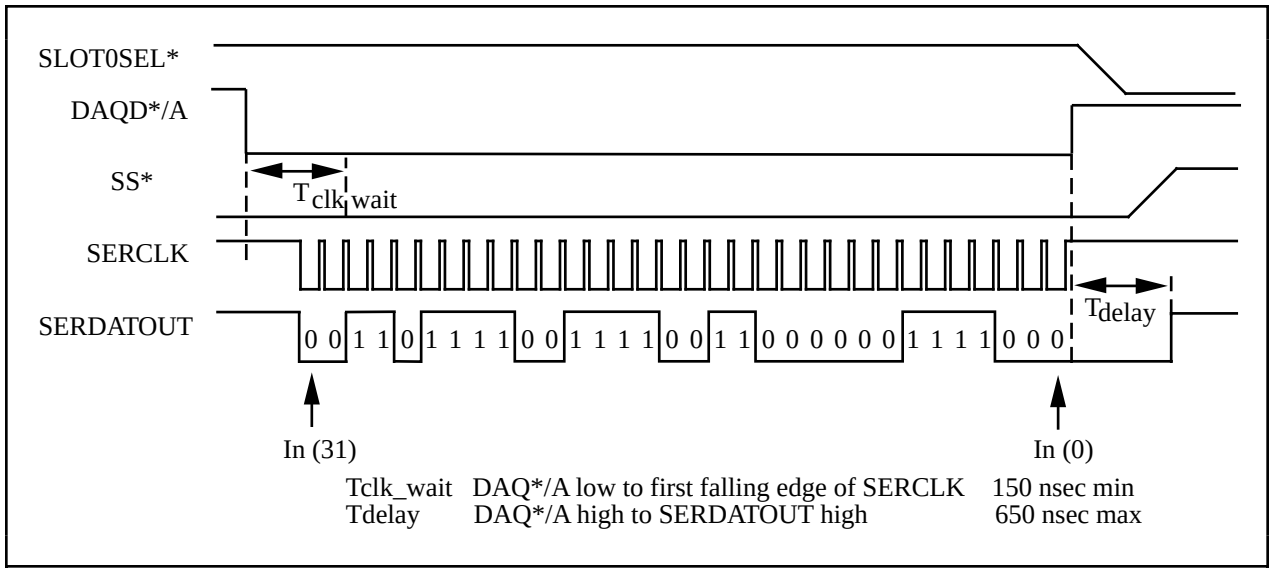


Figure 2-11. SCXI-1162 Data Register Read Timing Diagram

For further details on these registers and their addresses, refer to Chapter 4, *Register Descriptions*, and Chapter 5, *Programming*.

Chapter 3
Theory of Operation

This chapter contains a functional overview of the SCXI-1162 module and explains the operation of each functional unit making up the SCXI-1162.

Functional Overview

The block diagram in Figure 3-1 illustrates the key functional components of the SCXI-1162.

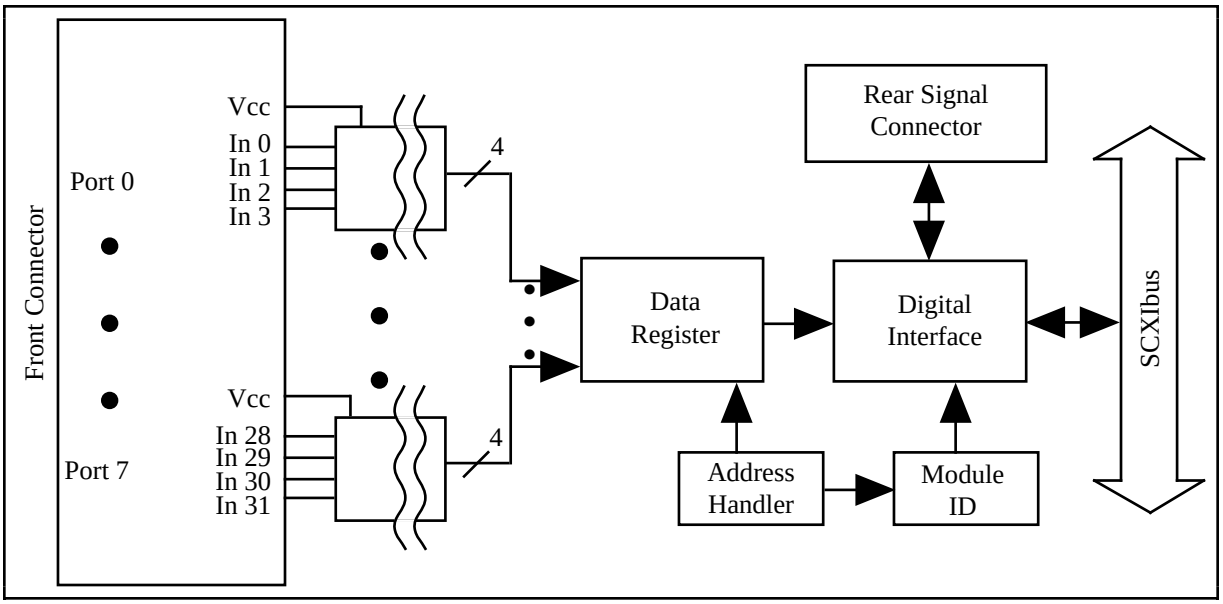


Figure 3-1. SCXI-1162 Block Diagram

The major components of the SCXI-1162 are as follows:

- SCXIbus connector
- Register circuitry
- Digital interface circuitry
- Optically isolated input channels

The SCXI-1162 module is dedicated to acquiring digital signals in the presence of common-mode voltages. The theory of operation of each of the SCXI-1162 components is explained in the rest of this chapter.

SCXIbus Connector

Figure 3-2 shows the pinout of the SCXIbus connector.

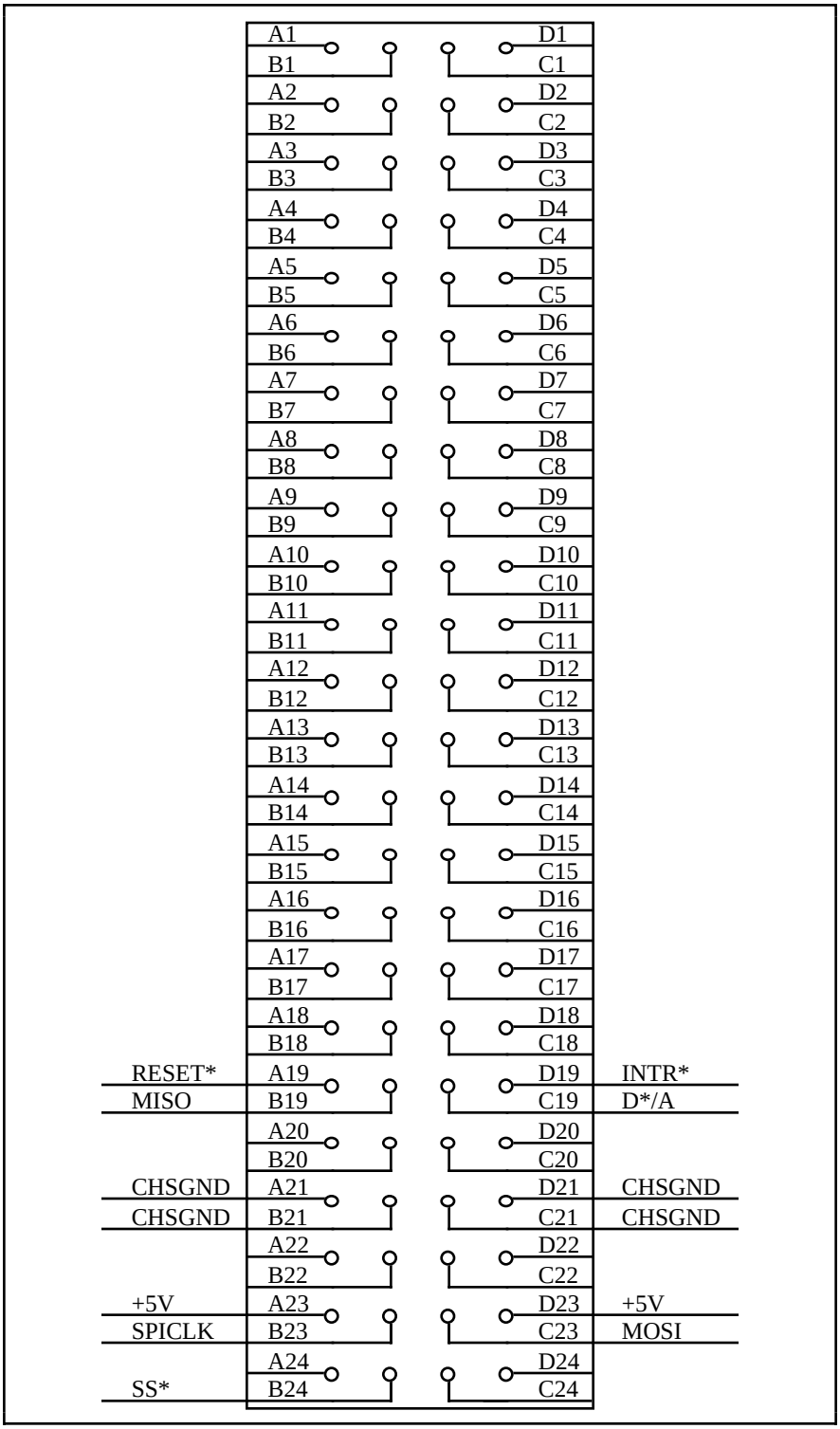


Figure 3-2. SCXIbus Connector Pin Assignment

SCXIbus Connector Signal Descriptions

Pin	Signal Name	Description
A21, B21, C21, D21	CHSGND	Chassis Ground – Digital ground reference.
A19	RESET*	Reset – When pulled low, reinitializes the module to its power-up state. Totem pole. Input.
B19	MISO	Master-In-Slave-Out – Transmits data from the module to the SCXIbus. Open collector. I/O.
C19	D*/A	Data/Address – Indicates to the module whether address information or data information is being sent to the module on MOSI. Open collector. I/O.
D19	INTR*	Interrupt – Active low. Causes data that is on MOSI to be written to the Slot 0 Slot-Select Register. Open collector. Output.
A23, D23	+5 V	+5 VDC Source – Digital power supply.
B23	SPICLK	Serial Peripheral Interface (SPI) Clock – Clocks the serial data on the MOSI and MISO lines. Open collector. I/O.
C23	MOSI	Master-Out-Slave-In – Transmits data from the SCXIbus to the module. Open collector. I/O.
B24	SS*	Slot Select – When low, enables module communications over the SCXIbus. Totem pole. Input.

All other pins are not connected.

MOSI, MISO, SPICLK, and SS* form a synchronous communication link that conforms with SPI using an idle-high clock and second-edge data latching. D*/A, INTR*, and RESET* are additional control signals.

When the module is in an SCXI-1000 or SCXI-1001 chassis, the data acquisition board, via the module rear signal connector, must tap into the open-collector backplane signal lines as a master to communicate on the SCXIbus. The signal connections from the rear signal connector to the backplane are shown in Table 3-1.

Table 3-1. SCXIbus Equivalents for the Rear Signal Connector

Rear Signal Connector Signal	SCXIbus Equivalent
SERDATIN	MOSI
DAQD*/A	D*/A
SLOT0SEL*	INTR*
SERCLK	SPICLK
SERDATOUT	MISO You must set jumper W6 to position DIO or MIO.

When the rear connector is jumper configured for serial communication with the SCXIbus, the SCXI-1162 module converts the data acquisition board signals to open-collector signals on the backplane of the SCXI chassis. For the data acquisition board to talk to a slot, the board must first assert the SS* for that slot. You do this by asserting INTR* low, writing a 16-bit number over MOSI corresponding to the desired slot (and chassis if you are using an SCXI-1001 chassis), and then releasing INTR* high. At this point, the SS* of the desired slot is asserted low and the data acquisition board can communicate with the module in that slot according to the SPI protocol.

Digital Interface

Figure 3-3 shows a diagram of the SCXI-1162 and SCXIbus digital interface circuitry.

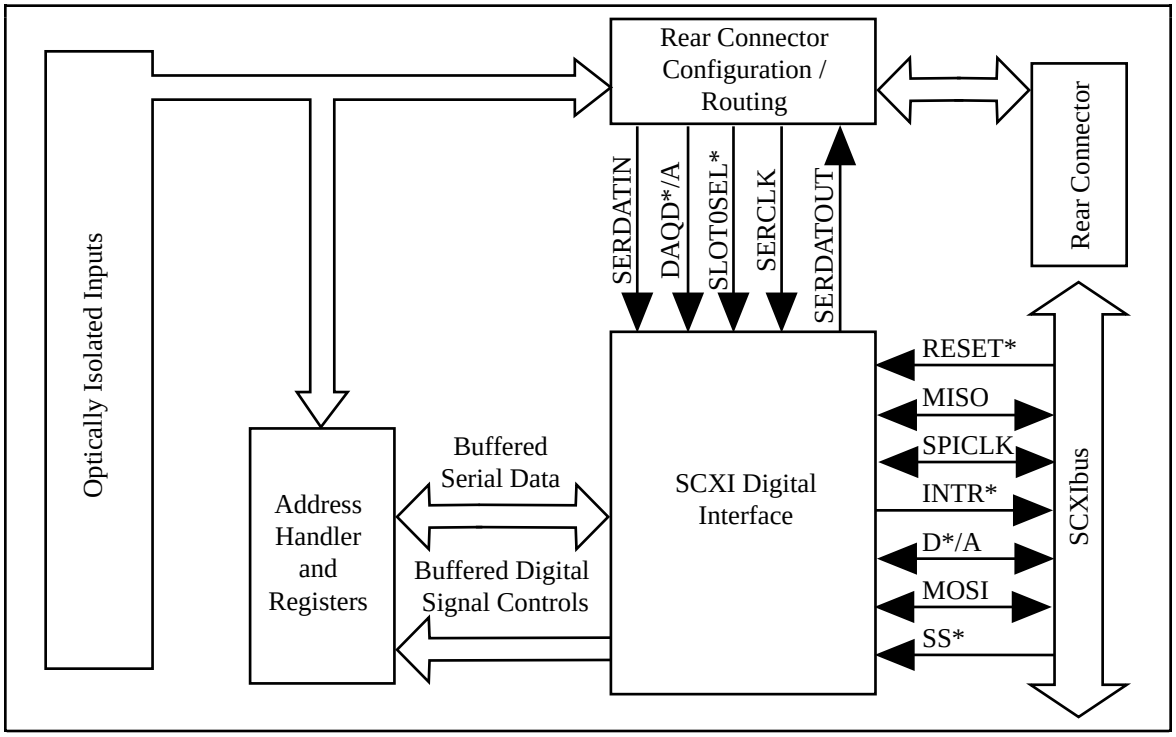


Figure 3-3. Digital Interface Circuitry Block Diagram

This circuitry is divided into an SCXI digital interface section and rear connector interface section.

The SCXI digital interface buffers signals from the SCXIbus to the module and drives signals from the module onto the SCXIbus.

The rear connector routing circuit determines the function of the rear connector from the jumper settings. The rear connector interface configures the rear connector for connection to either a DIO-type or an MIO-type data acquisition board. It also determines from the setting of jumper W2 whether to route the data signal directly to the rear connector in parallel or whether to establish a serial communication link to the SCXIbus interface. If the routing is to be in parallel, then the rear connector interface determines from jumper W1 whether to drive lines 0 through 31 or only lines 0 through 23.

Register Circuitry

Figure 3-4 diagrams the SCXI-1162 register circuitry.

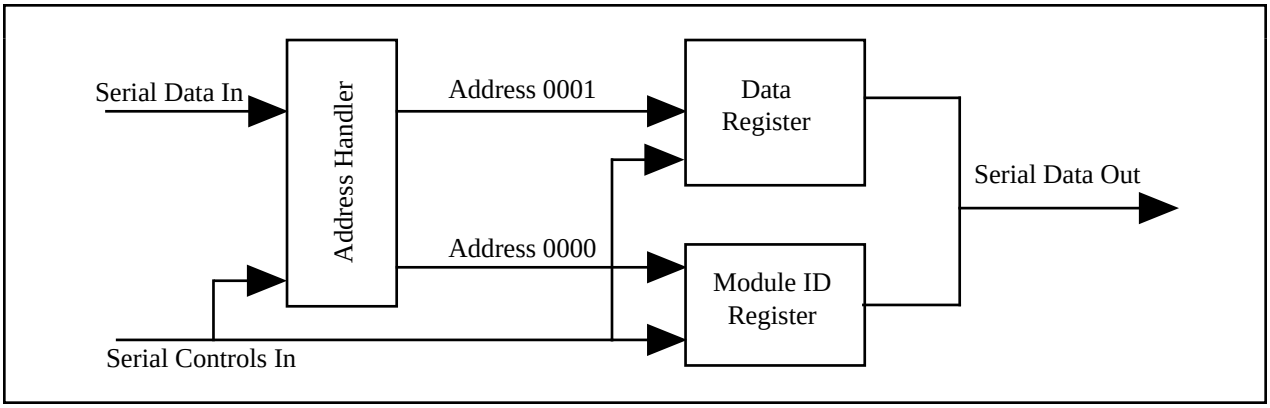


Figure 3-4. SCXI-1162 Register Circuitry

The register circuitry section consists of the Address Handler, the Data Register, and the Module ID Register.

The Data Register contains a 4-byte parallel-in serial-out shift register. When the SS* line is low (indicating that the module slot has been selected) and the address handler has selected address 0001, data from the isolated inputs is loaded into the Data Register when the D*/A line goes low (indicating a data transfer). After each downward transition of SPICLK, one data bit is clocked out, starting with bit 31. After all 32 bits are clocked out, D*/A must make another high-to-low transition to reload the data.

The Module ID Register connects to MISO on the SCXIbus. The Module ID Register is a read-only 4-byte parallel-in serial-out shift register and an SPI communication adapter. The address of the Module ID Register is hex 0000. The contents of the Module ID Register are written onto MISO during the first four bytes of transfer after you select the Module ID Register in the Address Handler. The Module ID Register will write zeros to MISO thereafter until you deselect the Module ID Register. The SCXI-1162 module ID is hex 00000010.

Reads from the Module ID or Data Registers require the following steps:

1. SS* goes low, enabling communication with the board. D*/A should be high, indicating communication with the address handler.
2. Write 0000 or 0001 (hexadecimal) to the Address Handler. This selects the Module ID Register or the Data Register, respectively.
3. D*/A goes low, indicating communication with a register. This action latches the bits into the register.
4. The serial data is available on MISO and SPICLK clocks it from the register.
5. SS* goes high and D*/A goes high, indicating an end of communication.

Input Channels

The SCXI-1162 consists of eight banks of four optically isolated digital inputs. Each bank of outputs has an isolated connection for the Vcc for that bank . The inputs of each bank are referenced from their particular Vccs; thus, for any bank of inputs to work, a Vcc must be connected to that particular bank . When an input is driven low, it must be pulled to 4 V below its respective Vcc with at least 7 mA of current to guarantee a logic low. The Vcc and four inputs of one bank are isolated from the Vcc and four inputs of any other bank , as well as from the internal circuitry of the module. The channel and bank assignments are shown in Table 3-2.

Table 3-2. SCXI-1162 Channel and Bank Assignments

Bank	Front Connector Pins	Channels
0	B30, A30, B29, A29, C30	0, 1, 2, 3, Vcc
1	B26, A26, B25, A25, C26	4, 5, 6, 7, Vcc
2	B22, A22, B21, A21, C22	8, 9, 10, 11, Vcc
3	B18, A18, B17, A17, C18	12, 13, 14, 15, Vcc
4	A13, B13, A14, B14, C13	16, 17, 18, 19, Vcc
5	A9, B9, A10, B10, C9	20, 21, 22, 23, Vcc
6	A5, B5, A6, B6, C5	24, 25, 26, 27, Vcc
7	A1, B1, A2, B2, C1	28, 29, 30, 31, Vcc

The voltage at any input should never be more than 10 V below its Vcc, nor should it be more than 5 V above its Vcc. If you need a Vcc of more than 10 V, you can add series resistors to the inputs to keep the current out of any input below 25 mA. Use the following guidelines to select the proper amount of series resistance:

$$(V_{max} - 10) / 24 < R_{series} < (V_{min} - 4) / 7$$
$$P_{rated} > (V_{max})^2 / (R_{series} \times 1000)$$

where V_{max} = maximum difference possible between inputs and Vcc (in volts)
V_{min} = minimum drop below Vcc for an input to guarantee a logic low (in volts)
R_{series} = value of the series resistor (in kΩ)
P_{rated} = power rating of the series resistor (in watts)

Note: This module has no access to the analog section of the backplane; this protects the backplane from faults when high voltages are available on the inputs.

Chapter 4
Register Descriptions

This chapter describes in detail the SCXI-1162 Address Handler, the Module ID Register, the Data Register, the Parking Register, and the Slot 0 Registers.

Note: If you plan to use a programming software package such as NI-DAQ, LabWindows, or LabVIEW with your SCXI-1162 board, you do not need to read this chapter.

Register Description

Register Description Format

This register description chapter discusses each of the SCXI-1162 registers and the Slot 0 registers. A detailed bit description of each register is given. The individual register description gives the type, word size, and bit map of the register, followed by a description of each bit.

The register bit map shows a diagram of the register with the MSB shown on the left (bit 31 for a 32-bit register, bit 15 for a 16-bit register, and bit 7 for an 8-bit register) and the LSB shown on the right (bit 0). A rectangle is used to represent each bit. Each bit is labeled with a name inside its rectangle. An asterisk (*) after the bit name indicates that the bit is inverted (negative logic). The Module ID register has a unique format and is described in the *Module ID Register* section.

In some of the registers, several bits are labeled with an X, indicating don't care bits. When you write to a register, you may set or clear these bits without effect.

SCXI-1162 Registers

The SCXI-1162 is a class II module. It has an address handler that chooses one of three registers. The Module ID Register is a 4-byte read-only register that contains the Module ID number of the SCXI-1162. The Data Register is a 32-bit write-only register you use to control the output states on the SCXI-1162. The Parking Register is a dummy register located at address FFFF. The Address Handler is a write-only register that contains the address of the register to be read from or written to.

Address Handler

You must write to the Address Handler at the beginning of each read from the SCXI-1162. Write the address of the register of interest to this handler, which in turn enables the register of interest. The Address Handler is two bytes long and contains the address of the register to be read from or written to. The Address Handler is selected when SS* is asserted low and D*/A indicates an address transfer (D*/A is high). At this time, the address is shifted in the Address Handler Register, MSB first. Table 4-1 contains a list of register addresses.

Table 4-1. Register Addresses

Address (Hexadecimal)	Register
0000	Module ID Register
0001	Data Register
FFFF	Parking Register

After you are finished writing, the D*/A line goes low, indicating a data transfer to a register. This enables the Address Handler output and selects the appropriate register.

At the end of each communication with the Module ID Register or the Data Register, select the Parking Register (write address FFFF to the Address Handler). This increases the noise immunity of the module when it is in its quiescent state. After you select the Parking Register, SS* should go high, deselecting the module.

At reset or at power up, the Address Handler content is cleared.

Module ID Register

The Module ID register contains the four-byte module ID code for the SCXI-1162. This code number is read on the MISO line whenever the Module ID register is accessed. The bytes appear least significant byte first. Within each byte, data is sent out MSB first. Additional data transfers result in all zeros being sent on the MISO line. The Module ID register is reinitialized to its original value each time it is deselected or at reset or power up. The Module ID Register address is hexadecimal 0000.

Type: Read-only

Word Size: 4-byte

Bit Map:

Byte 0

7	6	5	4	3	2	1	0
0	0	0	1	0	0	0	0

Byte 1

7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0

Byte 2

7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0

Byte 3

7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0

Data Register

The Data Register contains 32 bits that control the state of each input of the SCXI-1162. Whenever the Address Handler selects the Data Register, it will latch in the data present on the inputs, then shift out one bit of the data onto the MISO line, bit 31 first, with each falling edge of SPICLK.

Type: Write-only

Word Size: 32-bit

Bit Map:

31	30	29	28	27	26	25	24
IN(31)	IN(30)	IN(29)	IN(28)	IN(27)	IN(26)	IN(25)	IN(24)
23	22	21	20	19	18	17	16
IN(23)	IN(22)	IN(21)	IN(20)	IN(19)	IN(18)	IN(17)	IN(16)
15	14	13	12	11	10	9	8
IN(15)	IN(14)	IN(13)	IN(12)	IN(11)	IN(10)	IN(9)	IN(8)
7	6	5	4	3	2	1	0
IN(7)	IN(6)	IN(5)	IN(4)	IN(3)	IN(2)	IN(1)	IN(0)

Bit	Name	Description
31-0	IN<31..0>	Input(x) – These bits are the states of the inputs. If the inputs are driven low, the bits will be logic 0s. If the states are idled high, the bits will be logic 1s.

Parking Register

This register is a dummy register that you should select after the end of a read or write operation. Selecting the Parking Register places the module in a state insensitive to noise and to ESD, which may corrupt the Data Register content and cause the relays to change state.

Select the Parking Register by writing FFFF (hexadecimal) to the Address Handler.

Slot 0 Register Descriptions

Slot 0 has three registers–the FIFO Register, the Hardscan Register and the Slot-Select Register. Only the Slot-Select Register is relevant to this module. The Slot-Select Register is a 16-bit, write-only register that determines with which slot the data acquisition board speaks when SLOT0SEL* is released high. In the case of the SCXI-1001 chassis, the Slot-Select Register also determines in which chassis the desired slot is. Write to the Slot-Select Register using the SLOT0SEL* line. Maintain software copies of the Slot-Select Register.

If you are using multiple chassis, it is important to understand the architecture of the Slot-Select Register. Although each chassis has its own physical Slot-Select Register, all are written to at the same time. The jumper settings in Slot 0 of a chassis determine with which chassis number Slot 0 is identified. From the software perspective, only one Slot-Select Register exists in a system composed of multiple chassis.

Slot-Select Register

The Slot-Select Register contains 16 bits that determine which module in which chassis is enabled for communication when the SLOT0SEL* line is high. An SCXI-1000 chassis selects the appropriate module in its chassis, regardless of the chassis number written. The Slot-Select Register shifts in the data present on the MOSI line, bit 16 first, when SLOT0SEL* is low.

Type: Write-only

Word Size: 16-bit

Bit Map:

15	14	13	12	11	10	9	8
X	X	X	X	X	X	X	CHS4

7	6	5	4	3	2	1	0
CHS3	CHS2	CHS1	CHS0	SL3	SL2	SL1	SL0

Bit	Name	Description
15-9	X	Don't care bits – Unused.
8-4	CHS<4..0>	Chassis Bit 4 through 0 – These bits determine which chassis is selected. On the SCXI-1000 chassis, these are don't care bits.
3-0	SL<3..0>	Slot Bit 3 through 0 – These bits determine which slot in the selected chassis is selected.

Chapter 5
Programming

This chapter contains a functional programming description of the SCXI-1162 and Slot 0.

Note: If you plan to use a programming software package such as NI-DAQ, LabWindows, or LabVIEW with your SCXI-1162 board, you do not need to read this chapter.

Programming Considerations

Programming the SCXI-1162 involves reading from the Data Register. Programming the data acquisition boards involves writes to their registers. See your data acquisition board user manual for more information. The programming instructions list the sequence of steps to take. The instructions are language independent; that is, they instruct you to write a value to a given register without presenting the actual code.

Notation

For the bit patterns to be written, the following symbols are used:

`0` binary zero
`1` binary one
`X` don't care; either zero or one may be written

The bit patterns are presented MSB first, left to right.

Register Reads

This section describes how to read from the Data Register including the procedure for writing to the Slot-Select Register to select the appropriate slot. For timing specifics, refer to the *Timing Requirements and Communication Protocol* section in Chapter 2, *Configuration and Installation.* The rear signal connector pin equivalences to the different National Instruments data acquisition boards are given in Table 5-1. See also Appendix E, *SCXI-1162 Cabling.* The Data Register is a read-only register.

The different bits in this register contain the states of the input channels. This module uses positive logic; that is, a logic 1 in the Data Register indicates a high voltage level at the input.

Table 5-1. SCXIbus to SCXI-1162 Rear Signal Connector to Data Acquisition Board Pin Equivalences

SCXIbus Line	SCXI-1162 Rear Signal Connector	MIO-16	Lab-NB/Lab-PC/ Lab-PC+/Lab-LC	PC-LPM-16	DIO-24	DIO-96	DIO-32F
MOSI	SERDATIN	ADIO0	PB4	DOUT4	PB3	APB3	DIOB3
D*/A	DAQD*/A	ADIO1	PB5	DOUT5	PB2	APB2	DIOB2
INTR*	SLOT0SEL*	ADIO2	PB6	DOUT6	PB1	APB1	DIOB1
SPICLK	SERCLK	EXTSTROBE*	PB7	DOUT7	PB0	APB0	DIOB0
MISO	SERDATOUT	BDIO0	PC1	DIN6	PA0	APA0	DIOA0

Register Selection and Read Procedure

1. Select the slot of the module to be written to. Initial conditions:

   SERDATIN = X.
   DAQD*/A = 1.
   SLOT0SEL* = 1.
   SERCLK = 1.

2. Clear SLOT0SEL* to 0. This deasserts all SS* lines to all modules in all chassis.

3. For each bit, starting with the MSB (bit 15), do the following:

   a. Set SERDATIN = bit to be sent. These bits are the data that is written to the Slot-Select Register.

   b. Clear SERCLK to 0.

   c. Set SERCLK to 1. This rising edge clocks the data. If you are using an MIO-16 board, writing to the EXTSTROBE* register pulses EXTSTROBE* low and then high, accomplishing steps 3b and 3c.

4. Set SLOT0SEL* to 1. This asserts the SS* line of the module whose slot number was written to Slot 0. If you are using multiple chassis, only the appropriate slot in the chassis whose address corresponds to the written chassis number is automatically selected. When no communication is taking place between the data acquisition board and any modules, write zero to the Slot-Select Register to ensure that no accidental writes occur.

5. If you are reading from the Data Register, you must first write to the Address Handler address 0001 (hexadecimal):

    a. Establish the desired SERDATIN level corresponding to this bit.

    b. Clear SERCLK to 0.

    c. Set SERCLK to 1 (clock the data). If you are using an MIO-16 board, writing to the EXTSTROBE* register pulses EXTSTROBE* low and then high, accomplishing steps 5b and 5c.

    d. After you have written all the address bits, clear DAQD*/A to 0. This selects the Data Register and writes the data to the MOSI line.

6. For each bit to be read from the Data Register:

    a. Clear SERCLK to 0.

    b. Set SERCLK to 1 (clock the data). If you are using an MIO-16 board, writing to the EXTSTROBE* register pulses EXTSTROBE* low and then high, accomplishing steps 5a and 5b.

    c. Read the level of the SERDATOUT line.

    d. After clocking the last data bit, if you do not want to read another register, write hexadecimal address FFFF to the Address Handler to increase the noise immunity of the module when it is in the quiescent state.

7. Pull SLOT0SEL* low to deassert the SS* line and establish conditions for writing a new slot-select number to the Slot 0 Slot-Select Register.

8. If you are not selecting another slot, write zero to the Slot 0 Slot-Select Register. If you are selecting another slot, repeat the procedure starting at step 3.

For a timing illustration of a Data Register read, see Figure 2-9, *Data Register Read Timing Diagram*.

Note: You can always read data via the SCXIbus from an SCXI-1162 module regardless of its jumper settings. The jumper settings only affect the configuration of the rear connector. If you have properly configured the jumpers of the module in the chassis that is connected to a data acquisition board, the jumper settings of other modules that are not connected to anything via their rear connectors are irrelevant.

Appendix A
Specifications

This appendix lists the specifications for the SCXI-1162. These are typical at 25° C and 50% humidity unless otherwise stated. The operating temperature range is 0° to 50° C.

Digital Inputs

Power requirements per bank

Supply voltage (V_{CC}) (referenced to minimum signal level)	+4 V minimum, +10 V maximum

Inputs per channel

Logic low input voltage	(Vcc - 10 V) minimum, (Vcc - 4 V) maximum
Logic high input voltage	(Vcc - 1.5 V) minimum, (Vcc + 5 V) maximum
Logic low input current	7 mA minimum, 25 mA maximum
Input resistance	360 Ω

Isolation, bank-to-bank and bank-to-ground

Breakdown	1,900 Vrms maximum
Working	450 Vrms maximum

Maximum speed

Propagation delay, parallel mode (Vcc = 5 V)	2 µsec maximum, 0.5 µsec typical
Serial data rate	580 reads/sec*

Common-mode rejection	1,000 V/µsec typical

Physical

Dimensions	1.2 by 6.8 by 8.0 in.
Connectors	50-pin male ribbon-cable rear connector 48-pin DIN C male front connector (48-screw terminal adapter available)

* Serial data rate depends on the computer and software. This rate is the result of running a C program using NI-DAQ driver software on a 33 MHz 80386 computer.

Operating Environment

Temperature	0° to 50° C
Relative humidity	5% to 90% at 35° C

Storage Environment

Temperature	-55° to 150° C
Relative humidity	5% to 90% noncondensing

Appendix B
Rear Signal Connector

This appendix describes the pinout and signal names for the SCXI-1162 50-pin rear signal connector, including a description of each connection.

Figure B-1 shows the pin assignments for the SCXI-1162 rear signal connector.

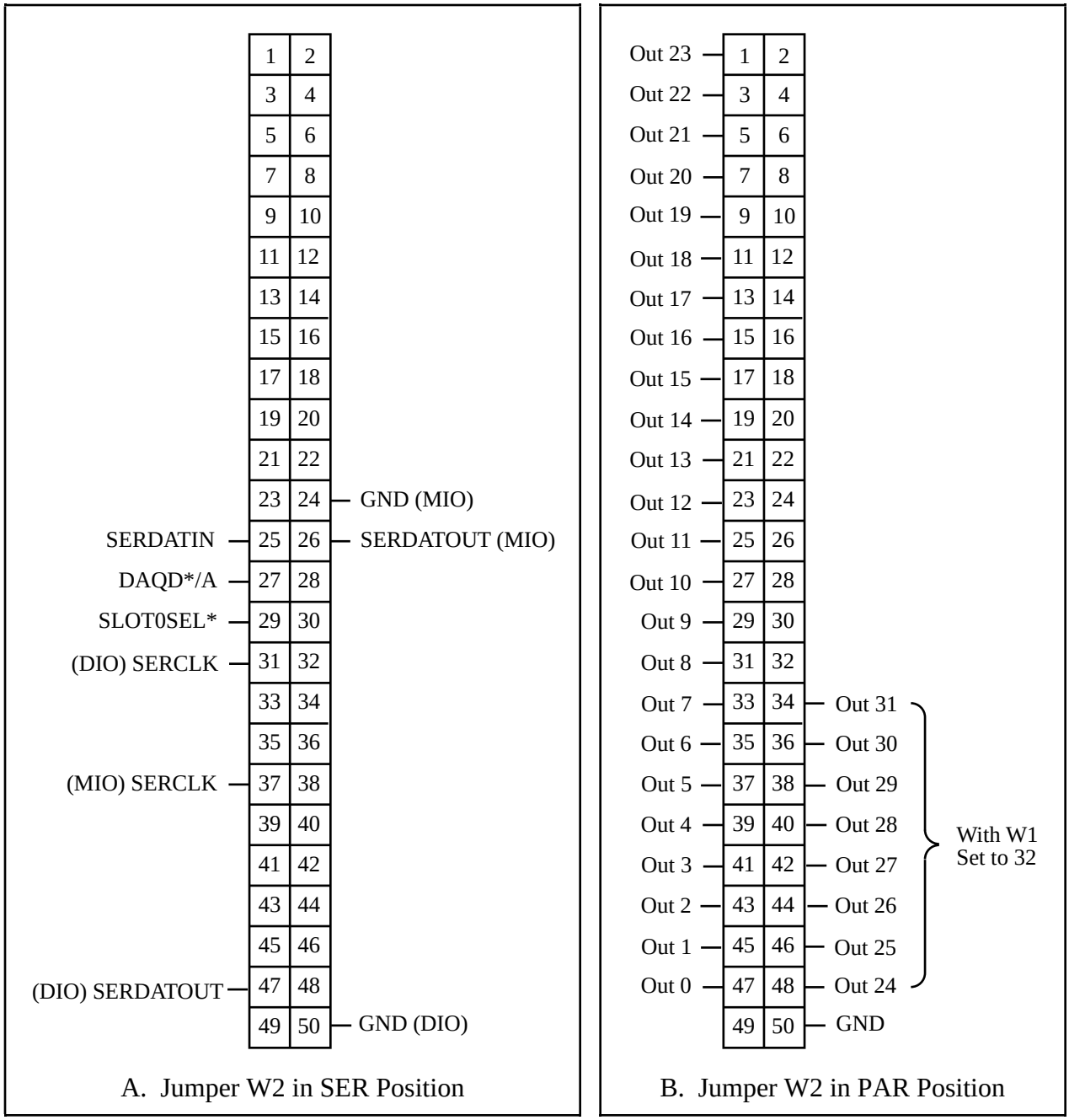


Figure B-1. SCXI-1162 Rear Signal Connector Pin Assignments

Rear Signal Connector Signal Descriptions

Pin	Signal	Description
24 or 50	DIG GND	Digital Ground – Supplies the reference for data acquisition board digital signals and is tied to the module digital ground. Pin 50 is for DIO boards. Pin 24 is for MIO boards and jumper W4 selects it.
25	SERDATIN	Serial Data In – Taps into the SCXIbus MOSI line to provide serial input data to a module or Slot 0.
26 or 47	SERDATOUT	Serial Data Out – Taps into the SCXIbus MISO line to accept serial output data from a module. Pin 47 is for DIO boards. Pin 26 is for MIO boards and jumper W6 selects it.
27	DAQD*/A	Data Acquisition Board Data/Address Line – Taps into the SCXIbus D*/A line to indicate to the module whether the incoming serial stream is data or address information.
29	SLOT0SEL*	Slot 0 Select – Taps into the SCXIbus INTR* line to indicate whether the information on MOSI is sent to a module or to Slot 0.
31 or 37	SERCLK	Serial Clock – Taps into the SCXIbus SPICLK line to clock the data on the MOSI and MISO lines. Pin 31 is for DIO boards. Pin 37 is for MIO boards and jumper W3 selects it.

All other pins are not connected.

With the rear connector configured for parallel communication, the signals are as follows:

Pin	Signal	Description
1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39,41, 43, 45, 47	Out <23..0>	Parallel outputs driven to the logic levels seen at inputs 23 through 0.
34, 36, 38, 40, 42, 44, 46, 48	Out <31..24>	Parallel outputs driven to the logic levels seen at inputs 31 through 24 when jumper W1 is set to 32.
50	GND	Ground – Supplies ground reference for the parallel outputs.

See the *Timing Requirements and Communication Protocol* section in Chapter 2, *Configuration and Installation*, for more detailed information on timing.

Appendix C
SCXIbus Connector

This appendix describes the pinout and signal names for the SCXI-1162 SCXIbus connector, including a description of each connection.

Figure C-1 shows the pinout of the SCXI-1162 SCXIbus connector.

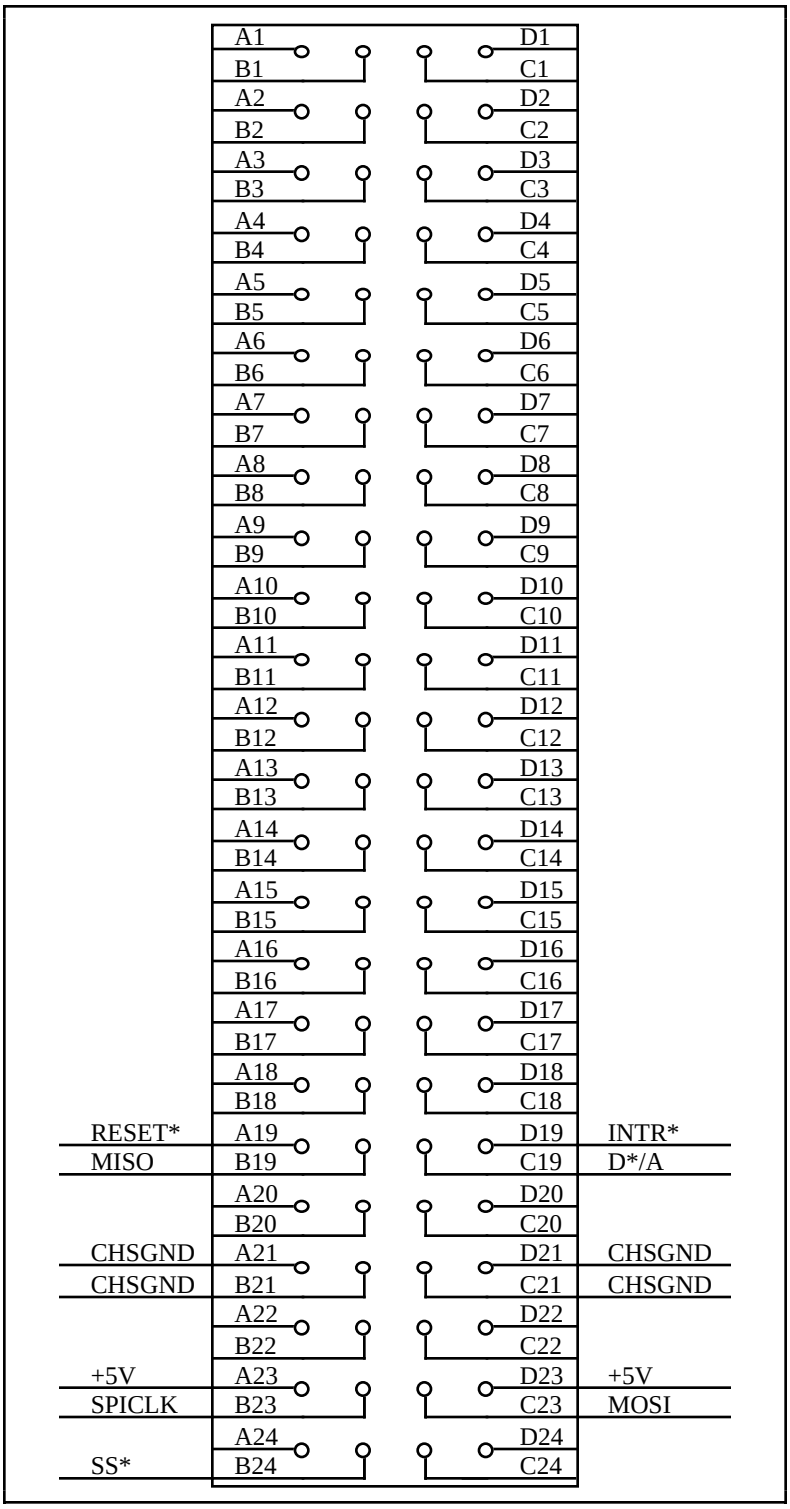


Figure C-1. SCXIbus Connector Pin Assignment

SCXIbus Connector Signal Descriptions

Pin	Signal Name	Description
A21, B21, C21, D21	CHSGND	Chassis Ground – Digital ground reference.
A19	RESET*	Reset – When pulled low, reinitializes the module to its power-up state. Totem pole. Input.
B19	MISO	Master-In-Slave-Out – Transmits data from the module to the SCXIbus. Open collector. I/O.
C19	D*/A	Data/Address – Indicates to the module whether address information or data information is being sent to the module on MOSI. Open collector. I/O.
D19	INTR*	Interrupt – Active low. Causes data that is on MOSI to be written to the Slot 0 Slot-Select Register. Open collector. Output.
A23, D23	+5 V	+5 VDC Source – Digital power supply.
B23	SPICLK	Serial Peripheral Interface (SPI) Clock – Clocks the serial data on the MOSI and MISO lines. Open collector. I/O.
C23	MOSI	Master-Out-Slave-In – Transmits data from the SCXIbus to the module. Open collector. I/O.
B24	SS*	Slot Select – When low, enables module communications over the SCXIbus. Totem pole. Input.

All other pins are not connected.

Further information is given in Chapter 3, *Theory of Operation.*

Appendix D
SCXI-1162 Front Connector

This appendix describes the pinout and signal names for the SCXI-1162 front connector, including a description of each connection.

Figure D-1 shows the pin assignments for the SCXI-1162 front connector.

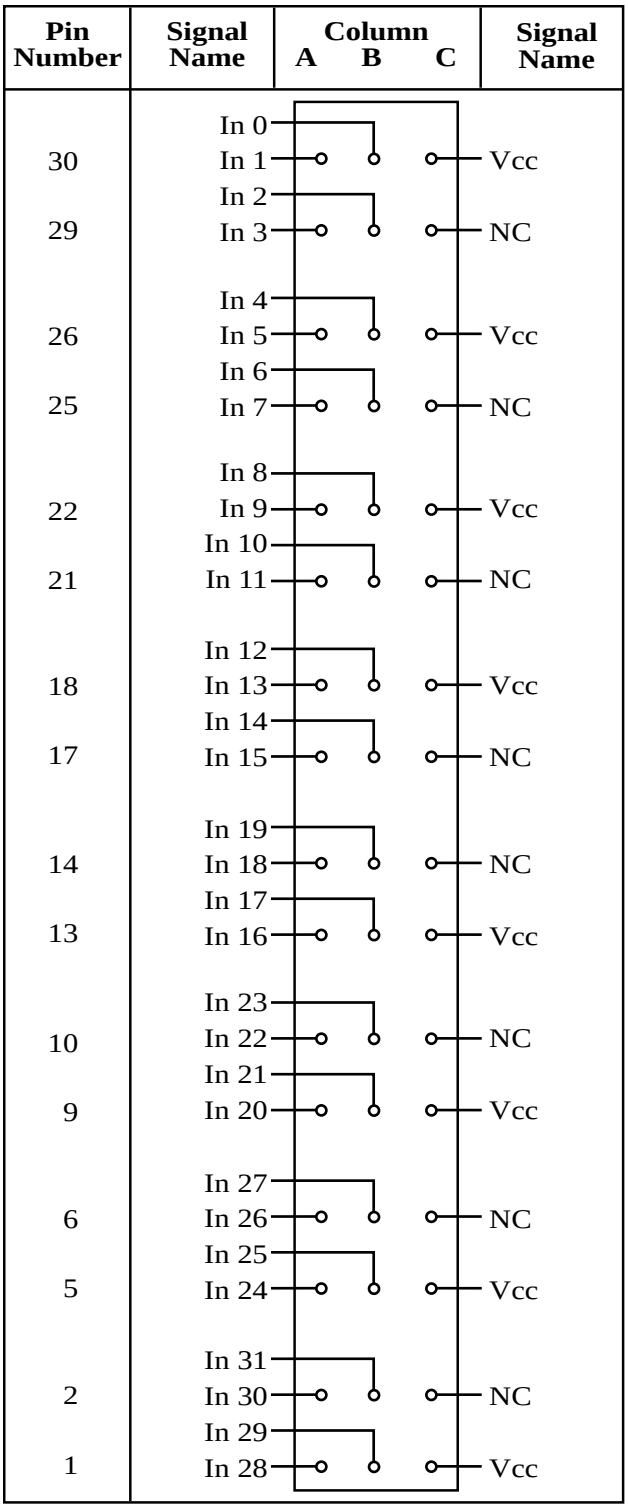


Figure D-1. SCXI-1162 Front Connector Pin Assignment

Front Connector Signal Descriptions

Pin	Signal Name	Description
B30, A30, B29, A29, C30	In <0..3>, Vcc	Bank 0 input channels and Vcc
B26, A26, B25, A25, C26,	In <4..7>, Vcc	Bank 1 input channels and Vcc
B22, A22, B21, A21, C22	In <8..11>, Vcc	Bank 2 input channels and Vcc
B18, A18, B17, A17, C18	In <12..15>, Vcc	Bank 3 input channels and Vcc
A13, B13, A14, B14, C13	In <16..19>, Vcc	Bank 4 input channels and Vcc
A9, B9, A10, B10, C9	In <20..23>, Vcc	Bank 5 input channels and Vcc
A5, B5, A6, B6, C5	In <24..27>, Vcc	Bank 6 input channels and Vcc
A1, B1, A2, B2, C1	In <28..32>, Vcc	Bank 7 input channels and Vcc
C2, C6, C10, C14, C17, C21, C25, C29	NC (No Connect)	Unused pins

Further information is given in Chapter 2, *Configuration and Installation.*

Appendix E
SCXI-1162 Cabling

This appendix describes how to use and install the hardware accessories for the SCXI-1162:

- SCXI-1340 cable assembly
- SCXI-1341 Lab-NB, Lab-PC, and Lab-PC+ cable assembly
- SCXI-1342 PC-LPM-16 cable assembly
- SCXI-1344 Lab-LC cable assembly
- SCXI-1348 DIO-32 cable assembly
- SCXI-1180 feedthrough panel
- SCXI-1302 50-pin terminal block
- SCXI-1351 one-slot cable extender
- SCXI-1350 multichassis adapter
- SCXI-1343 rear screw terminal adapter

SCXI-1340 Cable Assembly

The SCXI-1340 cable assembly connects an MIO-16 or DIO-24 board to an SCXI-1162 module. The SCXI-1340 consists of a 50-conductor ribbon cable that has a mounting bracket at one end and a 50-pin female connector at the other end. This female connector attaches to the I/O connector of the data acquisition board. Attached to the mounting bracket is the 50-pin female mounting bracket connector that connects to the rear signal connector of the module. A male breakout connector is near the mounting bracket on the ribbon cable. You can use this male breakout connector to extend the signals of the MIO-16 or DIO-24 board to an SCXI-1180 feedthrough panel or an SCXI-1181 breadboard module. All 50 pins from the MIO-16 or DIO-24 board go straight to the rear signal connector. You can use a standard 50-pin ribbon cable in lieu of the SCXI-1340 cable assembly.

The SCXI-1340 has the following advantages over the ribbon cable:

- The SCXI-1340 produces strain relief so that you cannot accidentally disconnect the cable.
- The SCXI-1340 includes a mounting bracket that mounts to the chassis so that you can remove and reinsert the module without explicitly removing the cable from the back of the chassis. This is especially useful when the SCXI chassis is rack mounted, making rear access difficult.

- The SCXI-1340 has an extra male breakout connector for use with the SCXI-1180 feedthrough panel or additional modules or breadboards that need a direct connection to the MIO-16 or DIO-24 board.
- The SCXI-1340 rear panel gives the module and the chassis both mechanical and electrical shielding.

Table E-1 lists the pin equivalences of the MIO-16 and DIO-24 boards and the SCXI-1162.

Table E-1. SCXI-1162, MIO-16, and DIO-24 Pinout Equivalences

Pin	SCXI-1162 Rear Signal Connector		MIO-16 Board Equivalent	DIO-24 Board Equivalent
	Serial	Parallel		
1		Out (23)		PC7
3		Out (22)		PC6
5		Out (21)		PC5
7		Out (20)		PC4
9		Out (19)		PC3
11		Out (18)		PC2
13		Out (17)		PC1
15		Out (16)		PC0
17		Out (15)		PB7
19		Out (14)		PB6
21		Out (13)		PB5
23		Out (12)		PB4
24	DIG GND (MIO)		DIG GND	
25	SERDATIN	Out (11)	ADIO0	PB3
26	SERDATOUT (MIO)		BDIO0	
27	DAQD*/A	Out (10)	ADIO1	PB2
29	SLOT0SEL*	Out (9)	ADIO2	PB1
31	SERCLK (DIO)	Out (8)		PB0
33		Out (7)		PA7
35		Out (6)		PA6
37	SERCLK (MIO)	Out (5)	EXTSTROBE*	PA5
39		Out (4)		PA4
41		Out (3)		PA3
43		Out (2)		PA2
45		Out (1)		PA1
47	SERDATOUT (DIO)	Out (0)		PA0
50	DIG GND (DIO)	GND		GND

No other pins are connected on the SCXI-1162.

SCXI-1340 Installation

Follow these steps to install the SCXI-1340:

1. Make sure that the computer and the SCXI chassis are turned off.
2. Install the SCXI module in the chassis.
3. Plug the mounting bracket connector onto the module rear signal connector (see Figure E-1). An alignment tab on the bracket enters the upper board guide of the chassis.
4. Screw the mounting bracket to the threaded strips in the rear of the chassis.
5. Connect the loose end of the cable assembly to the MIO-16 or DIO-24 board rear signal connector.

Check the installation.

After step 1, the order of these steps is not critical; however, it is easier to locate the correct position for the mounting bracket with a module installed in the chassis. If you are attaching a cable to the breakout connector, installation is easiest if you attach the second cable before installing the SCXI-1340.

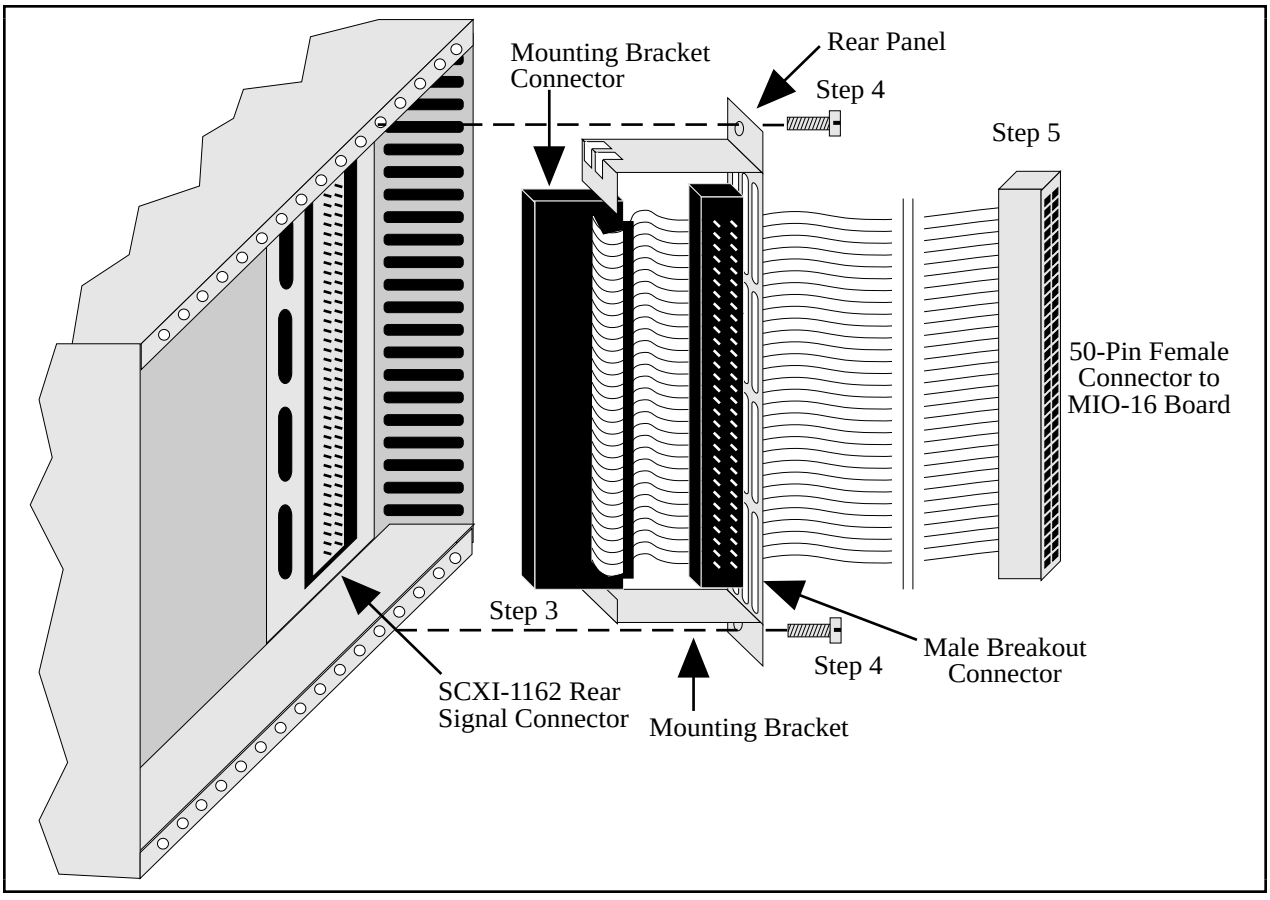


Figure E-1. SCXI-1340 Installation

SCXI-1341 Lab-NB, Lab-PC, or Lab-PC+ and SCXI-1344 Lab-LC Cable Assembly

The SCXI-1341 Lab-NB, Lab-PC, or Lab-PC+ cable assembly connects a Lab-NB, Lab-PC, or Lab-PC+ board to an SCXI-1162 module. The SCXI-1344 Lab-LC cable assembly connects a Lab-LC board to an SCXI-1162 module. The SCXI-1341 and SCXI-1344 cable assemblies consist of two pieces–an adapter board and a 50-conductor ribbon cable that connects the Lab board to the rear connector of the adapter board. The adapter board converts the signals from the Lab board I/O connector to a format compatible with the SCXI-1162 rear signal connector pinout at the front connector of the SCXI-1341 or SCXI-1344. The adapter board also has an additional male breakout connector that provides the unmodified Lab board signals for use with an SCXI-1180 feedthrough panel or SCXI-1181 breadboard module. The adapter board gives the Lab boards full access to the digital control lines. The position of jumper W1 on the SCXI-1341 and SCXI-1344 is irrelevant because the SCXI-1162 does not use jumper W1. Table E-2 lists the SCXI-1341 and SCXI-1344 pin translations.

Table E-2. SCXI-1341 Pin Translations

Lab Board Pin	Lab Board Signal	SCXI-1162 Pin	SCXI-1162 Signal
1	ACH0	3	No Connect
2	ACH1	5	No Connect
3	ACH2	7	No Connect
4	ACH3	9	No Connect
5	ACH4	11	No Connect
6	ACH5	13	No Connect
7	ACH6	15	No Connect
8	ACH7	17	No Connect
9	AIGND	1-2	No Connect
10	DAC0OUT	20	No Connect
11	AOGND	23	No Connect
12	DAC1OUT	21	No Connect
13, 50	DGND	24	DIG GND
26	PB4	25	SERDATIN
27	PB5	27	DAQD*/A
28	PB6	29	SLOT0SEL*
29	PB7	37	SERCLK
31	PC1	26	SERDATOUT
32	PC2	28	No Connect
40	EXTCONV*	36	No Connect
43	OUTB1	46	No Connect
49	+5 V	34-35	No Connect

All other pins of the Lab board pinout are not sent to the SCXI-1162 rear signal connector.

SCXI-1341 and SCXI-1344 Installation

Follow these steps to install the SCXI-1341 or SCXI-1344:

1. Make sure that the computer and the SCXI chassis are turned off.
2. Install the SCXI module in the chassis.
3. Connect one end of the ribbon cable to the adapter board rear connector. This is the 50-pin connector of the SCXI-1344 cable.
4. Plug the adapter board front connector to the module rear signal connector. A corner of the adapter board will enter the upper board guide of the chassis.
5. Screw the rear panel to the threaded strips in the rear of the chassis.
6. For an SCXI-1341, connect the loose end of the ribbon cable to the Lab-NB, Lab-PC, or Lab-PC+ I/O connector. For an SCXI-1344, connect the two 26-pin connectors to the Lab-LC board according to the instructions given in the *Installation* section of Chapter 2, *Configuration and Installation*, of the *Lab-LC User Manual*.

Check the installation.

SCXI-1342 PC-LPM-16 Cable Assembly

The SCXI-1342 PC-LPM-16 cable assembly connects a PC-LPM-16 board to an SCXI-1162 module. The SCXI-1342 cable assembly consists of two pieces–an adapter board and a 50-conductor ribbon cable that connects the PC-LPM-16 board to the adapter board. The adapter board converts the signals from the PC-LPM-16 I/O connector to a format compatible with the SCXI-1162 rear signal connector pinout. The adapter board also has an additional male breakout connector that provides the unmodified PC-LPM-16 signals for use with an SCXI-1180 feedthrough panel or SCXI-1181 breadboard module. The adapter board gives the PC-LPM-16 full access to the digital control lines. The position of jumper W1 on the SCXI-1342 is irrelevant because the SCXI-1162 does not use jumper W1. Table E-3 lists the SCXI-1342 pin translations.

Table E-3. SCXI-1342 Pin Translations

PC-LPM-16 Pin	PC-LPM-16 Signal	Rear Signal Connector Pin	SCXI-1162 Use
1-2	AIGND	1-2	No Connect
3	ACH0	3	No Connect
4	ACH8	4	No Connect
5	ACH1	5	No Connect
6	ACH9	6	No Connect
7	ACH2	7	No Connect
8	ACH10	8	No Connect
9	ACH3	9	No Connect
10	ACH11	10	No Connect
11	ACH4	11	No Connect
12	ACH12	12	No Connect
13	ACH5	13	No Connect
14	ACH13	14	No Connect
15	ACH6	15	No Connect
16	ACH14	16	No Connect
17	ACH7	17	No Connect
18	ACH15	18	No Connect
19, 50	DGND	24	DIG GND
28	DIN6	26	SERDATOUT
29	DIN7	28	No Connect
34	DOUT4	25	SERDATIN
35	DOUT5	27	DAQD*/A
36	DOUT6	29	SLOT0SEL*
37	DOUT7	37	SERCLK
46	OUT2	46	No Connect
49	+5 V	34-35	No Connect

All other pins of the PC-LPM-16 pinout are not sent to the SCXI-1162 rear signal connector.

SCXI-1342 Installation

Follow these steps to install the SCXI-1342:

1. Make sure that the computer and the SCXI chassis are turned off.
2. Install the SCXI module to which the SCXI-1342 will connect.
3. Connect one end of the ribbon cable to the adapter board rear connector.
4. Plug the adapter board front connector onto the module rear signal connector. A corner of the adapter board will enter the upper board guide of the chassis.
5. Screw the rear panel to the threaded strips in the rear of the chassis.
6. Connect the loose end of the ribbon cable to the PC-LPM-16 I/O connector.

DIO-96, AT-MIO-16D, and AT-MIO-64F-5 Board Connection

To use your SCXI-1162 with a DIO-96, AT-MIO-16D, or AT-MIO-64F-5 board, you need an NB5 cable. The NB5 cable is a ribbon cable with a 100-pin connector that mates with the data acquisition board rear signal connector. The other end of the cable is divided into two 50-pin connectors. Use positions 1 through 50 of the NB5 connector to control the SCXI-1162 and the SCXIbus via serial communication. Positions 51 through 100 of the NB5 cable are not used by the SCXI-1162 for serial communication. Positions 1 through 50 may also be used for parallel communication with the DIO-96, and positions 51 through 100 may be used for parallel communication with either the DIO-96 or the AT-MIO-16D board. You may connect either 50-pin connector directly to the SCXI-1162 or you may use an SCXI-1351.

The SCXI-1351 has the following advantages over the ribbon cable:

- The SCXI-1351 produces strain relief so that you cannot accidentally disconnect the cable.
- The SCXI-1351 includes a mounting bracket that mounts to the chassis so that you can remove and reinsert the module without explicitly removing the cable from the back of the chassis. This is especially useful when the SCXI chassis is rack mounted, making rear access difficult.
- The SCXI-1351 has an extra female connector for use with the SCXI-1180 feedthrough panel or additional modules or breadboards that need a direct connection to the DIO-96 board.
- The SCXI-1351 rear panel gives the module and the chassis both mechanical and electrical shielding.

Table E-4 lists the pin equivalences of the DIO-96, AT-MIO-16D, and AT-MIO-64F-5 board and the SCXI-1162.

Table E-4. SCXI-1162, DIO-96, AT-MIO-16D, and AT-MIO-64F-5 Pinout Equivalences

Pin	SCXI-1162 Rear Signal Connector		DIO-96 Board Equivalent	AT-MIO-16D	AT-MIO-64F-5 (pins 1-50 only)
	Serial	Parallel			
1, 51		Out (23)	APC7, CPC7	PC7	
3, 53		Out (22)	APC6, CPC6	PC6	
5, 55		Out (21)	APC5, CPC5	PC5	
7, 57		Out (20)	APC4, CPC4	PC4	
9, 59		Out (19)	APC3, CPC3	PC3	
11, 61		Out (18)	APC2, CPC2	PC2	
13, 63		Out (17)	APC1, CPC1	PC1	
15, 65		Out (16)	APC0, CPC0	PC0	
17, 67		Out (15)	APB7, CPB7	PB7	
19, 69		Out (14)	APB6, CPB6	PB6	
21, 71		Out (13)	APB5, CPB5	PB5	
23, 73		Out (12)	APB4, CPB4	PB4	
24	DIG GND (MIO)			DIG GND	DIG GND

(continues)

Table E-4. SCXI-1162, DIO-96, AT-MIO-16D, and AT-MIO-64F-5 Pinout Equivalences (Continued)

Pin	SCXI-1162 Rear Signal Connector		DIO-96 Board Equivalent	AT-MIO-16D	AT-MIO-64F-5 (pins 1-50 only)
	Serial	Parallel			
25, 75	SERDATIN (pin 25 only)	Out (11)	APB3, CPB3	ADIO0	ADIO0
26	SERDATOUT (MIO)			BDIO0	BDIO0
27, 77	DAQD*/A (pin 27 only)	Out (10)	APB2, CPB2	ADIO1, PB2	ADIO1
29, 79	SLOT0SEL* (pin 29 only)	Out (9)	APB1, CPB1	ADIO2, PB1	ADIO2
31, 81	SERCLK (DIO) (pin 31 only)	Out (8)	APB0, CPB0	PB0	
33, 83		Out (7)	APA7, CPA7	PA7	
34, 84		Out (31)	BPA7, DPA7		
35, 85		Out (6)	APA6, CPA6	PA6	
36, 86		Out (30)	BPA6, DPA6		
37, 87	SERCLK (MIO) (pin 37 only)	Out (5)	APA5, CPA5	EXTSTROBE*, PA5	EXTSTROBE*
38, 88		Out (29)	BPA5, DPA5		
39, 89		Out (4)	APA4, CPA4	PA4	
40, 90		Out (28)	BPA4, DPA4		
41, 91		Out (3)	APA3, CPA3	PA3	
42, 92		Out (27)	BPA3, DPA3		
43, 93		Out (2)	APA2, CPA2	PA2	
44, 94		Out (26)	BPA2, DPA2		
45, 95		Out (1)	APA1, CPA1	PA1	
46, 96		Out (25)	BPA1, DPA1		
47, 97	SERDATOUT (DIO) (pin 47 only)	Out (0)	APA0, CPA0	PA0	
48, 98		Out (24)	BPA0, DPA0		
50, 100	DIG GND (DIO)	GND	GND	GND	

No other pins are connected on the SCXI-1162.

SCXI-1351 and NB5 Cable Installation

Follow these steps to install the SCXI-1351:

1. Make sure that the computer and the SCXI chassis are turned off.
2. Install the SCXI module in the chassis.
3. Connect either the position 1 through 50 connector or the position 51 through 100 connector of the NB5 cable to the male breakout connector on the SCXI-1351.

4. Plug the mounting bracket connector onto the module rear signal connector (see Figure E-2). An alignment tab on the bracket will enter the upper board guide of the chassis.
5. Screw the mounting bracket to the threaded strips in the rear of the chassis.
6. Connect the 100-pin connector of the NB5 cable to the data acquisition board.

After step 1, the order of these steps is not critical; however, it is easier to locate the correct position for the mounting bracket with a module installed in the chassis. If you are attaching a cable to the female connector, installation is easiest if you attach the second cable before installing the SCXI-1351.

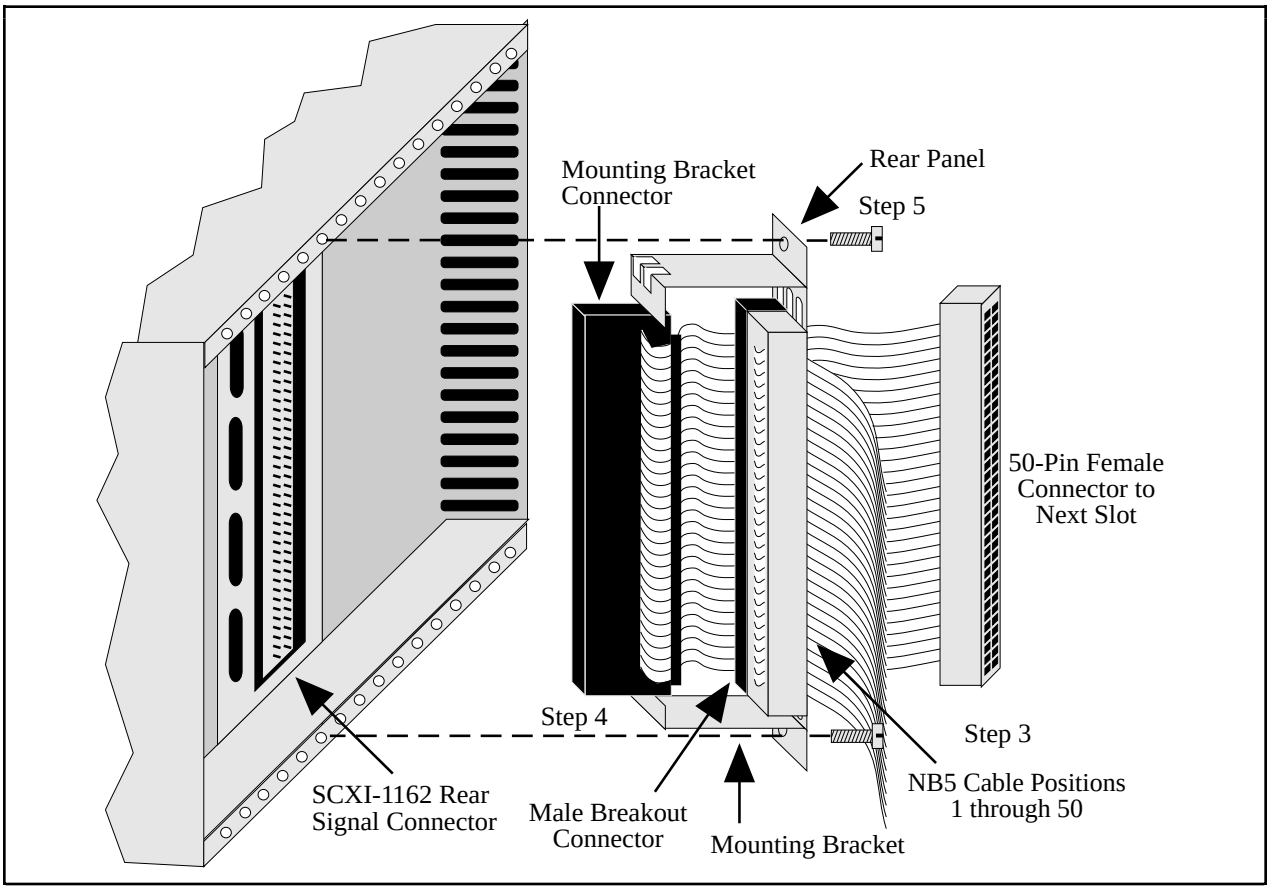


Figure E-2. SCXI-1351 and NB5 Cable Installation

SCXI-1348 DIO-32F Cable Assembly

The SCXI-1348 DIO-32F cable assembly connects a DIO-32F board to an SCXI-1162 module. The SCXI-1348 cable assembly consists of two pieces–an adapter board and a 50-conductor shielded ribbon cable that connects the DIO-32F board to the adapter board. The adapter board converts the signals from the DIO-32F I/O connector to a format compatible with the SCXI-1162 rear signal connector pinout. The adapter board also has an additional male breakout connector that provides the unmodified DIO-32F signals for use with an SCXI-1180 feedthrough panel or SCXI-1181 breadboard module. The adapter board gives the DIO-32F full access to the digital control lines. Table E-5 lists the SCXI-1348 pin translations.

Table E-5. SCXI-1348 Pin Translations

DIO-32F Pin	DIO-32F Signal	Rear Signal Connector Pin	SCXI-1162 Use
1	DIOD1	46	Out (25)
2	DIOD4	40	Out (28)
3	DIOD3	42	Out (27)
4	DIOD0	48	Out (24)
5	DIOD6	36	Out (30)
6	DIOD7	34	Out (31)
7	DIOD2	44	Out (26)
8	DIOD5	38	Out (29)
9	DIOC5	5	Out (21)
10	DIOC7	1	Out (23)
11	DIOC3	9	Out (19)
12	DIOC1	13	Out (17)
13	DIOC2	11	Out (18)
14	DIOC0	15	Out (16)
15	DIOC6	3	Out (22)
16	DIOC4	7	Out (20)
17, 19	DIG GND	2, 4	No Connect
21, 23	DIG GND	6, 8	No Connect
25, 26	DIG GND	10, 12	No Connect
28, 30	DIG GND	14, 16	No Connect
32, 34	DIG GND	50	DIG GND
18	ACK2	26	No Connect
20	IN2	28	No Connect
22	OUT2	30	No Connect
24	REQ2	32	No Connect
27	ACK1	18	No Connect
29	IN1	20	No Connect
31	OUT1	22	No Connect
33	REQ1	24	No Connect
35	DIOA4	39	Out (4)
36	DIOA6	35	Out (6)
37	DIOA0	47	SERDATOUT/Out (0)
38	DIOA2	43	Out (2)
39	DIOA1	45	Out (1)
40	DIOA3	41	Out (3)
41	DIOA7	33	Out (7)
42	DIOA5	37	Out (5)
43	DIOB5	21	Out (13)
44	DIOB2	27	DAQD*/A/Out (10)
45	DIOB7	17	Out (15)
46	DIOB6	19	Out (14)
47	DIOB0	31	SERCLK/Out (8)
48	DIOB3	25	SERDATIN/Out (11)
49	DIOB4	23	Out (12)
50	DIOB1	29	SLOT0SEL*/Out (9)

SCXI-1348 Installation

Follow these steps to install the SCXI-1348:

1. Make sure that the computer and the SCXI chassis are turned off.
2. Install the SCXI module to which the SCXI-1348 will connect.
3. Connect one end of the ribbon cable to the adapter board rear connector.
4. Plug the adapter board front connector onto the module rear signal connector. A corner of the adapter board will enter the upper board guide of the chassis.
5. Screw the rear panel to the threaded strips in the rear of the chassis.
6. Connect the loose end of the ribbon cable to the DIO-32F I/O connector.

Check the installation.

SCXI-1180 Feedthrough Panel

The SCXI-1180 feedthrough panel provides front panel access to the signals of any data acquisition board that uses a 50-pin I/O connector. The SCXI-1180 consists of a front panel with a 50-pin male front panel connector that occupies one slot in the SCXI chassis, and a ribbon cable with a female rear connector and a male breakout connector. You can attach the rear connector to the male breakout connector of an SCXI-1340, SCXI-1341, SCXI-1342, SCXI-1344, or SCXI-1351 in the adjacent slot. The breakout connector further extends the cabling scheme. The front panel connector has the feedthrough connection. You can attach an SCXI-1302 terminal block to the front panel connector for simple screw terminal connections. A rear filler panel that shields and protects the interior of the SCXI chassis is also included.

SCXI-1180 Installation

Install the SCXI-1180 to the right of a slot that has an SCXI-1340, SCXI-1341, SCXI-1342, or SCXI-1344 cable assembly or an SCXI-1351 slot extender in its rear connector space.

Follow these steps to install the SCXI-1180:

1. Make sure that the computer and the SCXI chassis are turned off.
2. Remove the front filler panel of the slot where you want to insert the SCXI-1180.
3. Thread the rear connector through the front of the chassis to the rear of the chassis. Attach the rear connector to the breakout connector of the adjacent cable assembly or slot extender, as shown in Figure E-3.
4. Screw in the rear panel to the threaded strip in the rear of the chassis.
5. Screw the front panel into the front threaded strip, as shown in Figure E-4.

Check the installation.

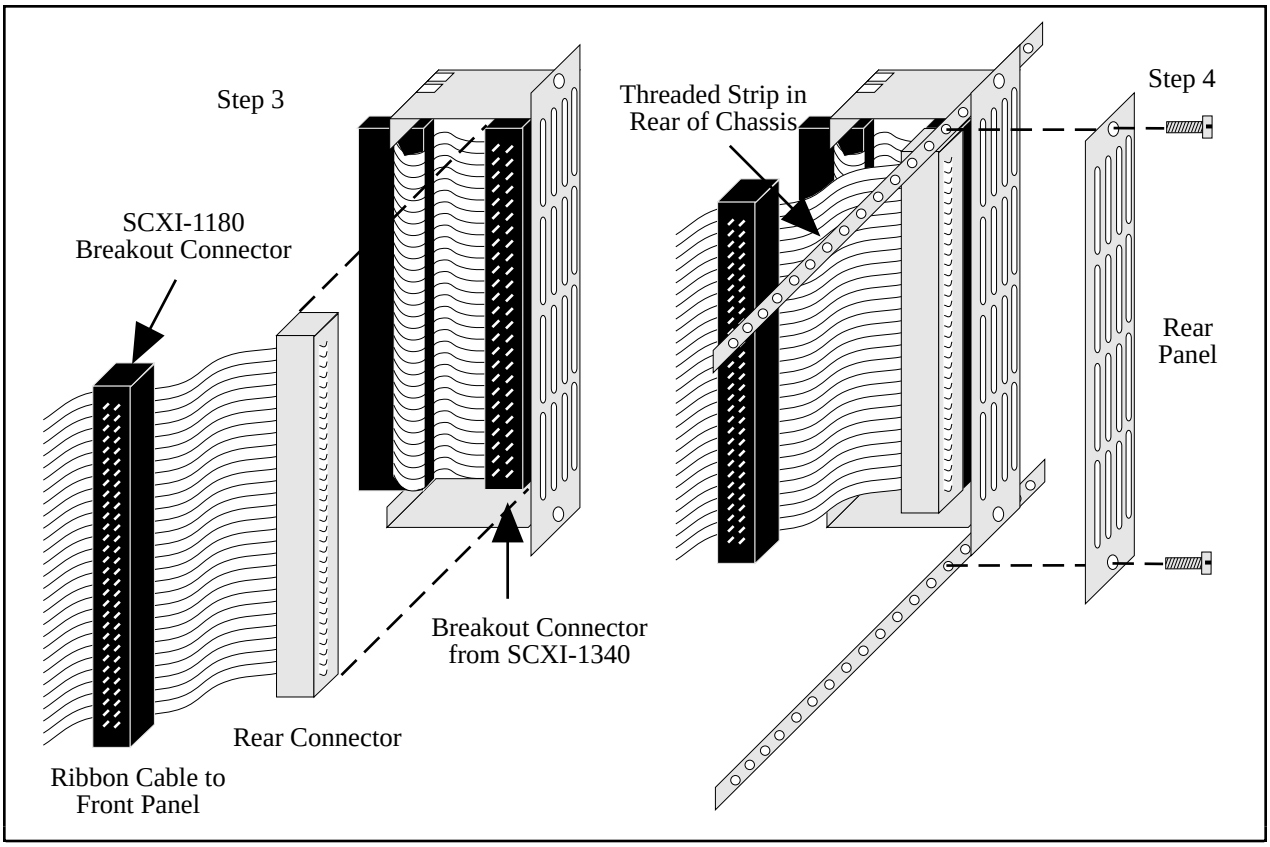


Figure E-3. SCXI-1180 Rear Connections

Note: If you are using the SCXI-1180 with an SCXI-1351 and an NB5 cable, connect the SCXI-1180 breakout connector to the female connector on the SCXI-1351. Place the SCXI-1180 to the *left* of the SCXI-1351 (looking to the front of the chassis).

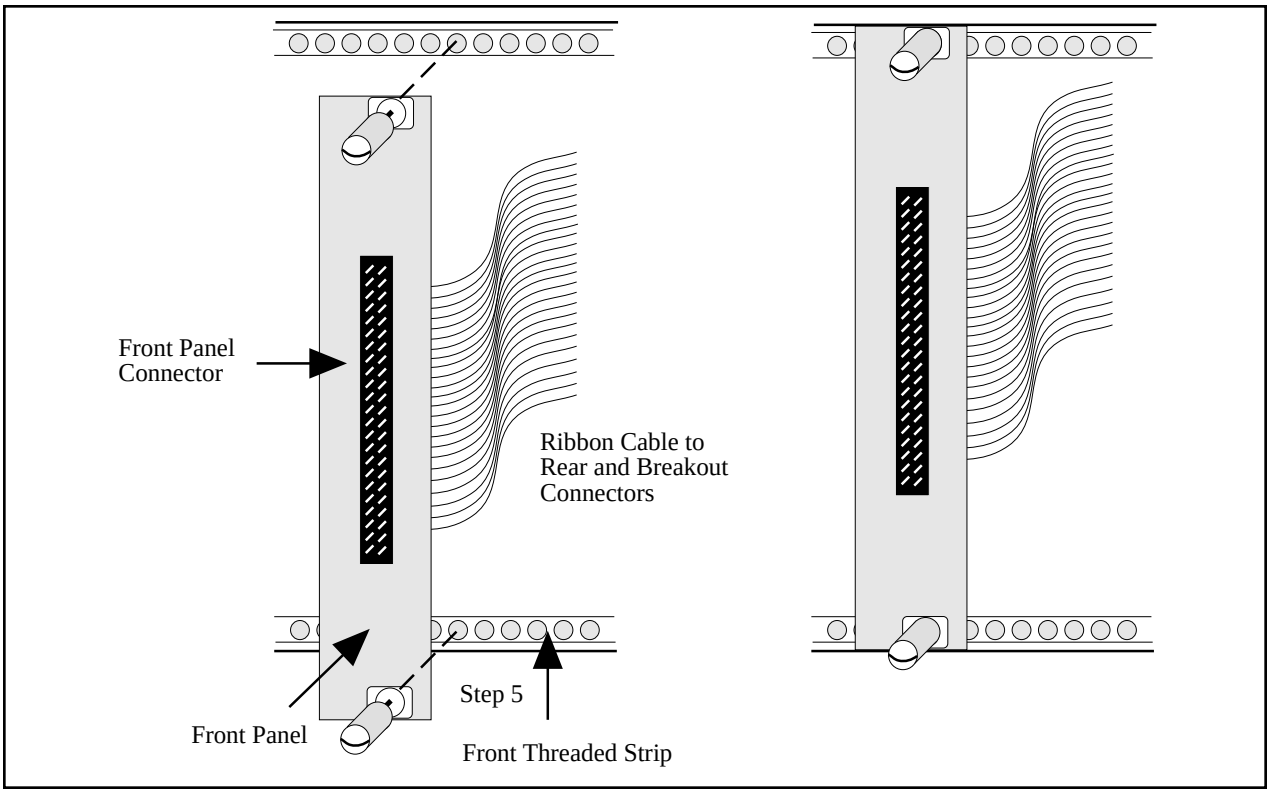


Figure E-4. SCXI-1180 Front Panel Installation

SCXI-1302 50-Pin Terminal Block

The SCXI-1302 terminal block has screw terminal connections for the 50-pin connector on the SCXI-1180 feedthrough panel.

SCXI-1302 Wiring Procedure

To wire the SCXI-1302 terminal block, you must remove the cover, connect all the wiring, and replace the cover. The procedure for this is as follows:

1. Unscrew the rear grounding screw on the back of the terminal block, as shown in Figure E-5.
2. With a flathead screwdriver, carefully pry the cover off the terminal block.
3. Insert each wire through the terminal block strain relief.
4. Connect the wires to the screw terminals.
5. Tighten the large strain relief screws to secure the wires.
6. Snap the cover back in place.
7. Reinsert the rear grounding screw. The terminal block is now ready to be connected to the front panel connector.

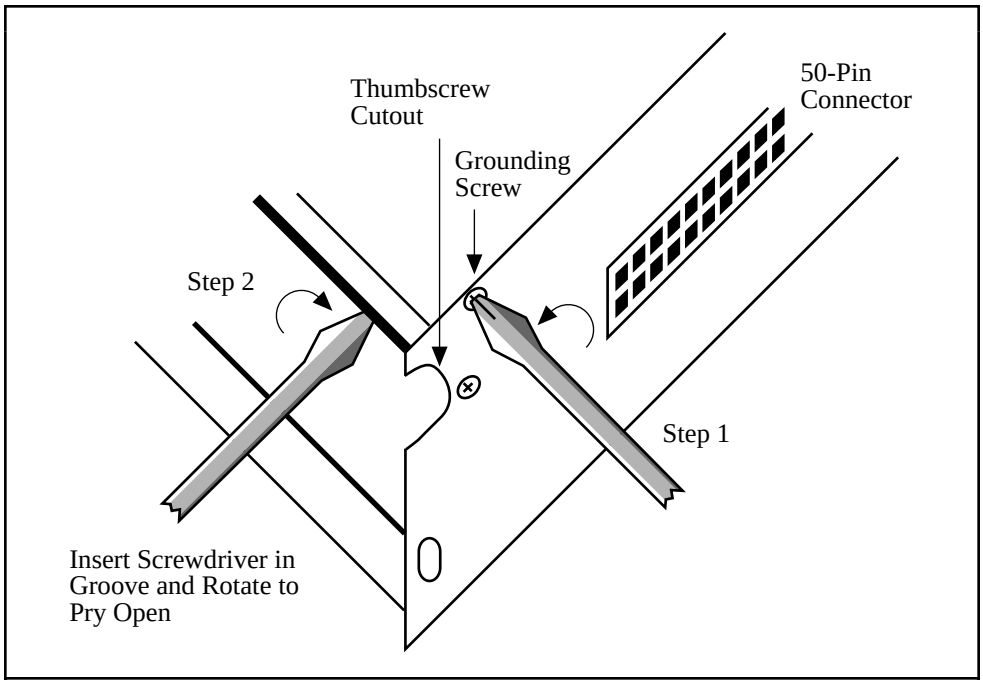


Figure E-5. Cover Removal

SCXI-1302 Installation

Follow these steps to install the SCXI-1302:

1. Install an SCXI-1180 feedthrough panel as described in the *SCXI-1180 Installation* section.
2. Wire the terminal block as previously described in the *SCXI-1302 Wiring Procedure* section.
3. Connect the SCXI-1302 terminal block to the front panel connector on the SCXI-1180 feedthrough panel. Be careful to fit the thumbscrews in the thumbscrew cutouts.
4. Tighten the top and bottom captive screws on the back of the terminal block into the screw holes in the front panel to hold the SCXI-1302 securely in place.

Check the installation.

SCXI-1351 One-Slot Cable Extender

The SCXI-1351 cable extender is a miniature SCXI-1340 cable assembly. Instead of connecting to an MIO board 1 m away, the SCXI-1351 female rear connector connects to a male breakout connector that must be in the rear connector space of the slot to the left. The SCXI-1351 has a female mounting bracket connector that mates with the rear signal connector of a module, and also has a male breakout connector on the ribbon cable for connecting to a feedthrough panel or more cable extenders.

SCXI-1351 Installation

Follow these steps to install the SCXI-1351:

1. Make sure that the computer and the SCXI chassis are turned off.

2. Install the SCXI module in the chassis.

3. Connect the rear connector of the cable extender to the breakout connector in the adjacent slot. This attachment is similar to Step 3 in the *SCXI-1180 Installation* section, as shown in Figure E-4.

4. Plug the mounting bracket connector to the module rear signal connector. An alignment tab on the bracket will enter the upper board guide of the chassis.

5. Screw the mounting bracket to the threaded strips in the rear of the chassis.

Check the installation.

Multiple-Chassis Connections for the SCXI-1162

The SCXI-1162 can operate in a multiple-chassis system with the DIO-24, DIO-96, MIO-16, and AT-MIO-64F-5 boards. A multiple-chassis system can consist of up to eight SCXI-1001 chassis controlled by the same data acquisition board. Notice that you cannot use the SCXI-1000 in a multiple-chassis system. For each chassis, you will need an SCXI-1350 multichassis adapter board and an NB1 ribbon cable.

SCXI-1350 Multichassis Adapter

Note: When connecting multiple chassis, you should use a 0.5 m length ribbon cable between chassis to minimize cable length and maintain signal integrity. However, you can use a 1.0 m cable from the data acquisition board to the first chassis. When you are using the AT-MIO-16D or AT-MIO-64F-5 or DIO-96 board, use an NB5 ribbon cable from the data acquisition board to the first chassis, connecting positions 1 through 50 to the SCXI-1350 in the first chassis.

SCXI-1350 Installation

After you have installed the data acquisition board into the computer and the SCXI modules into each of the SCXI-1001 chassis, cable one module from each chassis to the data acquisition board as follows:

1. Make sure that the computer and all the SCXI chassis are turned off.

2. Connect one end of the NB1 (or the 100-pin connector of the NB5) cable to the data acquisition board.

3. Plug the other end of the cable (or positions 1 through 50 of the NB5 cable) into the connector with the latches that are at the rear of the SCXI-1350 adapter board.

4. Connect another ribbon cable to the chassis extender connector that is in the middle of the SCXI-1350.

5. Plug the SCXI-1350 into the back of an SCXI module in the first chassis so that the module rear connector mates with the front connector on the SCXI-1350 adapter board. When you are connecting to an SCXI-1162, be sure to set the jumpers for either a DIO-type or an MIO-type board as needed.

6. Screw the rear panel to the threaded strips in the rear of the chassis.

7. Connect the loose end of the ribbon cable from step 4 into the rear connector of the second SCXI-1350, and install the adapter board.

8. Continue until all chassis are connected. You do not need to connect anything to the middle connector of the SCXI-1350 adapter board in the last chassis.

SCXI-1343 Rear Screw Terminal Adapter

You use the SCXI-1343 universal adapter to adapt custom wiring to the SCXI-1162. The SCXI-1343 has screw terminals and solder pads for signal connection. A strain relief is on the outside of the rear panel.

Table E-6. SCXI-1343 Pin Connections

Rear Signal Connector Pin	SCXI-1162 Use		Connection
	Parallel	Serial	
1	No Connect	In (23)	Solder pad
2	No Connect		Screw terminal
3	No Connect	In (22)	Screw terminal
4	No Connect		Screw terminal
5	No Connect	In (21)	Screw terminal
6	No Connect		Screw terminal
7	No Connect	In (20)	Screw terminal
8	No Connect		Screw terminal
9	No Connect	In (19)	Screw terminal
10	No Connect		Screw terminal
11	No Connect	In (18)	Screw terminal
12	No Connect		Screw terminal
13	No Connect	In (17)	Screw terminal
14	No Connect		Screw terminal
15	No Connect	In (16)	Screw terminal
16	No Connect		Screw terminal
17	No Connect	In (15)	Screw terminal
18	No Connect		Screw terminal
19	No Connect	In (14)	Screw terminal
20	No Connect		Solder pad
21	No Connect	In (13)	Solder pad
22	No Connect		Solder pad

(continues)

Table E-6. SCXI-1343 Pin Connections (Continued)

Rear Signal Connector Pin	SCXI-1162 Use		Connection
	Parallel	Serial	
23	No Connect	In (12)	Solder pad
24	DIG GND (MIO)		Solder pad
25	No Connect	In (11)	Solder pad
26	SERDATOUT (MIO)		Solder pad
27	DAQD*/A	In (10)	Solder pad
28	No Connect		Solder pad
29	SLOT0SEL*	In (9)	Solder pad
30	No Connect		Solder pad
31	SERCLK (DIO)	In (8)	Solder pad
32	No Connect		Solder pad
33	No Connect	In (7)	Solder pad
34	No Connect	In (31)	Solder pad
35	No Connect	In (6)	Solder pad
36	No connect	In (30)	Solder pad
37	SERCLK (MIO)	In (5)	Solder pad
38	No Connect	In (29)	Solder pad
39	No Connect	In (4)	Solder pad
40	No Connect	In (28)	Solder pad
41	No Connect	In (3)	Solder pad
42	No Connect	In (27)	Solder pad
43	No Connect	In (2)	Solder pad
44	No Connect	In (26)	Solder pad
45	No Connect	In (1)	Solder pad
46	No Connect	In (25)	Solder pad
47	SERDATOUT (DIO)	In (0)	Solder pad
48	No Connect	In (24)	Solder pad
49	No Connect		Solder pad
50	DIG GND (DIO)	DIG GND	Solder pad

SCXI-1343 Installation

1. Insert each wire through the adapter strain relief.
2. Make all solder connections first.
3. Tighten the strain relief screws to secure the wires.
4. Plug the adapter board front connector into the module rear signal connector. A corner of the adapter board will enter the upper board guide of the chassis.
5. Screw the rear panel to the threaded strips in the rear of the chassis.

Appendix F
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.

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Japan	(03) 3788-1921	(03) 3788-1923
Netherlands	03480-33466	03480-30673
Norway	32-848400	32-848600
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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 _____

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Fax (___)_____ Phone (___)_____

Computer brand _____ Model _____ Processor _____

Operating system _____

Speed _____ MHz RAM _____ M Display adapter _____

Mouse _____ yes _____ no Other adapters installed _____

Hard disk capacity _____ M 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 _____

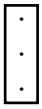
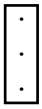
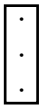
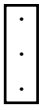
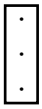
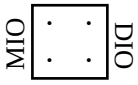
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_____

SCXI-1162 Hardware 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.

- SCXI-1162 Revision _____
- Chassis Slot _____
- Chassis Type _____

	My Setting	Factory Setting
• Jumper W1		
• Jumper W2		
• Jumper W3		
• Jumper W4		
• Jumper W5		
• Jumper W6		

Note: Mark your jumper positions on the jumper diagrams in the left column.

- Other Modules and Chassis in System _____
  _____
  _____
- Data Acquisition Boards Installed _____
  _____

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Edition Date: **March 1994**

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Glossary

Prefix	Meaning	Value
p-	pico-	10^{-12}
n-	nano-	10^{-9}
µ-	micro-	10^{-6}
m-	milli-	10^{-3}
k-	kilo-	10^{3}
M-	mega-	10^{6}

+5 V	+5 VDC Source signal
°	degrees
Ω	ohms
A	amperes
ADC	A/D converter
Arms	amperes, root mean square
AWG	American Wire Gauge
BCD	binary-coded decimal
C	Celsius
CHS	Chassis bit
CHSGND	Chassis Ground signal
CMRR	common-mode rejection ratio
D*/A	Data/Address signal
DAQD*/A	Data Acquisition Board Data/Address Line signal
dB	decibels
DIG GND	Digital Ground signal
DIN	Deutsche Industrie Norme
DMM	digital multimeter
F	farads
FIFO	first-in-first-out
ft	feet
GND	Ground signal
hex	hexadecimal
Hz	hertz
I_I	input current leakage
I_{in}	input current
I/O	input/output
I_{out}	output current
in.	inches
In	Input channel signal
IN	Input bit
INTR*	Interrupt signal
ksamples	1,000 samples
LSB	least significant bit
m	meters
M	megabytes of memory

MISO	Master-In-Slave-Out signal
MOSI	Master-Out-Slave-In signal
MSB	most significant bit
Out <23..0>	Parallel outputs driven to the logic levels seen at inputs 23 through 0.
Out <31..24>	Parallel outputs driven to the logic levels seen at inputs 31 through 24 when jumper W1 is set to 32.
ppm	parts per million
RAM	random-access memory
RESET*	Reset signal
rms	root mean square
RTI	Referred To Input
RTO	Referred To Output
RTSI	Real-Time System Integration
SCXI	Signal Conditioning eXtensions for Instrumentation (bus)
SDK	Software Developer's Kit
sec	seconds
SERCLK	Serial Clock signal
SERDATIN	Serial Data In signal
SERDATOUT	Serial Data Out signal
SL	Slot bit
SLOT0SEL*	Slot 0 Select signal
SPDT	single-pole double throw
SPI	serial peripheral interface
SPICLK	Serial Peripheral Interface (SPI) Clock
SS*	Slot Select signal
UL	Underwriters Laboratory
VAC	volts alternating current
Vcc	positive supply voltage
V	volts
V_{IH}	volts input high
V_{IL}	volts input low
V_{in}	volts in
V_{OH}	volts output high
V_{OL}	volts output low
V_{out}	volts out
VDC	volts direct current
Vrms	volts, root mean square
W	watts

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