

SSR Series

User Manual

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Contents

About This Manual	vii
Organization of This Manual	vii
Conventions Used in This Manual.....	vii
Related Documentation.....	viii
Customer Communication	ix
Chapter 1	
Introduction	1-1
What Your Kit Should Contain.....	1-1
SSR Module Part Numbers	1-2
Software Support.....	1-4
Unpacking.....	1-4
Chapter 2	
Connections and Theory of Operation	2-1
Connections.....	2-1
SSR Module Theory of Operation	2-2
Chapter 3	
SSR Mounting Racks and Modules	3-1
PB-8H Mounting Rack.....	3-1
Power Supply and Jumpers	3-3
SSR Module Installation	3-3
LEDs	3-3
Field Connections	3-3
PB-16-V Mounting Rack	3-4
Power Supply and Jumpers.....	3-5
SSR Module Installation	3-5
LEDs	3-6
Field Connections	3-6
PB-24-V Mounting Rack.....	3-6
Power Supply and Jumpers.....	3-7
SSR Module Installation	3-8
LEDs	3-8
Field Connections	3-8
PB-32D-V Mounting Rack	3-9
Power Supply and Jumpers.....	3-10
SSR Module Installation	3-10
LEDs	3-10
Field Connections	3-11
Power Allotment	3-11
Appendix A	
SSR Module Specifications	A-1
DC Output Modules.....	A-1

Input Specifications.....	A-1
Output Specifications.....	A-1
General Specifications	A-1
DC Input Modules.....	A-2
Input Specifications.....	A-2
Output Specifications.....	A-2
General Specifications	A-2
AC Output Modules.....	A-3
Input Specifications.....	A-3
Output Specifications.....	A-3
General Specifications	A-3
AC Input Modules.....	A-4
Input Specifications.....	A-4
Output Specifications.....	A-4
General Specifications	A-4

Appendix B

Customer Communication.....	B-1
------------------------------------	------------

Glossary	Glossary-1
-----------------------	-------------------

Index	Index-1
--------------------	----------------

Figures

Figure 1-1. SSR Modules Available from National Instruments.....	1-3
Figure 1-2. Detail of Two SSR Modules	1-3
Figure 2-1. Model IDC5 Wiring Diagram.....	2-3
Figure 2-2. Model IAC5 Wiring Diagram.....	2-4
Figure 2-3. Model ODC5 Wiring Diagram	2-5
Figure 2-4. Model OAC5 Wiring Diagram	2-6
Figure 3-1. PB-8H Mounting Rack with the 50-Conductor 1-m Cable.....	3-2
Figure 3-2. PB-8H Mounting Rack with the 50-to-26-Conductor 0.4-m Cable.....	3-2
Figure 3-3. Schematic of the PB-8H Mounting Rack.....	3-4
Figure 3-4. PB-16-V Mounting Rack	3-5
Figure 3-5. Schematic of the PB-16-V Mounting Rack.	3-6
Figure 3-6. PB-24-V Mounting Rack	3-7
Figure 3-7. Schematic of the PB-24-V Mounting Rack	3-9
Figure 3-8. PB-32D-V Mounting Rack	3-10
Figure 3-9. Schematic of the PB-32D-V Mounting Rack	3-11

Tables

Table 1-1. Contents of the SSR Mounting Rack Kits	1-1
Table 1-2. Available SSR Input Modules.....	1-2
Table 1-3. Available SSR Output Modules.....	1-2
Table 2-1. Connections Between Data Acquisition Boards and SSR Mounting Racks.....	2-2
Table 3-1. Amount of Power Supplied by Data Acquisition Boards	3-12

About This Manual

This manual describes the mechanical and electrical aspects of the SSR Series mounting racks and contains information about installing the modules. The SSR Series consists of six digital signal conditioning modules and four mounting racks. The SSR mounting racks interface the SSR modules to the National Instruments data acquisition boards for the Macintosh II (NB Series), IBM PS/2 Micro Channel (MC Series), and PC/XT/AT (AT Series, Lab) computers. A distinct SSR mounting rack is used with each type of data acquisition board: MIO-16, DIO-24, DIO-32F, DIO-96, and Lab boards.

Organization of This Manual

The *SSR Series User Manual* is organized as follows:

- Chapter 1, *Introduction*, lists the contents of your SSR kit, SSR module part numbers, software support, and unpacking instructions.
- Chapter 2, *Connections and Theory of Operation*, describes the connections between the mounting rack and data acquisition boards and explains the theory of operation for the SSR modules.
- Chapter 3, *SSR Mounting Racks and Modules*, describes the PB-8H SSR mounting rack, the PB-16-V SSR mounting rack, the PB-24-V SSR mounting rack, and the PB-32D-V SSR mounting rack in detail, including function, SSR module installation, and field connections.
- Appendix A, *SSR Module Specifications*, lists complete specifications for the input SSR modules and output SSR modules. This information is reprinted with permission from Gordos, Inc.
- Appendix B, *Customer Communication*, contains forms you can use to request help from National Instruments or to comment on our products and manuals.
- The *Glossary* contains an alphabetical list and description of terms used in this manual, including abbreviations, acronyms, metric prefixes, mnemonics, and symbols.

Conventions Used in This Manual

The following conventions are used in this manual:

- | | |
|----------------|---|
| <i>italics</i> | Italic text denotes emphasis, a cross reference, or an introduction to a key concept. |
| DIO-24 | DIO-24 refers to the PC-DIO-24, MC-DIO-24, and NB-DIO-24 boards. |

DIO-32F	DIO-32F refers to the AT-DIO-32F, MC-DIO-32F, and NB-DIO-32F boards.
DIO-96	DIO-96 refers to the PC-DIO-96 and NB-DIO-96 boards.
Lab	Lab refers to the Lab-LC, Lab-PC, Lab-PC+, and Lab-NB boards.
MIO-16	MIO-16 refers to the 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 boards.

Related Documentation

The following documentation from National Instruments contains 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-16X User Manual* (part number 320488-01)
- *AT-MIO-64F-5 User Manual* (part number 320487-01)
- *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)
- *SC-205X Series User Manual* (part number 320385-01)
- *SC-207X Series User Manual* (part number 320239-01)

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

Chapter 1

Introduction

This chapter lists the contents of your SSR kit, SSR module part numbers, software support, and unpacking instructions.

The SSR Series digital signal conditioning modules are used with the National Instruments MIO-16, DIO-24, DIO-32F, DIO-96, or Lab boards to sense voltages from field devices and convert them to digital signals or to convert digital signal voltages to control field devices. The SSR modules are high-performance, fully encapsulated devices that interface the personal computer to field devices via optical isolation. The SSR modules are designed to plug into one of the SSR mounting racks, which are available with 8, 16, 24, and 32 SSR module capacities (designated the PB-8H mounting rack, the PB-16-V mounting rack, the PB-24-V mounting rack, and the PB-32D-V mounting rack). Each mounting rack has screw terminals for field connections. A 50-pin connector connects the mounting rack to the data acquisition board. The mounting racks also have LEDs that indicate the *on* status of each SSR module.

What Your Kit Should Contain

The contents of the PB-8H mounting rack, PB-16-V mounting rack, PB-24-V mounting rack, and PB-32D-V mounting rack kits are listed in Table 1-1. Notice that there are three versions of the PB-8H mounting rack kit. One version contains a 50-conductor 1.0-m cable, one version contains a special 50-to-26-conductor 0.4-m cable, and the other version contains no cable.

Table 1-1. Contents of the SSR Mounting Rack Kits

Kit Name and Part Number	Kit Components	Part Number
PB-8H mounting rack kit with 1.0-m cable (776290-08)	PB-8H mounting rack <i>SSR Series User Manual</i> 50-conductor 1.0-m NB1 cable	PB-8H (Gordos Product Label) 320268-01 180524-10
PB-8H mounting rack kit with 0.4-m cable (776290-18)	PB-8H mounting rack <i>SSR Series User Manual</i> 50-to-26-conductor 0.4-m NB8 cable	PB-8H (Gordos Product Label) 320268-01 180913-10
PB-8H mounting rack kit without cable (776290-908)	PB-8H mounting rack <i>SSR Series User Manual</i>	PB-8H (Gordos Product Label) 320268-01

(continues)

Table 1-1. Contents of the SSR Mounting Rack Kits (Continued)

Kit Name and Part Number	Kit Components	Part Number
PB-16-V mounting rack kit with 1.0-m cable (776290-16)	PB-16-V mounting rack <i>SSR Series User Manual</i> 50-conductor 1.0-m NB1 cable	PB-16-V (Gordos Product Label) 320268-01 180524-10
PB-16-V mounting rack kit without cable (776290-916)	PB-16-V mounting rack <i>SSR Series User Manual</i>	PB-16-V (Gordos Product Label) 320268-01
PB-24-V mounting rack kit with 1.0-m cable (776290-24)	PB-24-V mounting rack <i>SSR Series User Manual</i> 50-conductor 1.0-m NB1 cable	PB-24-V (Gordos Product Label) 320268-01 180524-10
PB-24-V mounting rack kit without cable (776290-924)	PB-24-V mounting rack <i>SSR Series User Manual</i>	PB-24-V (Gordos Product Label) 320268-01
PB-32D-V mounting rack kit with 1.0-m cable (776290-32)	PB-32D-V mounting rack <i>SSR Series User Manual</i> 50-conductor 1.0-m NB1 cable	PB-32D-V (Gordos Product Label) 320268-01 180524-10

Contact National Instruments if your kit is missing any of its components. SSR modules are sold separately and are listed in Table 1-2 and Table 1-3.

SSR Module Part Numbers

Two types of SSR modules are available—input modules and output modules. Each of these types is available in three voltage ranges. The SSR modules available from National Instruments are listed in the following tables.

Table 1-2. Available SSR Input Modules

SSR Input Modules			
Model	Input	National Instruments Part Number	Gordos Product Label
SSR-IAC-5	90 to 140 VAC/VDC	776238-01	IAC5
SSR-IAC-5A	90 to 280 VAC/VDC	776238-02	IAC5A
SSR-IDC-5	3.3 to 32 VDC	776239-01	IDC5

Table 1-3. Available SSR Output Modules

SSR Output Modules					
Model	Output Voltage	Maximum Output Current	Maximum 5 VDC Current	National Instruments Part Number	Gordos Product Label
SSR-OAC-5	12 to 140 VAC	3.5 A	18 mA	776240-01	OAC5
SSR-OAC-5A	24 to 280 VAC	3.5 A	18 mA	776240-02	OAC5A
SSR-ODC-5	3 to 60 VDC	3.0 A	18 mA	776241-01	ODC5

Figure 1-2 shows the SSR modules available from National Instruments and Figure 1-3 is a detail of two modules.

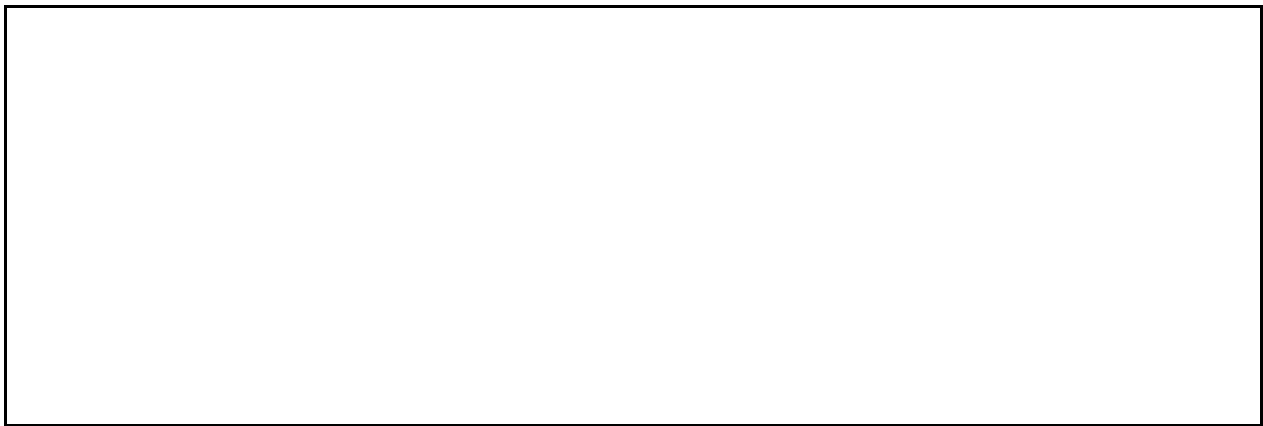


Figure 1-1. SSR Modules Available from National Instruments



Figure 1-2. Detail of Two SSR Modules

Software Support

The SSR mounting racks are invisible to the host computer and thus require no additional software support beyond the software you use for the data acquisition board.

Unpacking

Remove the mounting rack from the package and inspect it for loose components or any other sign of damage. Notify National Instruments if the mounting rack appears damaged in any way. Do *not* connect a damaged mounting rack to your computer.

Chapter 2

Connections and Theory of Operation

This chapter describes the connections between the mounting rack and data acquisition boards and explains the theory of operation for the SSR modules.

Connections

Connections to the DIO-24 board and DIO-32F board are made directly with the 50-conductor cable supplied with most of the kits (see the *What Your Kit Should Contain* section in Chapter 1). Connections to the AT-MIO-16D board are made directly with a 100-conductor NB5 cable, available separately. The NB5 cable terminates the AT-MIO-16D pins with two 50-pin connectors, one of which is pin compatible with the DIO-24 connector. The remaining eight digital I/O lines of the AT-MIO-16D can be connected to a PB-8H mounting rack using an SC-205X Series board. The only direct connections (with the supplied cable) that are possible with these four mounting racks are as follows:

- A DIO-24 board can connect directly to the PB-8H mounting rack, PB-16-V mounting rack, or PB-24-V mounting rack.
- The DIO-32F can connect directly only to the PB-32D-V mounting rack.
- An AT-MIO-16D can connect directly to the PB-8H mounting rack, PB-16-V mounting rack, or PB-24-V mounting rack.

If you are using a DIO-24 or an AT-MIO-16D, the SSR module draws its power from the computer and no external power is required. If you are using a DIO-32F, the SSR module receives no power from the computer, so external power must be supplied to the PB-32D-V mounting rack.

The SC-205X Series boards can connect to the PB-8H mounting rack for use with Lab and MIO-16 boards. Using the SC-2052 board, the PB-8H mounting rack can be connected to the DIO-32F. In these cases, a special 26-conductor type NB8 cable is required. This cable connects the PB-8H mounting rack directly to any one of the 26-pin digital I/O connectors on any SC-205X Series board. The SC-205X Series board then attaches to the data acquisition board (either MIO-16, DIO-24, DIO-32F, DIO-96, or Lab) via a standard 50-conductor cable. If you are using an AT-MIO-16D or AT-MIO-64F-5, the SC-205X Series board attaches to the data acquisition board via a 100-conductor NB5 cable. Consult the *SC-205X Series User Manual* for information on using the SC-205X Series boards. You can order the required 26-conductor cable as part of one of the two PB-8H mounting rack kits, or you can order it separately.

Table 2-1 shows the possible connections among National Instruments data acquisition boards and the various SSR mounting racks.

Table 2-1. Connections Between Data Acquisition Boards and SSR Mounting Racks

	PB-8H Mounting Rack	PB-16-V Mounting Rack	PB-24-V Mounting Rack	PB-32D-V Mounting Rack
MIO-16	2	None	None	None
AT-MIO-16D	1, 2	1	1	1
DIO-24	1, 2	1	1	None
DIO-32F	2	None	None	1
DIO-96	2	2	2	None
Lab	2	None	None	None
1–Direct cable connection with 50-conductor cable.				
2–Connection through an SC-205X Series board and special 26-conductor cable.				

SSR Module Theory of Operation

Two types of SSR modules are available—input modules and output modules. Input SSR modules sense voltages from a field source and return a logic value to the data acquisition board. The SSR modules use negative logic. If a voltage within the selected input range for the SSR module is present, the SSR module returns a logic low. Otherwise, the SSR module returns a logic high. Output SSR modules sense a logic value from the data acquisition board and control external devices. They control the power in a similar manner to conventional relays. If the data acquisition board is sending a logic low, then the SSR module is turned on and current can flow. If a logic high is sent, the SSR module is turned off. Both types of SSR modules optically isolate the field signals from the computer, preventing any possibility of damage to the computer by overvoltage transients on these lines. The optical isolation is rated for surges up to 4000 V.

Output SSR modules are similar to relays, but there are some important differences. Unlike conventional relays, these solid state relays require voltage to be present and current to flow through them in the *on* state, or they will turn off, even if a logic high is at their input. This occurrence is referred to as *dropout*. The dropout voltage and current specifications for the output SSR modules are given in Appendix A, *SSR Module Specifications*. For most control applications, such as controlling motors or lamps, these requirements are not difficult to meet. If a solid state relay should drop out for some reason, it must be turned off with a logic high before it can be turned on again. A second difference between these output SSR modules and conventional relays is that they do not turn completely off. A small leakage current flows all the time, even in the *off* state. For most control applications, this current presents no problems.

There are four SSR Series modules, two input modules (Model IDC5 and Model IAC5) and two output modules (Model ODC5 and Model OAC5).

Model IDC5 is a DC input module. The wiring diagram of Model IDC5 with an SSR mounting rack is shown in Figure 2-1.

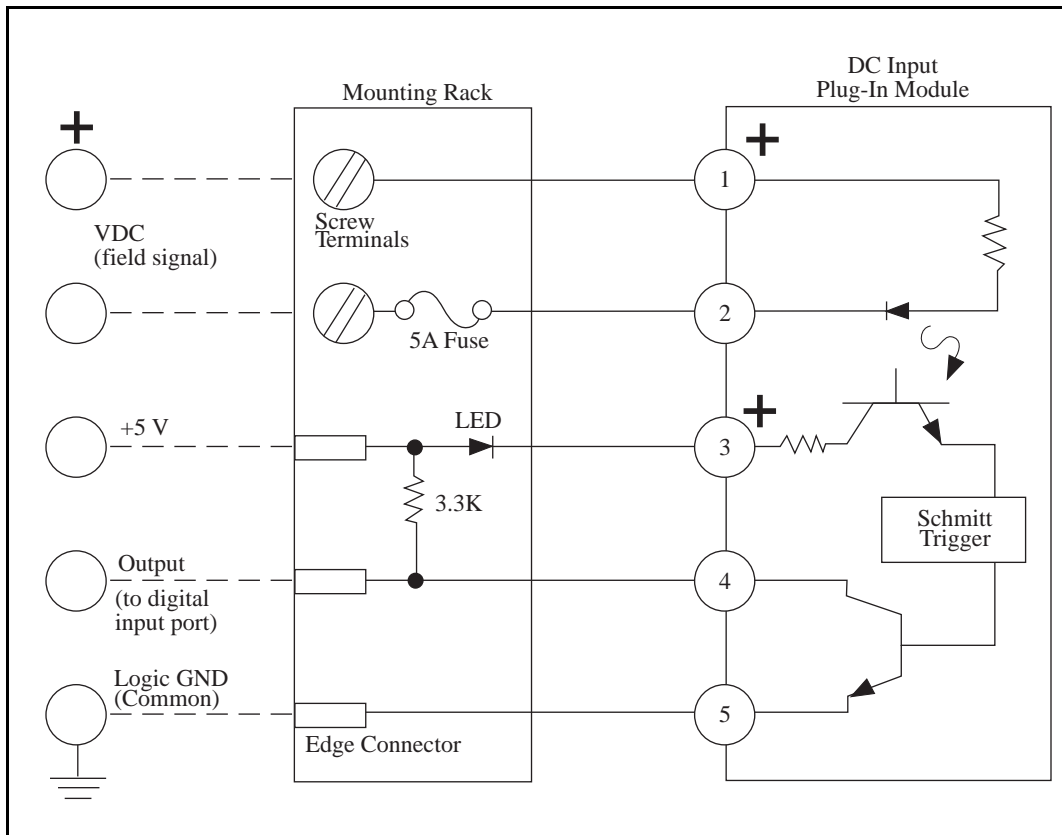


Figure 2-1. Model IDC5 Wiring Diagram

Model IAC5 is an AC input module. The wiring diagram of Model IAC5 with an SSR mounting rack is shown in Figure 2-2.

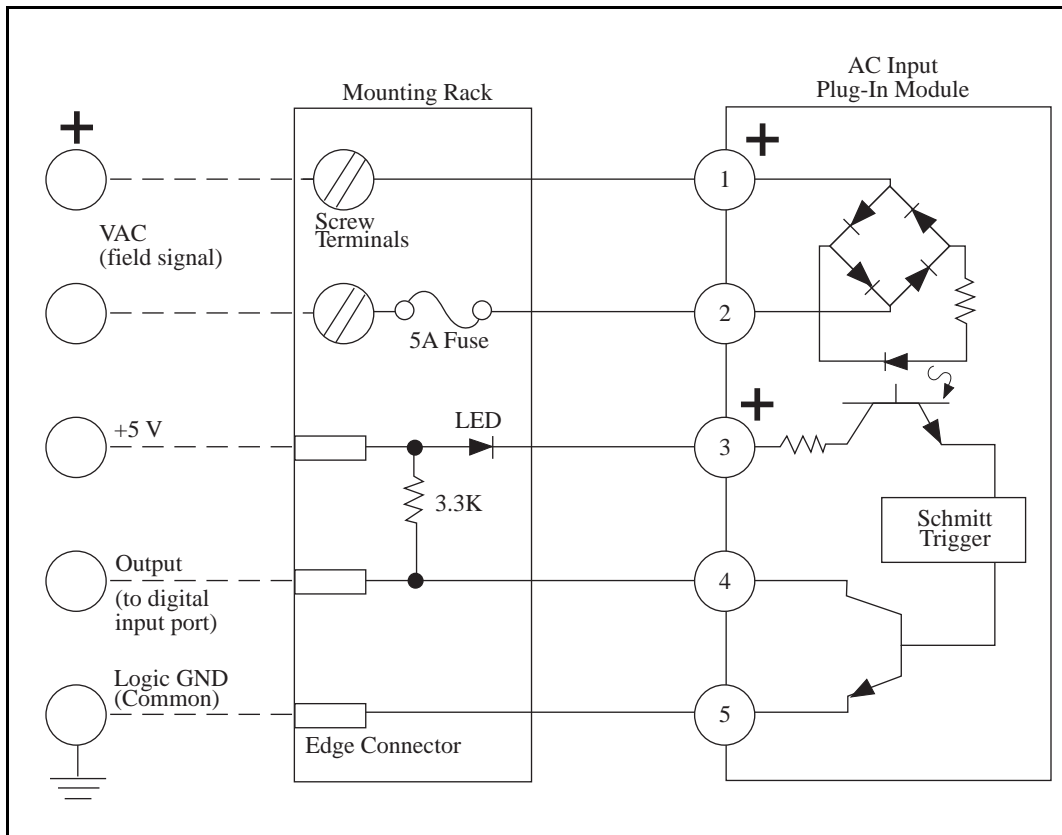


Figure 2-2. Model IAC5 Wiring Diagram

Model ODC5 is a DC output module. The wiring diagram of Model ODC5 with an SSR mounting rack is shown in Figure 2-3. A commutating diode should be used to protect the output module if the load is inductive.

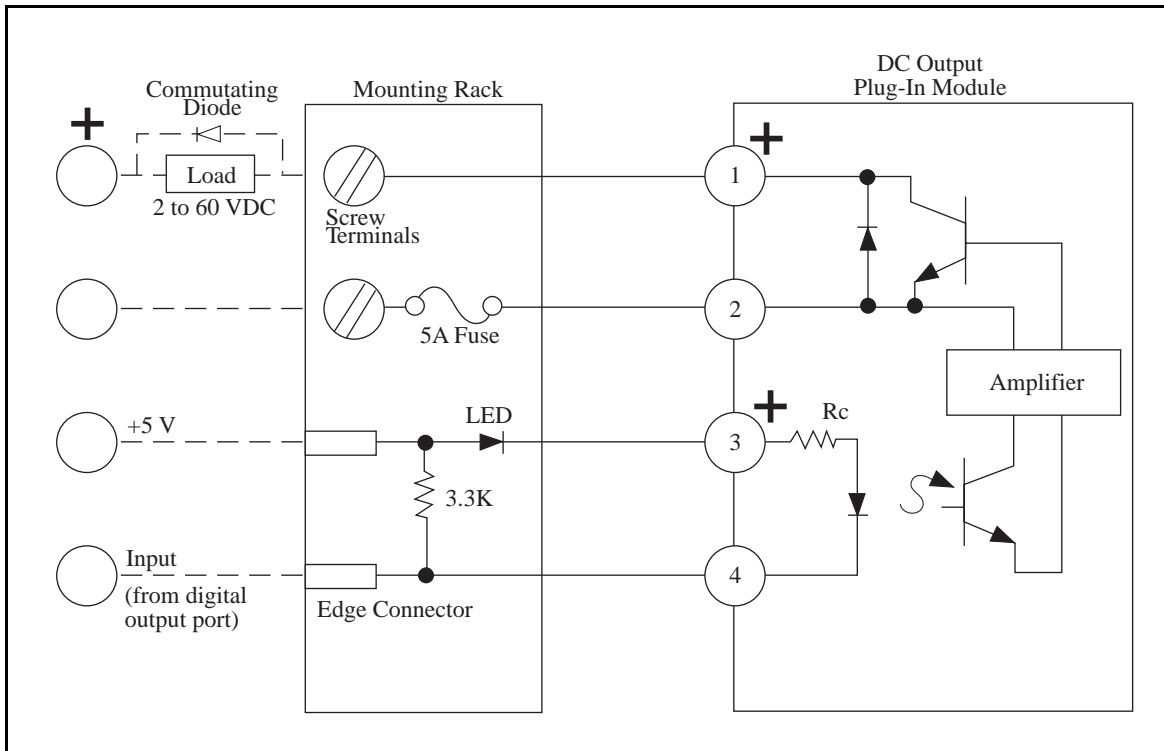


Figure 2-3. Model ODC5 Wiring Diagram

Model OAC5 is an AC output module. The wiring diagram of Model OAC5 with an SSR mounting rack is shown in Figure 2-4.

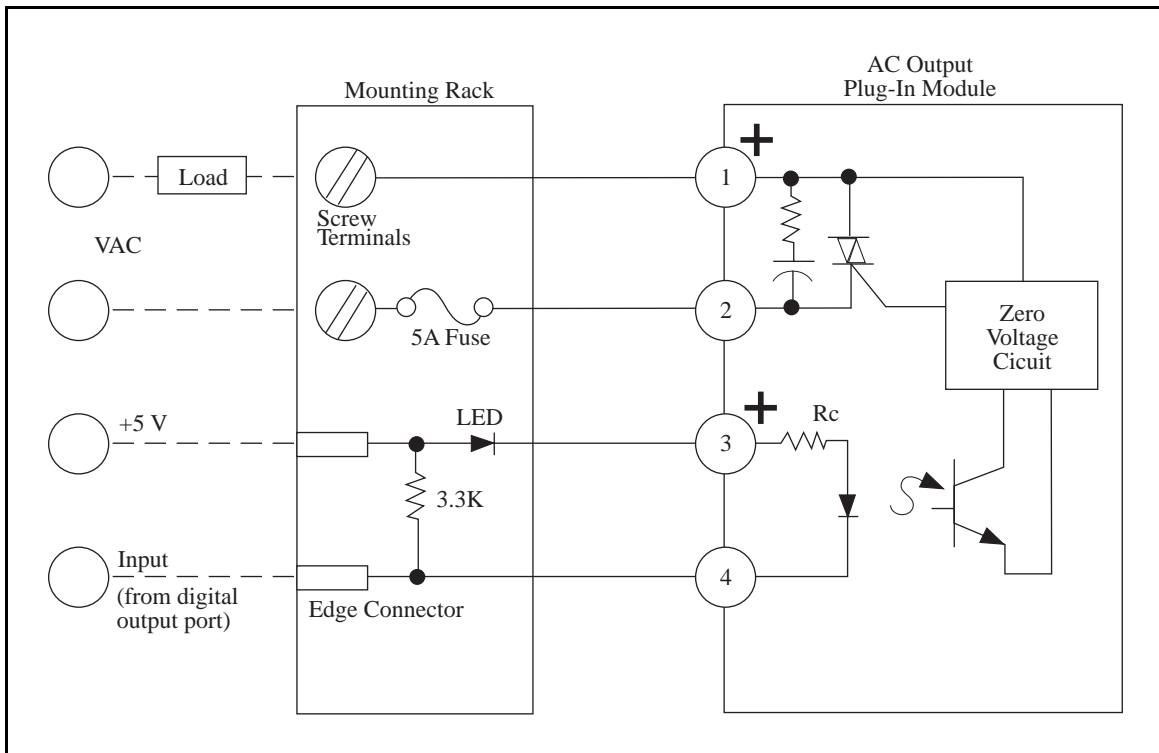


Figure 2-4. Model OAC5 Wiring Diagram

Chapter 3

SSR Mounting Racks and Modules

This chapter describes the PB-8H SSR mounting rack, the PB-16-V SSR mounting rack, the PB-24-V SSR mounting rack, and the PB-32D-V SSR mounting rack in detail, including function, SSR module installation, and field connections.

PB-8H Mounting Rack

The PB-8H mounting rack accommodates up to eight SSR modules. The PB-8H can be connected directly to a DIO-24 (NB Series, MC Series, or AT Series) via a 50-conductor NB1 cable or to an AT-MIO-16D via a 100-conductor NB5 cable. It *cannot* be connected directly to any other data acquisition board with these cables. If it is connected directly to a DIO-24 or AT-MIO-16D, the eight SSR modules are connected to the eight lines of Port A on the board. Alternatively, the PB-8H mounting rack can be ordered with a special 26-conductor cable for use with the SC-205X Series boards (see the *What Your Kit Should Contain* section in Chapter 1). This cable has a 26-position connector at one end and a 50-position connector at the other. The 50-position connector plugs into the PB-8H mounting rack. The 26-position connector can be plugged into any digital I/O port position on any of the SC-205X Series boards, thus allowing the PB-8H mounting rack to be used with the DIO-32F, DIO-96, Lab, and MIO-16 boards or with Port B and Port C on the DIO-24 or AT-MIO-16D. This special 26-conductor cable is also available separately. See the *SC-205X Series User Manual* for more information about connecting to the digital I/O ports via SC-205X Series boards.

Warning: Do *not* attempt to connect the PB-8H mounting rack to a host computer board for which it was not designed. Such connections can result in damage to any or all SSR modules connected to the PB-8H mounting rack, to the host computer, and to the data acquisition board. National Instruments is not liable for any damages resulting from incorrect connections.

Figure 3-1 shows the PB-8H mounting rack with the 50-conductor 1.0-m cable.

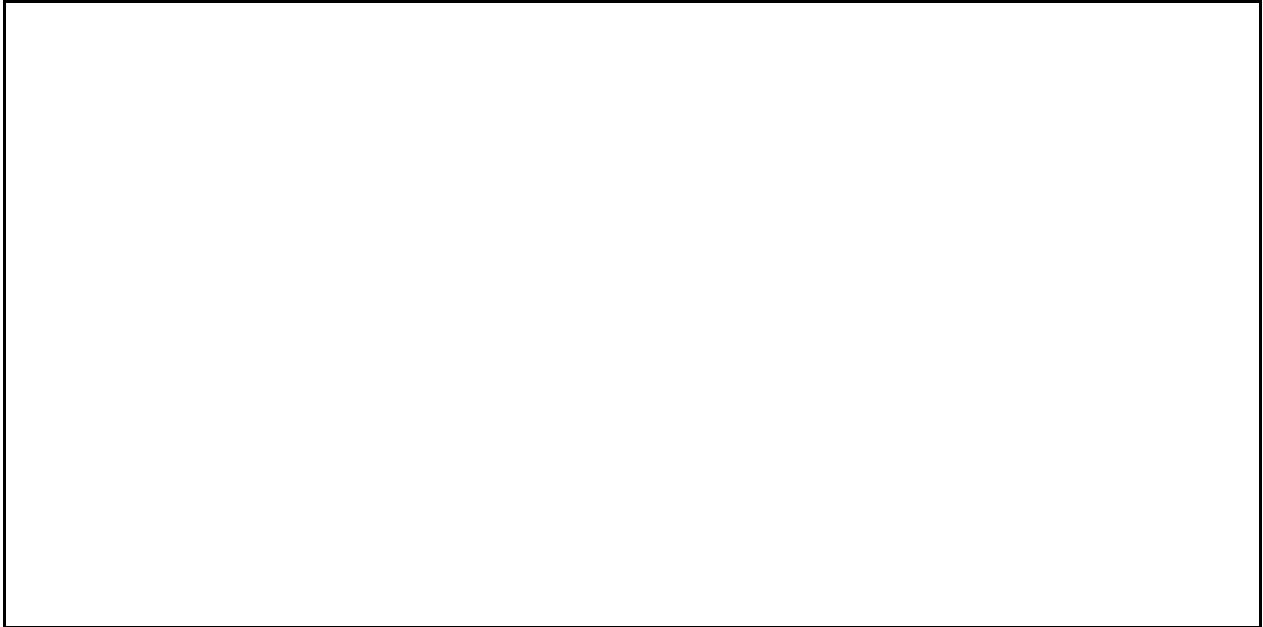


Figure 3-1. PB-8H Mounting Rack with the 50-Conductor 1.0-m Cable

Figure 3-2 shows the PB-8H mounting rack with the 50-to-26-conductor 0.4-m cable.

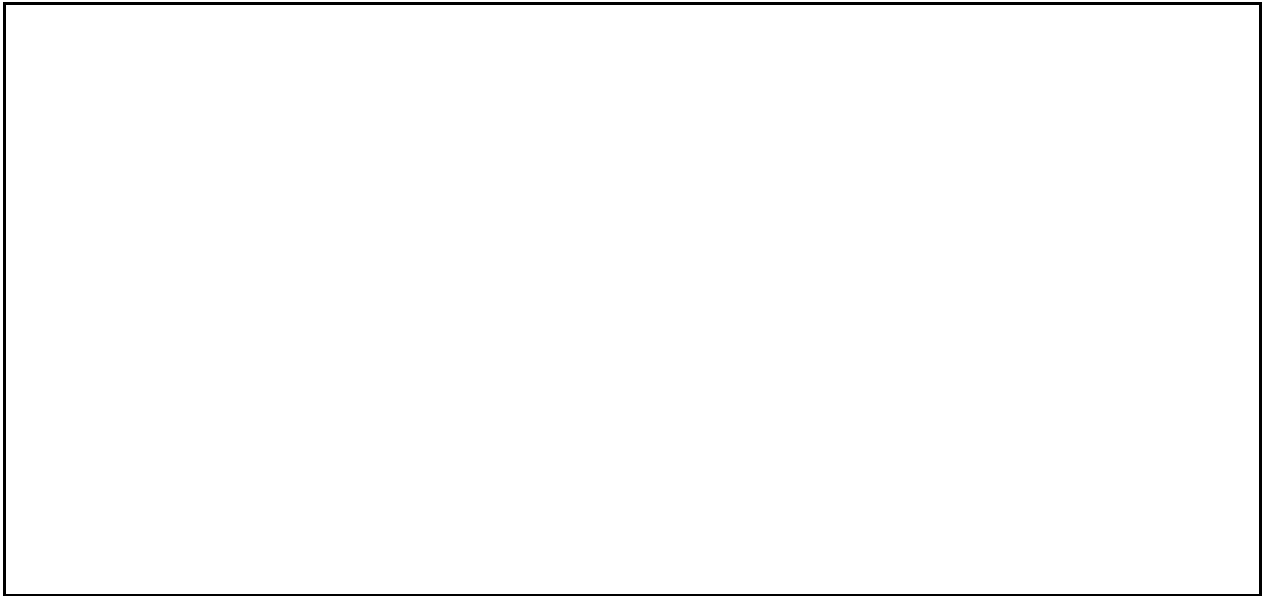


Figure 3-2. PB-8H Mounting Rack with the 50-to-26-Conductor 0.4-m Cable

Power Supply and Jumpers

The PB-8H can be powered by either the data acquisition board (via the 50-pin header) or an external power supply connected to the +5 V and GND screw terminals. An external supply is required if the PB-8H is connected to a DIO-32F via an SC-2052, because the DIO-32F does not supply +5 V power. An external power supply is also needed if the power requirements for all accessories connected to one computer slot exceed the limitations for that slot. To determine if the power requirements for a particular slot have exceeded the limitations, add the +5 V current of all accessories connected (that is, each SSR module, SC-205X Series board, and so on), and compare the total current with the information given in Table 3-1.

If the PB-8H is being powered from the data acquisition board, then no modifications are required. If an external supply is connected to the +5 V and GND screw terminals, then the +5 V jumpers adjacent to the 50-pin header must be removed. They must be reinserted if the board is to be powered from the data acquisition board at a later time.

SSR Module Installation

SSR modules are easily installed on the PB-8H mounting rack by simply plugging them in one of the eight designated positions. They are keyed, so they cannot be inserted incorrectly. Notice that most National Instruments data acquisition boards require that all of the digital I/O lines in a port be configured either for input or output. Therefore, all SSR modules installed on the PB-8H mounting rack should always be the same type; that is, all input or all output. *Do not* mix types under any circumstances, or you may damage the SSR modules or the data acquisition board.

LEDs

Each SSR module position of the PB-8H mounting rack has an LED to visually indicate the status of the SSR module. For input SSR modules, the LED is illuminated when a voltage within the SSR module's input range is present. The SSR module returns a logic low to the data acquisition board in this case. If no voltage is present, the LED is off, and the SSR module returns a logic high. In the case of output SSR modules, the LED is off when you write a logic high to the SSR module. If you write a logic low, then both the LED and the SSR module are on.

Field Connections

Figure 3-3 shows a schematic of the PB-8H mounting rack. External devices are connected to the SSR modules via the screw terminals. Output SSR modules turn on by allowing current to flow between the two screw terminals on the mounting rack designated for the SSR module position. Input SSR modules require that the voltage to be sensed connects to one terminal, and the ground reference for this voltage connects to the other. It is advisable to connect the high, or live, side of any field source to the screw terminal (screw terminal 2, screw terminal 4, screw terminal 6, and so on) that passes through the fuse. See Figures 2-1 through 2-4 for more information on connecting field signals to the mounting rack and SSR modules.

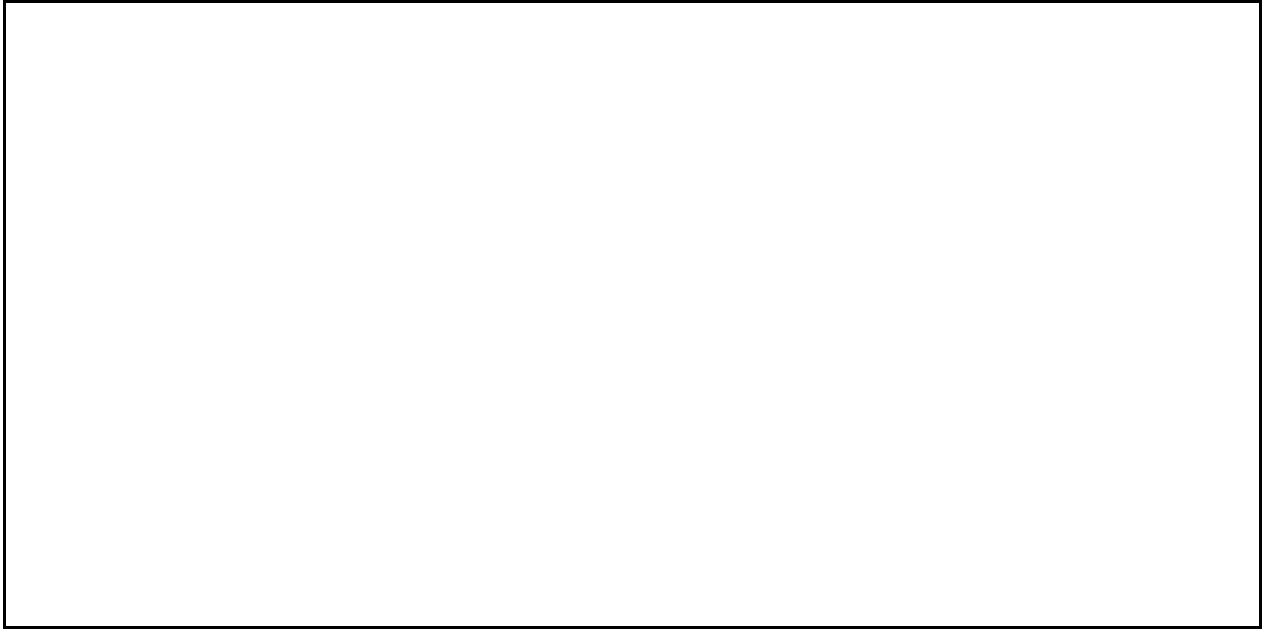


Figure 3-3. Schematic of the PB-8H Mounting Rack

PB-16-V Mounting Rack

The PB-16-V mounting rack accommodates up to 16 SSR modules. It can be connected directly to a DIO-24 (NB Series, MC Series, or AT Series) via a 50-conductor NB1 cable or to an AT-MIO-16D via a 100-conductor NB5 cable. It *cannot* be connected to any other data acquisition board with these cables. If it is connected directly to a DIO-24 or AT-MIO-16D, the 16 SSR modules are connected to Port A and Port B on the board. Modules 1 through 8 connect to Port A, and SSR modules 9 through 16 connect to Port B. The PB-16-V mounting rack can be connected to a DIO-96 via the SC-2054 cable adapter board. The PB-16-V can only be used with other data acquisition boards if you supply a custom cable. National Instruments does not sell any cable to connect other data acquisition boards directly to a PB-16-V mounting rack.

Warning: Do *not* attempt to connect the PB-16-V mounting rack to a host computer board for which it was not designed. Such connections can result in damage to any or all SSR modules connected to the PB-16-V mounting rack, to the host computer, and to the data acquisition board. National Instruments is not liable for any damages resulting from incorrect connections.

Figure 3-4 shows the PB-16-V mounting rack.

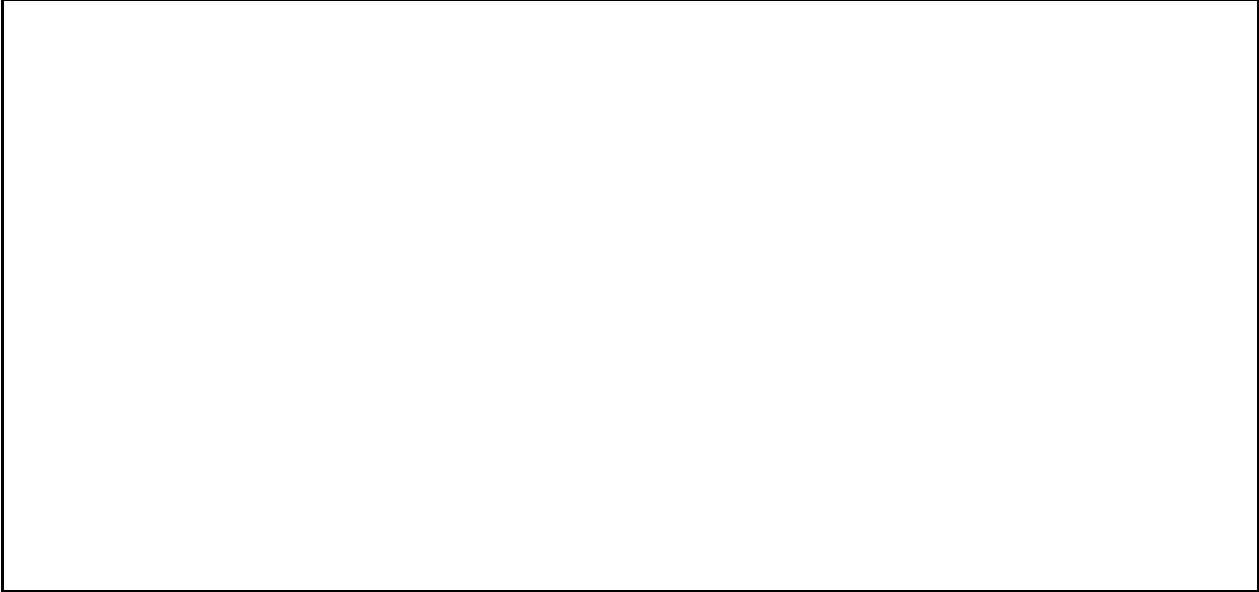


Figure 3-4. PB-16-V Mounting Rack

Power Supply and Jumpers

The PB-16-V can be powered by either the DIO-24 (via the 50-pin header) or an external power supply connected to the +5 V and GND screw terminals. An external power supply is also needed if the power requirements for all accessories connected to one computer slot exceed the limitations for that slot. To determine if the power requirements for a particular slot have exceeded the limitations, add the +5 V current of all accessories connected (that is, each SSR module), and compare the total current with the information given in Table 3-1.

If the PB-16-V is being powered by an external power supply, then no modifications are required. If the DIO-24 is used to supply +5 V power, then jumpers must be inserted into the open positions near pin 1 and pin 49 of the 50-pin header. These jumpers must be removed if an external supply is used later.

SSR Module Installation

SSR modules are easily installed on the PB-16-V mounting rack by simply plugging them in one of the 16 designated positions. They are keyed, so they cannot be inserted incorrectly. Notice that most National Instruments data acquisition boards require that all of the digital I/O lines in a port be configured together either for input or output. Therefore, all SSR modules installed within each block of eight positions (that is, 1 through 8 and 9 through 16) on the PB-16-V mounting rack should be the same type; that is, all input or all output. Input and output SSR modules can be mixed on the PB-16-V mounting rack if they are connected to *different* I/O ports. *Do not* mix types within a port under any circumstances, or you can damage the SSR modules or the data acquisition board.

LEDs

Each SSR module position of the PB-16-V mounting rack has an LED to visually indicate the status of the SSR module. For SSR input modules, the LED is illuminated when a voltage within the SSR module's input range is present. The SSR module returns a logic low to the data acquisition board in this case. If no voltage is present, the LED is off, and the SSR module returns a logic high. In the case of output SSR modules, the LED is off when you write a logic high to the SSR module. If you write a logic low, then both the LED and the SSR module are on.

Field Connections

Figure 3-5 shows a schematic of the PB-16-V mounting rack. External devices are connected to the SSR modules via the screw terminals. SSR output modules turn on by allowing current to flow between the two screw terminals on the mounting rack designated for the SSR module positions. SSR input modules require that the voltage to be sensed connects to one terminal, and the ground reference for this voltage connects to the other. It is advisable to connect the high, or live, side of any field source to the screw terminal (screw terminal 2, screw terminal 4, screw terminal 6, and so on) that passes through the fuse. See Figures 2-1 through 2-4 for more information on connecting field signals to the mounting rack and SSR modules.

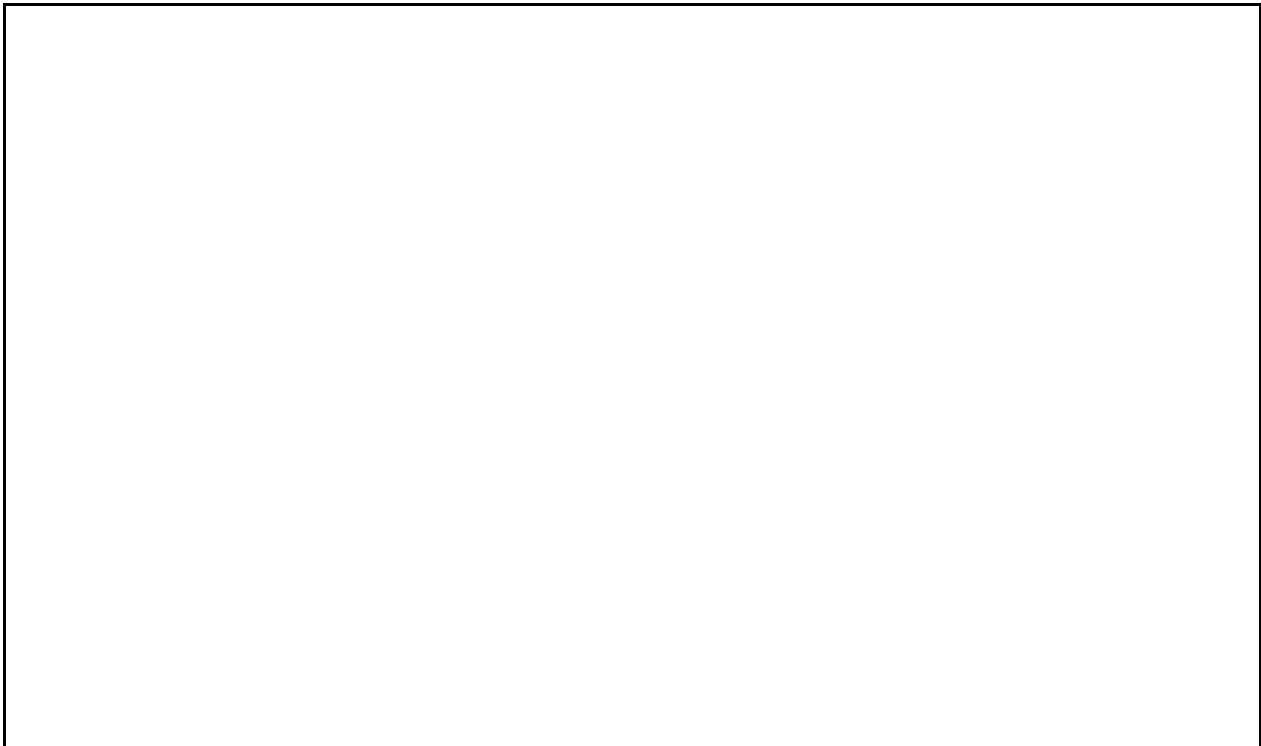


Figure 3-5. Schematic of the PB-16-V Mounting Rack

PB-24-V Mounting Rack

The PB-24-V mounting rack accommodates up to 24 SSR modules. It can be connected directly to a DIO-24 (NB Series, MC Series, or AT Series) via a 50-conductor NB1 cable or to an AT-MIO-16D via a 100-conductor NB5 cable. It *cannot* be connected directly to any other data acquisition board with these cables. If it is connected directly to a DIO-24 or AT-MIO-16D, the 24 SSR modules are connected to Port A, Port B, and Port C of the board. SSR modules 1 through 8 connect to Port A; SSR modules 9 through 16 connect to Port B; and SSR modules 17 through 24 connect to Port C. The PB-24-V mounting rack can be connected to a DIO-96 via the SC-2054 cable adapter board. The PB-24-V can only be used with the other data acquisition boards if a user-supplied custom cable is made. National Instruments does not sell any cable to connect other data acquisition boards to a PB-24-V.

Warning: Do *not* attempt to connect the PB-24-V mounting rack to a host computer board for which it was not designed. Such connections can result in damage to any or all SSR modules connected to the PB-24-V mounting rack, to the host computer, and to the data acquisition board. National Instruments is not liable for any damages resulting from incorrect connections.

Figure 3-6 shows the PB-24-V mounting rack.

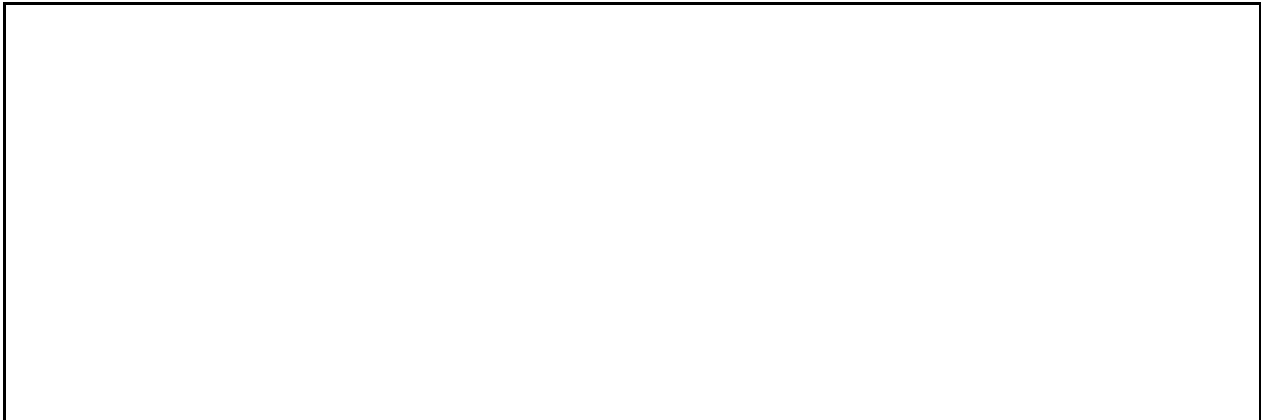


Figure 3-6. PB-24-V Mounting Rack

Power Supply and Jumpers

The PB-24-V can be powered by either the data acquisition board (via the 50-pin header) or an external power supply connected to the +5 V and GND screw terminals. An external power supply is also needed if the power requirements for all accessories connected to one computer slot exceed the limitations for that slot. To determine if the power requirements for a particular slot have exceeded the limitations, add the +5 V current of all accessories connected (that is, each SSR module), and compare the total current with the information given in Table 3-1.

If the PB-24-V is being powered from the data acquisition board, then no modifications are required.

Note: If the PB-24-V is being powered from an external power supply, then the fuse on your DIO-24 board must be removed. This fuse must be reinserted if the PB-24-V is to be powered from the DIO-24 at a later time.

SSR Module Installation

SSR modules are easily installed on the PB-24-V mounting rack by simply plugging them in one of the 24 positions. They are keyed, so they cannot be inserted incorrectly. Notice that most National Instruments data acquisition boards require that all of the digital I/O lines in a port be configured either for input or output. Therefore, all SSR modules installed within each block of eight positions (that is, 1 through 8, 9 through 16, and 17 through 24) on the PB-24-V mounting rack should be the same type; that is all input or all output. Input and output SSR modules can be mixed on the PB-24-V mounting rack if they are connected to *different* I/O ports. *Do not* mix types within a port under any circumstances, or you can damage the SSR modules or the data acquisition board.

LEDs

Each SSR module position of the PB-24-V mounting rack has an LED to visually indicate the status of the SSR module. For SSR input modules, the LED is illuminated when a voltage within the SSR module's input range is present. The SSR module returns a logic low to the data acquisition board in this case. If no voltage is present, the LED is off, and the SSR module returns a logic high. In the case of output SSR modules, the LED is off when you write a logic high to the SSR module. If you write a logic low, then both the LED and the SSR module are on.

Field Connections

Figure 3-7 shows a schematic of the PB-24-V mounting rack. External devices are connected to the SSR modules via the screw terminals on the mounting rack designated for the SSR module positions. SSR output modules turn on by allowing current to flow between the two screw terminals on the mounting rack for the SSR module position. SSR input modules require that the voltage to be sensed connects to one terminal, and the ground reference for this voltage connects to the other. It is advisable to connect the high, or live side of any field source to the screw terminal (screw terminal 2, screw terminal 4, screw terminal 6, and so on) that passes through the fuse. See Figures 2-1 through 2-4 for more information on connecting field signals to the mounting rack and SSR modules.

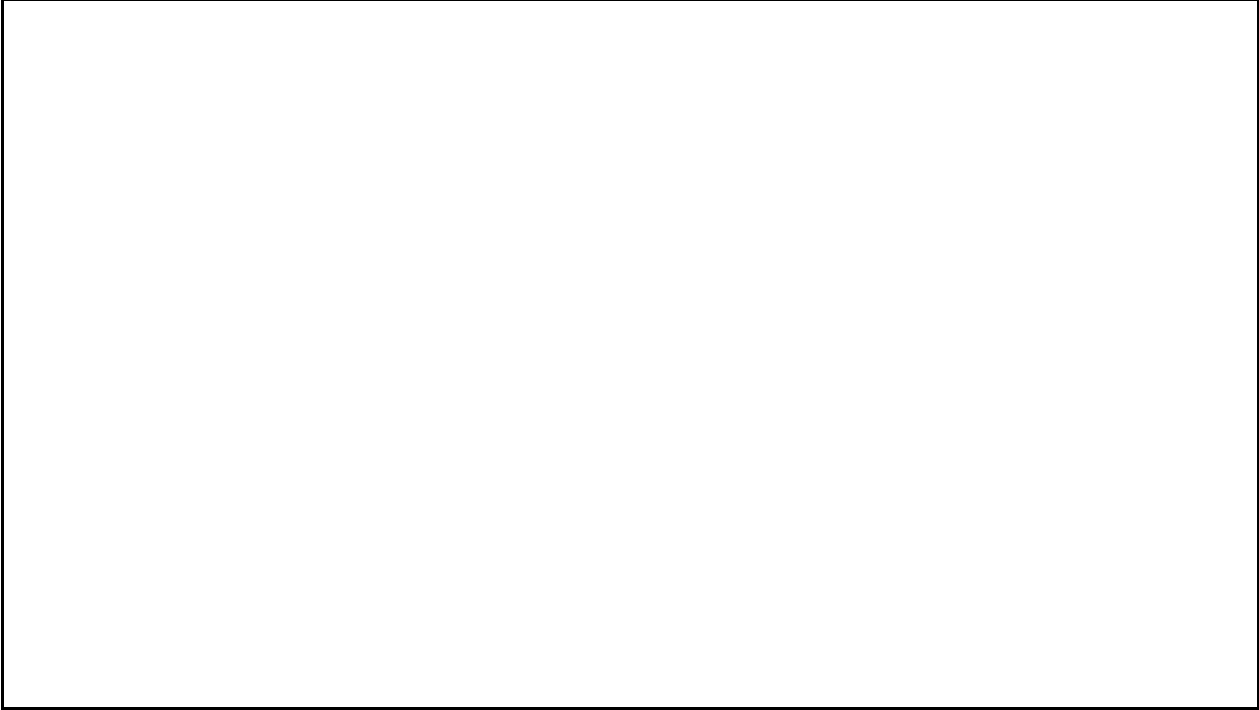


Figure 3-7. Schematic of the PB-24-V Mounting Rack

PB-32D-V Mounting Rack

The PB-32D-V mounting rack accommodates up to 32 SSR modules. It can be connected directly to a DIO-32F (NB Series or AT Series) via a 50-conductor cable. It *cannot* be connected to any other data acquisition board with this cable. If it is connected directly to a DIO-32F the 32 SSR modules are connected to Port A, Port B, Port C, and Port D of the DIO-32F. SSR modules 1 through 8 connect to Port A; SSR modules 9 through 16 connect to Port B; SSR modules 17 through 24 connect to Port D; and SSR modules 25 through 32 connect to Port C. The PB-32D-V mounting rack *cannot* be used with the SC-205X Series boards. It can only be used with the DIO-24 if a user-supplied custom cable is made. National Instruments does not sell any cable to connect the DIO-24 to a PB-32D-V mounting rack.

Warning: Do *not* attempt to connect the PB-32D-V mounting rack to a host computer board for which it was not designed. Such connections can result in damage to any or all SSR modules connected to the PB-32D-V mounting rack, to the host computer, and to the data acquisition board. National Instruments is not liable for any damages resulting from incorrect connections.

Figure 3-8 shows the PB-32D-V mounting rack.



Figure 3-8. PB-32D-V Mounting Rack

Power Supply and Jumpers

The PB-32D-V receives its +5 V power through the two screw terminals near the 50-pin header. It cannot be powered from the DIO-32F. No jumpers need to be removed or inserted. Be sure that your power supply is capable of powering 32 modules (see Appendix A, *SSR Module Specifications*).

SSR Module Installation

SSR modules are easily installed on the PB-32D-V mounting rack by simply plugging them in one of the 32 positions. They are keyed, so they cannot be inserted incorrectly. Notice that most National Instruments data acquisition boards require that all of the digital I/O lines in a port be configured either for input or output. Therefore, all SSR modules installed within each block of eight positions (that is, 1 through 8, 9 through 16, 17 through 24, and 25 through 32) on the PB-32D-V mounting rack should be the same type; that is, all input or all output. Input and output SSR modules can be mixed on the PB-32D-V mounting rack if they are connected to *different* I/O ports. *Do not* mix types within a port under any circumstances, or you may damage the SSR modules or the data acquisition board.

LEDs

Each SSR module position of the PB-32D-V SSR mounting rack has an LED to visually indicate the status of the SSR module. For SSR input modules, the LED is illuminated when a voltage within the SSR module's input range is present. The SSR module returns a logic low to the data acquisition board in this case. If no voltage is present, the LED is off, and the SSR module returns a logic high. In the case of output SSR modules, the LED is off when you write a logic high to the SSR module. If you write a logic low, then both the LED and the SSR module are on.

Field Connections

Figure 3-9 shows a schematic of the PB-32D-V mounting rack. External devices are connected to the SSR modules via the screw terminals on the mounting rack designated for the SSR module positions. Output SSR modules turn on by allowing current to flow between the two screw terminals on the mounting rack for the SSR module position. Input SSR modules require that the voltage to be sensed connects to one terminal, and the ground reference for this voltage connects to the other. It is advisable to connect the high, or live side of any field source to the screw terminal (screw terminal 2, screw terminal 4, screw terminal 6, and so on) that passes through the fuse. See Figures 2-1 through 2-4 for more information on connecting field signals to the mounting rack and SSR modules.

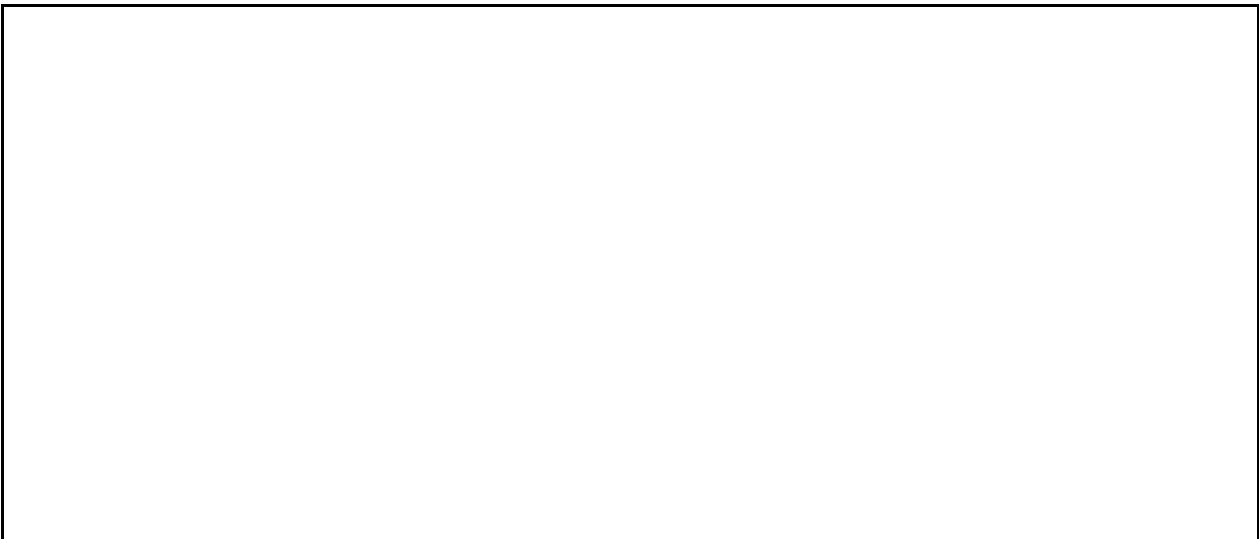


Figure 3-9. Schematic of the PB-32D-V Mounting Rack

Power Allotment

Table 3-1 shows the allotted power per slot of the data acquisition boards. Use this table to determine if an external power supply is required with your SSR Series mounting rack.

Table 3-1. Amount of Power Supplied by Data Acquisition Boards

Board	Allotted Power by Slot	Power Used by Board	Power from Board Available for Accessories
AT-DIO-32F	Not Specified ¹	1.28 A	0 A ³
AT-MIO-16	Not Specified ¹	1.5 A	1 A ²
AT-MIO-16D	Not Specified ¹	1.75 A	1 A ²
AT-MIO-16F-5	Not Specified ¹	1.7 A	1 A ²
AT-MIO-16X	Not Specified ¹	2.0 A	1 A ²
AT-MIO-64F-5	Not Specified ¹	2.0 A	1 A ²
Lab-PC	Not Specified ¹	0.6 A	1 A ²
Lab-PC+	Not Specified ¹	0.15 A	1 A ²
PC-DIO-24	Not Specified ¹	0.16 A	1 A ²
PC-DIO-96	Not Specified ¹	0.45 A	1 A ²
MC-DIO-24	1.6 A	0.8 A	0.8 A
MC-DIO-32F	1.6 A	1.4 A	0 A ³
MC-MIO-16	1.6 A	1.4 A	0.2 A
Lab-LC	0.8 A	0.25 A	0.5 A
Lab-NB	2.0 A	0.8 A	1 A ²
NB-DIO-24	2.0 A	0.8 A	1 A ²
NB-DIO-32F	2.0 A	1.6 A	0 A ³
NB-MIO-16	2.0 A	1.5 A	0.5 A
NB-MIO-16X	2.0 A	1.4 A	0.25 A ²
<p>¹ The allocated power by slot is not specified on the XT and AT bus and depends on the power supply capacity and the power used by other boards installed in your system.</p> <p>² These limitations are caused by a series fuse on the +5 V out on these boards, rather than the remaining power per slot.</p> <p>³ The DIO-32F does not have a +5 V digital supply output. All SSR Series modules require an external power supply when used with the DIO-32F.</p>			

Appendix A

SSR Module Specifications

This appendix lists complete specifications for the output SSR modules and the input SSR modules. This information is reprinted with permission from Gordos, Inc.

DC Output Modules

Input Specifications¹

Parameter	ODC5
Nominal input voltage	5.0 VDC
Minimum turn-on voltage	2.75 VDC
Maximum input voltage	8.0 VDC
Dropout voltage	1.0 VDC
Maximum input current ³	16 mADC
Nominal input resistance ⁴	250 Ω

Output Specifications¹

Parameter	ODC5
Maximum line voltage	60 VDC
Minimum line voltage	3.0 VDC
Maximum off-state voltage	60 VDC
Maximum off-state leakage ⁵	1.0 mADC
Maximum on-state current ⁶	3.0 ADC
Minimum on-state current	10 mADC
Maximum 1 sec surge ⁷	5.0 ADC
Peak on-state voltage ⁸	1.5 VDC

General Specifications¹

Parameter	All Devices
Operating temperature range	-30° to +80° C
Storage temperature range	-40° to +100° C
Maximum turn-on time ⁹	25 μ sec
Maximum turn-off time ⁹	50 μ sec
Input to output isolation voltage ¹⁰	4,000 Vrms
Capacitance input to output (maximum)	8 pF

Footnotes:

- Specifications apply to T_a -30° to +80° C unless otherwise noted.
- Tolerance: inches \pm .020; millimeters \pm , 50.
- At nominal input voltage.
- Does not include IRED impedance (drop).
- At T_a of 80° C and maximum line voltage.
- At T_a of 20° C, derate 38 mA/° C to 80° C for standard version.
At T_a of 45° C, derate 18 mA/° C to 80° C for A version.

- At T_a of 25° C, non-repetitive.
- At T_a of 25° C, and maximum rated current.
- At maximum voltage and current, nominal logic supply voltage. 15 V and 24 V modules 1 msec turns on, 2 msec turns off.
- At T_a of 25° C for one sec, maximum leakage 100 μ A.

DC Input Modules

Input Specifications¹

Parameter	IDC5
Maximum input voltage	32 VDC
Minimum input voltage	3.3 VDC
Input resistance ³	1 k Ω
Maximum input current ⁴	32 mADC
Drop out current	1.0 mADC
Allowable input for no output ⁵	1.0 mADC
Allowable input for no output	2.0 VDC

Output Specifications¹

Parameter	IDC5
Nominal logic supply voltage	5.0 VDC
Maximum logic supply voltage	6.0 VDC
Minimum logic supply voltage	2.75 VDC
Maximum logic supply current ⁶	16 mADC
Maximum logic supply leakage current	10 μ ADC
Maximum output voltage ⁷	30 VDC
Maximum output current	50 mADC
Maximum output leakage current	10 μ ADC
Maximum output voltage drop	200 mVDC

General Specifications¹

Parameter	All Devices
Operating temperature range	-30° to +80° C
Storage temperature range	-40° to +100° C
Maximum turn-on time ⁸	1.0 msec
Maximum turn-off time ⁸	1.0 msec
Input to output isolation voltage ⁹	4,000 Vrms
Capacitance input to output (maximum)	8 pF

Footnotes:

- 1 Specifications apply to T_a-30° C to +80° C unless otherwise noted.
- 2 Tolerance: inches \pm 0.020; millimeters \pm , 50.
- 3 Does not include IRED impedance (drop).
- 4 At 32 VDC input.
- 5 Series operation with GORDOS ODC modules is permitted.
- 6 With external LED indicator. 18 mADC without external LED.
- 7 Breakdown voltage of output transistor.
- 8 At nominal V_{logic}.
- 9 At T_a of 25° C, for one second, maximum leakage 100 μ A.
- 10 Pin tolerance: inches \pm .0001, millimeters \pm .025.

AC Output Modules

Input Specifications¹

Parameter	OAC5	OAC5A
Nominal input voltage	5.0 VDC	5.0 VDC
Minimum turn-on voltage	2.5 VDC	2.5 VDC
Maximum input voltage	8.0 VDC	8.0 VDC
Drop out voltage	1.0 VDC	1.0 VDC
Maximum input current ³	18 mADC	18 mADC
Nominal input resistance ⁴	250 Ω	250 Ω

Output Specifications¹

Parameter	OAC5	OAC5A
Nominal line voltage	120 Vrms	240 Vrms
Minimum line voltage	12 Vrms	24 Vrms
Maximum line voltage	140 Vrms	280 Vrms
Maximum peak off-state volt ⁵	400 Vpeak	600 Vpeak
Maximum off-state leakage ⁶	3.0 mArms	6.0 mArms
Static (off-state) dv/dt	200 V/ μ sec	200 V/ μ sec
Maximum on-state current ⁷	3.5 Arms	3.5 Arms
Minimum on-state current	0.05 Arms	0.05 Arms
Maximum 1 cycle surge ⁸	150 Apeak	150 Apeak
Peak on-state voltage ⁹	1.6 Vpeak	1.6 Vpeak

General Specifications¹

Parameter	All Devices
Operating temperature range	-30° to +80° C
Storage temperature range	-40° to +100° C
Response time	.5 Cycle
Input to output isolation voltage ¹⁰	4,000 Vrms
Capacitance input to output (maximum)	8 pF
Line frequency range	47 Hz to 63 Hz

Footnotes:

- ¹ Specifications apply to T_a-30° C to +80° C unless otherwise noted.
- ² Tolerance: inches \pm 020; millimeters \pm , 50.
- ³ At nominal input voltage.
- ⁴ Does not include IRED impedance (drop).
- ⁵ One minute maximum duration.
- ⁶ At T_a of 25° C and maximum line voltage.
- ⁷ At T_a of 40° C, derate by 58 mA/° C to 80° C. Note: CSA rating is 3.0 A at 40° C T_a.
- ⁸ At T_a of 25° C, non-repetitive.
- ⁹ At T_a of 25° C and maximum on-state current.
- ¹⁰ At T_a of 25° C, for one second, maximum leakage 1 mA. VDE versions, complying with VDE specification 0806, and IEC specification 380 are available. Specify by adding the suffix *V* to the part number (example: OAC5AV)
- ¹¹ Pin tolerance: inches \pm .001, millimeters \pm .025.

AC Input Modules

Input Specifications¹

Parameter	IAC5	IAC5A
Nominal input voltage ³	120 Vrms/VDC	240 Vrms/VDC
Maximum input voltage	140 Vrms/VDC	280 Vrms/VDC
Minimum input voltage	90 Vrms/VDC	90 Vrms/VDC
Maximum input current	10 mA	10 mA
Drop out current ⁴	2.5 mA	1.5 mA
Allowable input for no output ⁴	3.0 mA	2.0 mA
Allowable input for no output	40 Vrms/VDC	40 Vrms/VDC

Output Specifications¹

Parameter	IAC5	IAC5A
Nominal logic supply voltage	5.0 VDC	5.0 VDC
Maximum logic supply voltage	6.0 VDC	6.0 VDC
Minimum logic supply voltage	2.75 VDC	2.75 VDC
Maximum logic supply current ⁵	16 mADC	16 mADC
Maximum logic supply leakage current	10 μ ADC	10 μ ADC
Maximum output voltage ⁶	30 VDC	30 VDC
Maximum output current	50 mADC	50 mADC
Maximum output leakage current	10 μ ADC	10 μ ADC
Maximum output voltage drop	200 mVDC	200 mVDC

General Specifications¹

Parameter	All Devices
Operating temperature range	-30° to +80° C
Storage temperature range	-40° to +100° C
Maximum turn-on time ⁷	20 msec
Maximum turn-off time ⁷	30 msec
Input to output isolation voltage ⁸	4,000 Vrms
Capacitance input to output (maximum)	8 pF
Line frequency range (input)	47 Hz to 63 Hz

Footnotes:

- Specifications apply to T_a -30° to +80° C unless otherwise noted.
- Tolerance: inches \pm .020; millimeters \pm , 50.
- Gordos IAC modules will operate on AC or DC input voltage.
- Series operation with Gordos standard OAC modules is permitted. Does not include A versions.
- With external LED indicator. 18 mADC without external LED.
- Breakdown voltage of output transistor.
- At nominal V_{logic} , V_{out} of 30 V, I_{out} of 25 mA, V_{in} of 120 VAC and T_a of 25° C.
- At T_a of 25° C, for one second, maximum leakage 100 μ A. VDE versions, complying with VDE specification 0806, and IEC specification 380, are available. Specify by adding the suffix V to the part number (example: IAC5AV).
- Pin tolerance: inches \pm .001, millimeters \pm .025.

Appendix B

Customer Communication

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

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

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(512) 794-5678

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Japan	(03) 3788-1921	(03) 3788-1923
Mexico	95 800 010 0793	95 800 010 0793
Netherlands	03480-33466	03480-30673
Norway	32-848400	32-848600
Singapore	2265886	2265887
Spain	(91) 640 0085	(91) 640 0533
Sweden	08-730 49 70	08-730 43 70
Switzerland	056/20 51 51	056/20 51 55
Taiwan	02 377 1200	02 737 4644
U.K.	0635 523545	0635 523154

Technical Support Form

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

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

Name _____

Company _____

Address _____

Fax (____) _____ Phone (____) _____

Computer brand _____ Model _____ Processor _____

Operating system _____

Speed _____MHz RAM _____MB Display adapter _____

Mouse _____yes _____no Other adapters installed _____

Hard disk capacity _____MB Brand _____

Instruments used _____

National Instruments hardware product model _____ Revision _____

Configuration _____

National Instruments software product _____ Version _____

Configuration _____

The problem is _____

List any error messages _____

The following steps will reproduce the problem _____

Documentation Comment Form

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

Title: **SSR Series User Manual**

Edition Date: **March 1995**

Part Number: **320268-01**

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

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

Thank you for your help.

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Glossary

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

°	degrees
A	amperes
C	Celsius
Hz	hertz
in.	inches
m	meters
%	percent
F	farads
sec	seconds
V	volts
Vrms	volts, root mean square

Index

A

- AC input modules. *See* input modules.
- AC output modules. *See* output modules.
- AT-MIO-16D board
 - connections with SSR modules
 - PB-16-V mounting rack, 3-4
 - PB-24-V mounting rack, 3-6 to 3-7
 - specific modules (table), 2-2
 - power allotment (table), 3-12

C

- connections between SSR module and data acquisition boards, 2-1
 - (table), 2-2
- customer communication, *ix*, B-1

D

- data acquisition boards
 - connections with SSR module, 2-1
 - specific modules (table), 2-2
 - power allotment (table), 3-12
- DC input modules. *See* input modules.
- DC output modules. *See* output modules.
- DIO-24 board
 - connections with SSR modules, 2-1
 - PB-8H mounting rack, 3-1
 - PB-16-V mounting rack, 3-4
 - PB-24-V mounting rack, 3-6 to 3-7
 - specific mounting racks (table), 2-2
 - power allotment (table), 3-12
- DIO-32F board
 - connections with SSR modules
 - PB-32D-V, 3-9
 - specific modules (table), 2-2
 - power allotment (table), 3-12
- DIO-96 board
 - connections with SSR module (table), 2-2
 - power allotment (table), 3-12
- documentation
 - conventions used in manual, *vii–viii*
 - organization of manual, *vii*

- related documentation, *viii–ix*
- dropout voltage, 2-2

F

- fuse, 3-3, 3-6, 3-8, 3-12

I

- input modules
 - part numbers (table), 1-2
 - specifications
 - AC input modules, A-4
 - DC input modules, A-2
 - theory of operation, 2-2
 - wiring diagrams
 - Model IAC5, 2-4
 - Model IDC5, 2-3
- installation of SSR modules
 - PB-8H mounting rack, 3-3
 - PB-16-V mounting rack, 3-5
 - PB-24-V mounting rack, 3-8
 - PB-32D-V mounting rack, 3-10

J

- jumpers. *See* power supply and jumpers.

L

- Lab boards
 - connections with SSR module (table), 2-2
 - power allotment (table), 3-12
- LEDs
 - PB-8H mounting rack, 3-3
 - PB-16-V mounting rack, 3-6
 - PB-24-V mounting rack, 3-8
 - PB-32D-V mounting rack, 3-10 to 3-11

M

manual. *See* documentation.
 MIO-16 boards
 connections with SSR module
 (table), 2-2
 power allotment (table), 3-12
 Model IAC5
 specifications, A-4
 wiring diagram, 2-4
 Model IDC5
 specifications, A-2
 wiring diagram, 2-3
 Model OAC5
 specifications, A-3
 wiring diagram, 2-6
 Model ODC5
 specifications, A-1
 wiring diagram, 2-5
 mounting racks. *See* specific mounting rack.

O

output modules
 part numbers (table), 1-2
 specifications
 AC output modules, A-3
 DC output modules, A-1
 theory of operation, 2-2
 wiring diagrams
 Model OAC5, 2-6
 Model ODC5, 2-5

P

part numbers
 input modules (table), 1-2
 output modules (table), 1-2
 PB-8H mounting rack
 capabilities, 3-1
 connecting to host computer
 (warning), 3-1
 field connections, 3-3
 illustrations
 with 50-conductor 1.0-m cable, 3-2
 with 50-to-26 conductor 0.4-m
 cable, 3-2
 installation, 3-3

 kit contents (table), 1-1
 LEDs, 3-3
 power supply and jumpers, 3-3
 schematic, 3-4
 PB-16-V mounting rack
 capabilities, 3-4
 connecting to host computer
 (warning), 3-4
 field connections, 3-6
 illustration, 3-5
 installation of SSR module, 3-5
 kit contents (table), 1-1
 LEDs, 3-6
 power supply and jumpers, 3-5
 schematic, 3-6
 PB-24-V mounting rack
 capabilities, 3-6 to 3-7
 connecting to host computer
 (warning), 3-7
 field connections, 3-8
 illustration, 3-7
 installation of SSR module, 3-8
 kit contents (table), 1-2
 LEDs, 3-8
 power supply and jumpers, 3-7 to 3-8
 schematic, 3-9
 PB-32D-V mounting rack
 capabilities, 3-9
 connecting to host computer
 (warning), 3-9
 field connections, 3-11
 illustration, 3-10
 installation of SSR module, 3-10
 kit contents (table), 1-2
 LEDs, 3-10 to 3-11
 power supply and jumpers, 3-10
 schematic, 3-11
 power supply and jumpers
 PB-8H mounting rack, 3-3
 PB-16-V mounting rack, 3-5
 PB-24-V mounting rack, 3-7 to 3-8
 PB-32D-V mounting rack, 3-10

S

SC-205X boards, connections with SSR
 module, 2-1
 schematics
 PB-8H mounting rack, 3-4

- PB-16-V mounting rack, 3-6
- PB-24-V mounting rack, 3-9
- PB-32D-V mounting rack, 3-11
- specifications
 - AC input modules, A-4
 - AC output modules, A-3
 - DC input modules, A-2
 - DC output modules, A-1
- SSR module
 - available modules (illustration), 1-3
 - connections with data acquisition boards, 2-1
 - specific boards (table), 2-2
 - mounting rack kit contents (table), 1-1 to 1-2
 - overview, 1-1
 - part numbers
 - input modules (table), 1-2
 - output modules (table), 1-2
 - software support, 1-4
 - theory of operation, 2-2
 - unpacking, 1-4
 - wiring diagrams
 - Model IAC5, 2-4
 - Model IDC5, 2-3
 - Model OAC5, 2-6
 - Model ODC5, 2-5

T

- technical support, B-1
- theory of operation
 - overview, 2-2
 - wiring diagrams
 - Model IAC5, 2-4
 - Model IDC5, 2-3
 - Model OAC5, 2-6
 - Model ODC5, 2-5

W

- wiring diagrams. *See* theory of operation.