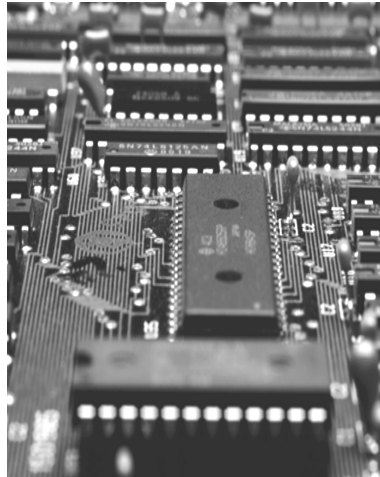



TSX Momentum I/O Base User Guide

870 USE 002 00

Version 2.0



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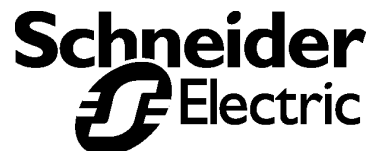
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TSX Momentum

I/O Base User Guide

870 USE 002 00 Version 2.0

May 1999



Document Set

TSX Momentum Processor Adapter and Option Adapter User Guide
870 USE 101 00

TSX Momentum InterBus Communication Adapter User Manual
870 USE 003 00

TSX Momentum Profibus-DP Communication Adapter User Manual
870 USE 004 00

TSX Momentum FIPI/O Communication Adapter User Manual
870 USE 005 00

TSX Momentum ControlNet Communication Adapter User Manual
870 USE 007 00

TSX Momentum Modbus Plus PNT Series Communication Adapter User Manual
870 USE 103 00

TSX Momentum DeviceNet Communication Adapter User Manual
870 USE 105 00

TSX Momentum Modbus Plus NEF Series Communication Adapter User Manual
870 USE 111 00

TSX Momentum Ethernet Communication Adapter User Manual
870 USE 112 00

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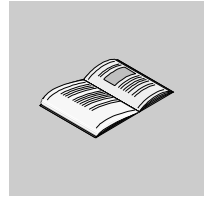
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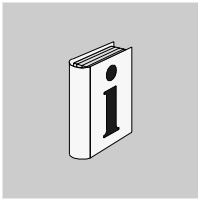
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About This Book



A

Revision History

This is version 2.0 of this manual. The manual has been reorganized and reformatted. The following topics have been added:

Chapter	Topic
6	170 AAI 030 00 Analog 8 Channel Differential Input Module Base
20	170 ADM 690 50, 170 ADM 690 51 120 VAC - 10 Pt. In / 8 Pt. Out Module Bases Discrete Module Base
19	170 ADM 540 80 120 VAC - 6 Pt. In / 3 Pt. Out Discrete MCC Module Base
28	170 ANR 120 90 Analog 6 Ch. In / 4 Ch. Out Module Base w/ 24 VDC I/O pts
29	170 CPS 110 00 TIO Power Supply Module
D	Field Wire Length

To find out about any changes to the manual after this version was published, consult our web site at www.modicon.com.

Document Scope

This manual contains complete information about the TSX Momentum I/O Bases. It contains only passing references to other TSX Momentum components, including Processor Adapters, Option Adapters and Communication Adapters.

Continued on next page

Related Documentation

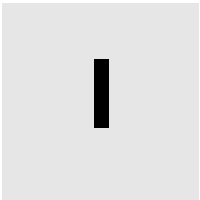
You may find the following other manuals useful:

Title	Part Number
TSX Momentum Processor Adapter and Option Adapter User Guide	870 USE 101 00
TSX Momentum InterBus Communication Adapter User Manual	870 USE 003 00
TSX Momentum Profibus-DP Communication Adapter User Manual	870 USE 004 00
TSX Momentum FIPI/O Communication Adapter User Manual	870 USE 005 00
TSX Momentum ControlNet Communication Adapter User Manual	870 USE 007 00
TSX Momentum Modbus Plus PNT Series Communication Adapter User Manual	870 USE 103 00
TSX Momentum DeviceNet Communication Adapter User Manual	870 USE 105 00
TSX Momentum Modbus Plus NEF Series Communication Adapter User Manual	870 USE 111 00
TSX Momentum Ethernet Communication Adapter User Manual	870 USE 112 00

User Comments

We welcome your comments about this document. You can reach us by e-mail at techcomm@modicon.com.

Using Momentum I/O Bases



At a Glance

Purpose This part describes how to assemble TSX Momentum I/O bases with other Momentum components, how to mount assembled modules and how to ground them.

In This Part This part contains the following chapters:

For Information On ...	See Chapter ...	On Page...
Introducing the TSX Momentum I/O Bases	1	23
Selecting Other TSX Momentum Components	2	29
Assembly	3	41
Dimensions and Mounting Instructions	4	67
Power and Grounding Guidelines	5	75

Introducing the TSX Momentum I/O Bases

1

At a Glance

Purpose This chapter introduces the basic features and types of TSX Momentum I/O bases.

In This Chapter This chapter contains the following topics:

For This Topic...	See Page...
Basic Features of I/O Bases	24
Types of I/O Bases	26

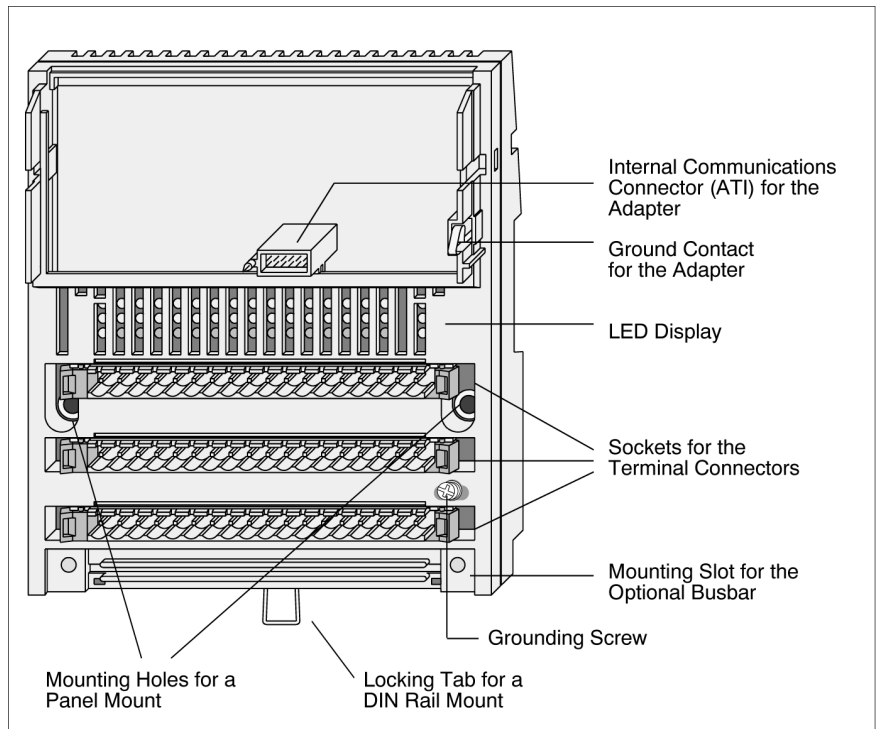
Basic Features of I/O Bases

Overview

This section provides a drawing of a typical I/O base and describes basic features of I/O bases.

Front View

The front panel components of a typical I/O base are shown in the illustration below:



Continued on next page

Basic Features of I/O Bases, Continued

Internal Communications Connector

The internal communications connector on an I/O base provides automatic communication to any adapter mounted on the base.

Ground Contact

This contact provides an earth ground connection to any adapter mounted on the base.

LED Display

Each I/O base has a custom LED display, providing information about the status of input and output devices. Refer to the LED illustration and description for your I/O base for details.

Terminal Connector Sockets

Each I/O base has sockets for as many as three terminal connectors. Terminal connectors are required for connecting I/O devices and must be ordered separately. For ordering information, see *Terminal Connectors* on page 31.

Busbar Slot

A slot at the bottom of the I/O base allows a busbar to be attached to support 3- and 4-wire field devices. Busbars are optional. They must be ordered separately. For ordering information, see *Busbars* on page 63.

Mounting

Each I/O base has mounting holes for a panel mount and a locking tab for a DIN rail mount. For mounting instructions, see *Mounting TSX Momentum Devices* on page 73.

CE Compliant

TSX Momentum I/O bases are designed to meet CE mark requirements for open equipment.

Types of I/O Bases

Overview

This section provides part numbers and descriptions for the TSX Momentum I/O bases.

Analog

The following analog I/O bases are available:

Part Number	Channels	Type	Details
170 AAI 030 00	8	Input	Broken wire detection
170 AAI 140 00	16	Input	Single-ended
170 AAI 520 40	4	Input	RTD/Thermocouple/mV
170 AAO 120 00	4	Output	0...20 mA
170 AAO 921 00	4	Output	4...20 mA

Combination

The following I/O bases support a combination of analog and discrete I/O:

Part Number	Channels	Type	Details
170 AMM 090 00	4 analog in 2 analog out 4 discrete in 4 discrete out	Input/ Output	24 VDC

Continued on next page

Types of I/O Bases, Continued

Discrete

The following discrete I/O bases are available:

Part Number	Points	Type	Details
170 ADI 340 00	16	Input	24 VDC
170 ADI 350 00	32	Input	24 VDC
170 ADI 540 50	16	Input	120 VAC
170 ADM 350 10	16 in 16 out	Input Output	24 VDC
170 ADM 350 11	16 in 16 out	Input Output	24 VDC
170 ADM 370 10	16 in 8 out	Input Output	24 VDC @ 2 A
170 ADM 390 10	16 in 12 out	Input Output	24 VDC
170 ADM 390 30	10 in 8 relay out	Input Output	24 VDC
170 ADM 690 50	10 in 8 out	Input Output	120 VAC
170 ADM 690 51	10 in 8 out	Input Output	120 VAC
170 ADO 340 00	16	Output	24 VDC
170 ADO 350 00	32	Output	24 VDC
170 ADO 530 50	8	Output	115 VAC @ 2A
170 ADO 540 50	16	Output	120 VAC
170 ADO 730 50	8	Output	230 VAC @ 2A
170 ADO 740 50	16	Output	230 VAC

Counter

The following counter I/O base is available:

Part Number	Points	Type	Details
170 AEC 920 00	2	Input	24 VDC

Selecting Other TSX Momentum Components

2

At a Glance

Purpose A TSX Momentum I/O base must be assembled with a Communication Adapter or Processor Adapter in order to function. If you choose a Processor Adapter, you may also use an Option Adapter.

This chapter describes:

- TSX Momentum adapters
- Terminal connectors
- Busbars

In This Chapter This chapter contains the following topics:

For This Topic...	See Page...
Which Components Should I Use?	30
Communication Adapters	32
Processor Adapters	33
Option Adapters	35
Terminal Connectors	36
Busbars	38

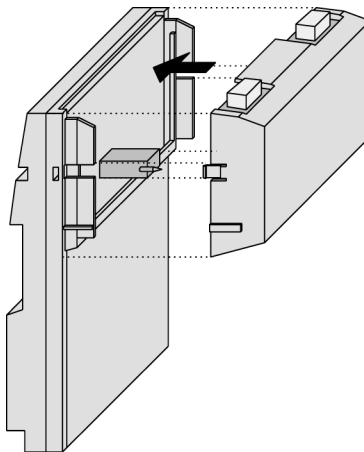
Which Components Should I Use?

Purpose

This section explains the choices you have in assembling a Momentum I/O device.

Primary Adapter

Each TSX Momentum I/O base must be assembled with a Communication Adapter or a Processor Adapter. Without one of these adapters, the I/O base will not function.

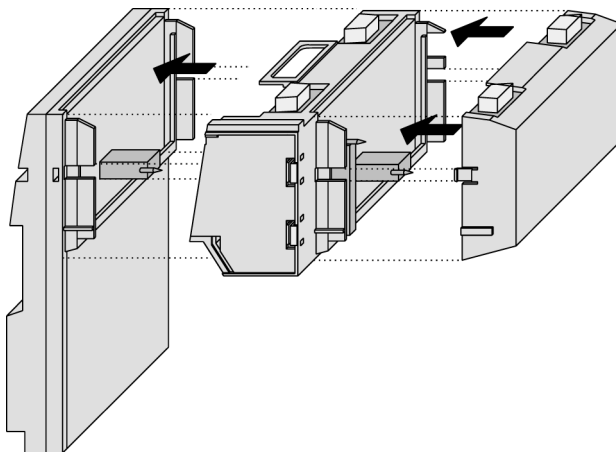


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Which Components Should I Use, Continued

Option Adapter

If you use a Processor Adapter, you may add an Option Adapter. Option Adapters cannot be used with Communication Adapters.



Terminal Connectors

Terminal connectors must be used to connect I/O devices to the I/O base.

Busbars

Busbars may be used to support 3- and 4-wire field devices. They are optional.

Communication Adapters

Overview This section describes the function of Communication Adapters, the types available and where to get more information.

Function A Communication Adapter provides an interface between an I/O base and a number of industry standard open-communication networks.

Types The following Communication Adapters are available:

For This Network...	Order This Adapter...	And This Manual...
ControlNet	170 LNT 810 00	870 USE 007 00
DeviceNet	170 LNT 710 00	870 USE 105 00
Ethernet	170 ENT 110 00	870 USE 112 00
FIPI/O	170 FNT 110 00	870 USE 005 00
InterBus	170 INT 110 00	870 USE 003 00
Modbus Plus (IEC data format)	170 PNT 110 20 (Single Port) 170 PNT 160 20 (Dual Port)	870 USE 103 00
Modbus Plus (984 data format)	170 NEF 110 21 (Single Port) 170 NEF 160 21 (Dual Port)	870 USE 111 00
Profibus-DP	170 DNT 110 00	870 USE 004 00

For More Information Refer to the manuals specified in the chart above.

Processor Adapters

Overview

This section describes the function of Processor Adapters, the types available and where to get more information.

Function

A Processor Adapter is a Programmable Logic Controller (PLC). It stores and executes a logic program and controls I/O points over a common communication bus. It is designed to mount on any Momentum I/O base and to control its points as local I/O.

Types

Six TSX Momentum Processor Adapters are available:

Model	Internal Memory	Flash RAM	Clock Speed	Comm Ports
171 CCS 700 00	64K bytes	256K bytes	20 MHz	One Modbus RS-232 port
171 CCS 700 10	64K bytes	256K bytes	32 MHz	One Modbus RS-232 port
171 CCS 760 00	256K bytes	256K bytes	20 MHz	One Modbus RS-232 port
				One I/O Bus port
171 CCC 760 10	512K bytes	512K bytes	32 MHz	One Modbus RS-232 port
				One I/O Bus port
171 CCS 780 00	64K bytes	256K bytes	20 MHz	One Modbus RS-232 port
				One Modbus RS-485 port
171 CCC 780 10	512K bytes	512K bytes	32 MHz	One Modbus RS-232 port
				One Modbus RS-485 port

Continued on next page

Processor Adapters, Continued

For More Information

For detailed descriptions of all the Processor Adapters, refer to the *TSX Momentum Processor Adapter and Option Adapter User Guide* (870 USE 101 00).

Option Adapters

Overview This section describes the function of Option Adapters, the types available and where to get more information.

Function An Option Adapter is used in conjunction with a Processor Adapter and an I/O base to provide:

- A time-of-day clock
- A battery backup
- One or more additional communication ports

Types Three TSX Momentum Option Adapter models are available:

For These Communication Ports...	Order Adapter Part Number...
One user-selectable RS-232/RS-485 port	172 JNN 210 32
One Modbus Plus port	172 PNN 210 22
Two (redundant) Modbus Plus ports	172 PNN 260 22

For More Information For detailed descriptions of all the Option Adapters, refer to the *TSX Momentum Processor Adapter and Option Adapter User Guide* (870 USE 101 00).

Terminal Connectors

Overview

This section describes:

- The function of terminal connectors
 - The coding key feature
 - Types of terminal connectors available
 - How many are needed
 - How to order them
-

Function

Terminal connectors are used to connect I/O field devices and the power supply to the I/O base. While busbars may also be used, terminal connectors are electrically connected to the module, busbars are not.

Coding Key Feature

Some I/O bases can be operated over dangerous voltage ranges (above 42.4 VAC and above 60 VDC). Coding keys shipped with the I/O base and coding tabs shipped with the terminal connector can be used to prevent the accidental insertion into an I/O base of a terminal connector wired for the wrong voltage range.

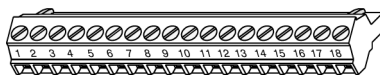
For information on using coding keys, see *Using Terminal Connector Coding Keys* on page 60.



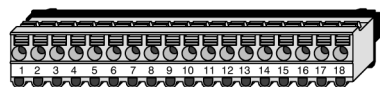
Note: For maximum protection, key coding is required during installation.

Types

Terminal connectors are available in screw-in and spring-clip versions.



Screw-type terminal block



Spring-clip terminal terminal block

Continued on next page

Terminal Connectors, Continued

How Many Do I Need?

One terminal connector is required for each row of terminals that you will connect to the module's operating voltages and field devices.

Ordering Information

Terminal connectors must be ordered separately. They are available in kits of three. They are not shipped with the Momentum I/O bases.

Type	Kit Part Number	Wire Type	Wire Size
Screw-in (set of 3)	170 XTS 001 00	Solid or stranded	If one wire, use 12AWG (2.5mm ²) max.
Spring-clip (set of 3)	170 XTS 002 00	Solid only	If two wires, use 14AWG (1.5mm ²) max.

Busbars

Overview

This section describes:

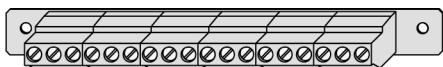
- The function of busbars
- Types of busbars
- How to choose a busbar
- How to order a busbar

Function

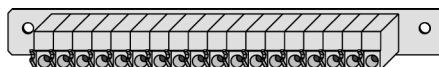
A busbar may be plugged into the fourth row of an I/O base. Busbars provide a common connection for the field devices and serve as protective distribution connectors, for instance to PE. Each row of terminals on the busbar is connected internally. There is no electrical connection to the I/O base.

Types

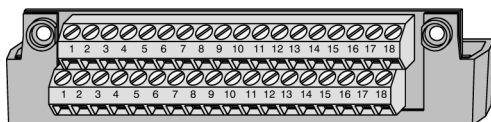
Depending on the I/O base and the type and number of field devices to which it is connected, a 1-, 2-, or 3-row busbar may be used. They are available in screw-in and spring-clip versions.



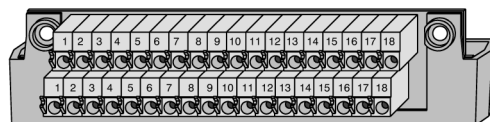
Screw-in 1-row busbar



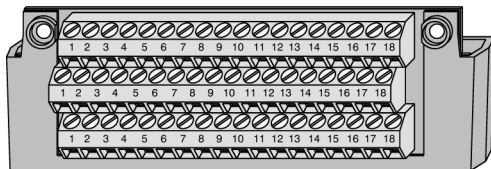
Spring-clip 1-row busbar



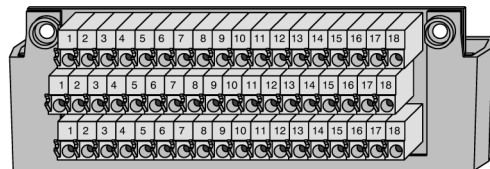
Screw-in 2-row busbar



Spring-clip 2-row busbar



Screw-in 3-row busbar



Spring-clip 3-row busbar

Continued on next page

Busbars, Continued

Specifications

Busbars have the following specifications:

Busbar type	Screw-in	Spring-clip
Max. load at 20 deg. C	250 V 14 A	250 V 17.5 A
Short circuit	100 A 30 s	100 A 30 s
Test voltage	2.2 kV	2.2 kV
Creepage / air dist.	per IEC 664A	per IEC 664A
Pollution	2nd degree	2nd degree
Contact derating at 70 deg. C	ca. 60% of nominal value	ca. 60% of nominal value

How to Choose a Busbar

See the internal pin connections and field wiring diagrams associated with your I/O base to determine whether or not you need a busbar and which busbar best suits your needs.

Ordering Information

Busbars should be ordered separately. They are not shipped with I/O bases.

Busbar Type	Part Number	# of Rows	Wire Size
Screw-in	170 XTS 006 01	1	If one wire, use 10AWG (4mm ²) max. If two wires, use 14AWG (1.5mm ²) max.
	170 XTS 005 01	2	One or two wires 14AWG (1.5mm ²) max.
	170 XTS 004 01	3	One or two wires 14AWG (1.5mm ²) max.
Spring-clip	170 XTS 007 01	1	If one wire, use 10AWG (4mm ²) max. If two wires, use 14AWG (1.5mm ²) max.
	170 XTS 008 01	2	One or two wires 14AWG (1.5mm ²) max.
	170 XTS 003 01	3	One or two wires 14AWG (1.5mm ²) max.

At a Glance

Purpose

This chapter describes how to assemble and disassemble the components of a TSX Momentum device:

- An I/O base
- A Communication Adapter or a Processor Adapter
- An Option Adapter
- Terminal connectors
- Busbars
- A label

In This Chapter

This chapter contains the following sections:

For Information On ...	See Section ...	On Page...
Assembling an Adapter and an I/O Base	1	43
Assembling a CPU with an Option Adapter	2	48
Installing Terminal Connectors	3	59
Busbars	4	63
Labels	5	65

Section 3.1

Assembling an Adapter and an I/O Base

Overview

Purpose

This section describes how to assemble and disassemble:

- a Communication Adapter or a Processor Adapter
 - an I/O base
-

In This Section

This section contains the following topics:

For This Topic...	See Page...
Assembling an Adapter and an I/O Base	43
Disassembling an Adapter from an I/O Base	46

Assembling an Adapter and an I/O Base

Overview

A Processor Adapter or Communication Adapter can be snapped directly onto a Momentum I/O base. This section contains safety precautions for handling components and an assembly procedure.

Connection Points

The adapter and I/O base connect at these three points:

- The plastic snap extensions on the two sides of the adapter fit into the two slots on the sides of the I/O base
 - The 12-pin ATI connectors on the two units mate together
-

No Tools Required

The components can be snapped together by hand – no assembly tools are required.



CAUTION

ADAPTER MAY BE DAMAGED BY STATIC ELECTRICITY

Use proper ESD procedures when handling the adapter, and do not touch the internal elements. The adapter's electrical elements are sensitive to static electricity.

Failure to observe this precaution can result in equipment damage.



CAUTION

ELECTRICAL CIRCUITRY MAY BE EXPOSED

Electrical circuitry on the I/O base may be exposed when a Momentum adapter is not mounted. Make sure that the I/O base is not under power when it does not have an adapter mounted on it. To make sure that power is not present, do not insert the wiring connectors to the I/O base until after the adapter has been mounted.

Failure to observe this precaution can result in injury or equipment damage and will void the product warranty.

Continued on next page

Assembling an Adapter and an I/O Base, Continued



CAUTION

Because of the voltage present when the unit is under power, the I/O base must never be put under power unless an adapter is on top of it. Be sure that the power is OFF whenever the I/O base has not been fully assembled.

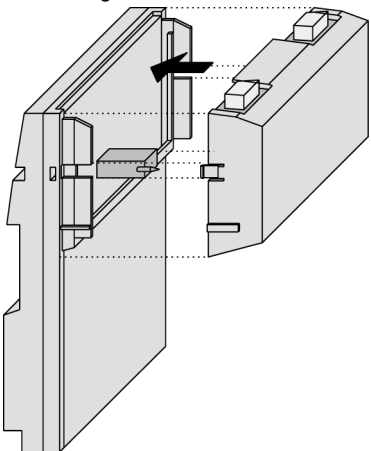
To be sure that power is not present, do not insert the wiring terminal connectors onto the I/O base until after the adapter has been mounted.

If you intend to remove an adapter from the base, disconnect the terminal connectors before removing the adapter.

Failure to observe this precaution can result in equipment damage.

Procedure

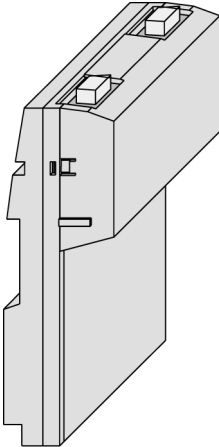
Follow the steps in the table below to assemble an adapter and an I/O base..

Step	Action
1	Choose a clean environment to assemble the I/O base and adapter to protect the circuitry from contamination.
2	Make sure that the I/O base is not under power while you assemble the module.
3	Align the two plastic snap extensions on the adapter with the slots on the sides of the I/O base. The 12-pin ATI connectors will automatically line up when the units are in this position. The two devices should be oriented such that their communication ports are facing out on the back side of the assembly. 

Continued on next page

Assembling an Adapter and an I/O Base, Continued

Procedure,
Continued

Step	Action
4	<p>Push the adapter onto the base, gently pressing the locking tabs inward.</p> <p>Result: The locking tabs on each side of the adapter slide inside the I/O base and out through the locking slot. The 12-pin ATI connectors on the two units are mated to each other in the process.</p> 

Next Step

Once the adapter and I/O base have been assembled, the device can be mounted on a DIN rail or surface-mounted inside a panel enclosure.

A Momentum device is classified as open equipment; ie., electrical circuitry on the unit may be exposed. Open equipment should be installed in an industry-standard enclosure, and direct access must be restricted to qualified service personnel.

Disassembling an Adapter from an I/O Base

Overview This section contains safety precautions and a procedure for disassembling an adapter from an I/O base.

Tools Required A flat-head screw driver.



CAUTION
ELECTRICAL CIRCUITRY MAY BE EXPOSED

Before removing an adapter from the base, disconnect the wiring connectors. Make sure that the I/O base is not under power when it does not have a Momentum adapter mounted on it.

Failure to observe this precaution can result in injury or equipment damage and will void the product warranty.

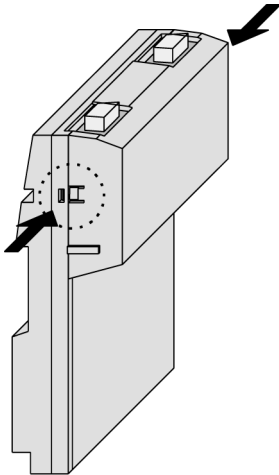
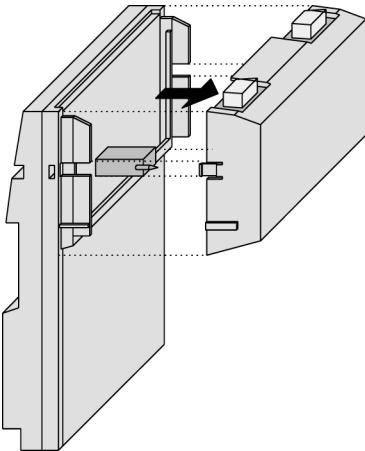
Procedure Follow the steps in the table below to remove an adapter from an I/O base.

Step	Action
1	Choose a clean environment to disassemble the unit, in order to protect the circuitry from contamination.
2	Make sure that the I/O base is not under power by removing the terminal connectors from the I/O base.

Continued on next page

Disassembling an Adapter from an I/O Base, Continued

Procedure,
Continued

Step	Action
3	Use a screwdriver to push the clips on both sides of the adapter inward, as shown in the illustration below.  A 3D perspective diagram of the adapter assembly. A screwdriver is shown from the side, with its tip pressing against a small rectangular clip on the left side of the adapter. A dashed circle highlights the clip's location. Two black arrows point towards the clips on both the left and right sides of the adapter, indicating the direction of force to be applied.
4	Lift off the adapter.  A 3D perspective diagram showing the adapter being lifted away from the I/O base. A black arrow points upwards from the adapter, indicating the direction of removal. Dotted lines are used to show the alignment and separation of the adapter from the base's internal components.

Section 3.2

Assembling a CPU with an Option Adapter

Overview

Purpose

An Option Adapter may only be used in conjunction with a Processor Adapter. It may not be used in conjunction with a Communication Adapter or alone with an I/O base.

This section describes how to add an Option Adapter when assembling a TSX Momentum device and how to remove an Option Adapter from the assembled device.

In This Section

This section contains the following topics:

For This Topic...	See Page...
Assembling a Processor Adapter and an Option Adapter	49
Mounting the Assembled Adapters on the I/O Base	52
Disassembling a Module with an Option Adapter	55

Assembling a Processor Adapter and an Option Adapter

Overview If a TSX Momentum Option Adapter is used, it is mounted between a M1 Processor Adapter and an I/O base in a three-tiered stack.

This section contains guidelines, safety precautions and a procedure for assembling a Processor Adapter and an Option Adapter.

Guidelines We recommend that you snap together the Option Adapter and the M1 Processor Adapter before mounting them on the I/O base.

Connection Points The Option Adapter and M1 Processor connect at these four points:

- The plastic snap extensions on the two sides of the Processor Adapter fit into the two slots on the sides of the Option Adapter
- The 12-pin ATI connectors on the center of the back walls of the two units mate together
- The 34-pin processor extension connectors that run along the left sidewalls of the components mate together


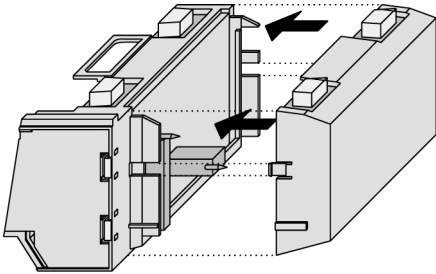
No Tools Required The components can be snapped together by hand; no assembly tools are required. A flat-head screw driver is required to disassemble the unit.

Continued on next page

Assembling a Processor Adapter and an Option Adapter, Continued

Procedure

Follow the steps in the table below to assemble an Option Adapter and an M1 Processor Adapter.

Step	Action
1	Choose a clean environment to assemble the option adapter and processor to protect the circuitry from contamination.
2	<p>Align the two plastic snap extensions on the sides of the M1 Processor Adapter with the slots on the sides of the Option Adapter.</p> <p>The 12-pin AT! connectors and processor extension connectors will automatically line up when the units are in this position. The two devices should be oriented such that their communication ports are facing out on the back side of the assembly.</p>
	<p>CAUTION</p> <p>PIN ALIGNMENT</p> <p>Proper assembly requires that the 34 pins on the processor extension connector be aligned correctly with the mating socket on the M1 processor adapter. Do not connect one side and try to rotate the M1 onto the option adapter.</p> <p>Failure to observe this precaution can result in equipment damage.</p>
3	<p>Push the Processor Adapter onto the Option Adapter, gently pressing the locking tabs inward.</p>  <p>Result: The locking tabs on each side of the Processor Adapter slide inside the Option Adapter and out through the locking slot. The 12-pin AT! connectors on the two units are mated to each other in the process.</p>

Continued on next page

Assembling a Processor Adapter and an Option Adapter, Continued

Next Step

Follow the directions in the next section to mount the assembled adapters on the I/O base.

Mounting the Assembled Adapters on the I/O Base

Overview

This section gives guidelines, safety precautions and a procedure for mounting the assembled Processor and Option Adapter on an I/O base.

Connection Points

The assembled adapters connect with the I/O base at these seven points:

- Two plastic snaps on the front of the Option Adapter fit into two slots on the front of the I/O base
 - The plastic snap extensions on the two sides of the Option Adapter fit into the two slots on the sides of the I/O base
 - The 12-pin ATI connectors on the center of the back walls of the two units mate together
 - The plastic stirrup on the back of the Option Adapter clips onto the bottom of the I/O base
-

No Tools Required

The components can be snapped together by hand; no assembly tools are required. A flat-head screw driver is required to disassemble the unit.



CAUTION

ELECTRICAL CIRCUITRY MAY BE EXPOSED

Electrical circuitry on the I/O base may be exposed when an adapter is not mounted. Make sure that the I/O base is not under power whenever it does not have a Momentum adapter mounted on it.

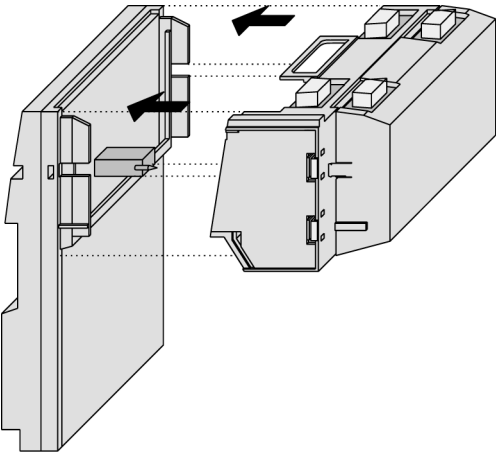
To make sure that power is not present, do not insert the wiring connectors to the I/O base until after the adapter has been mounted. When more than one connector is on the I/O base, remove all connectors to prevent the unit from receiving power from an unexpected source.

Failure to observe this precaution can result in injury or equipment damage and will void the product warranty.

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Mounting the Assembled Adapters on the I/O Base, Continued

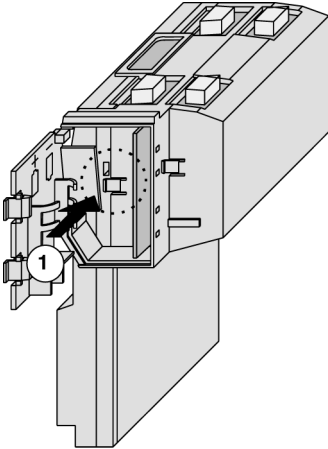
Procedure Follow the steps in the table below to mount the assembly on an I/O base.

Step	Action
1	Make sure that the I/O base is not under power when you assemble the module.
2	<p>Align the four plastic snap extensions (on the front and sides of the Option Adapter) with the slots on the I/O base.</p> <p>The 12-pin ATI connectors will automatically line up when the units are in this position. The devices should be oriented such that their communication ports are facing out on the back side of the assembly.</p> 

Continued on next page

Mounting the Assembled Adapters on the I/O Base, Continued

Procedure, Continued

Step	Action
3	<p>Push the assembled adapters onto the base, gently pressing the locking tabs inward.</p> <p>Snap #1 shown in the illustration below will not align properly with the mating slot in the I/O base unless the Option Adapter is placed straight onto the base. Do not attach just one latch and rotate the Option Adapter onto the I/O base.</p>  <p>Result: The locking tabs on each side of the Option Adapter slide inside the I/O base and out through the locking slot. The 12-pin ATI connectors on the two units are mated to each other in the process.</p>
4	<p>Apply slight pressure to the top of the stirrup on the back of the Option Adapter so that it snaps into place on the bottom of the I/O base.</p>


Disassembling a Module with an Option Adapter

Overview The three-tiered assembly is designed to fit together tightly so it can withstand shock and vibration in an operating environment. This section contains two procedures:

- Removing the assembled adapters from the I/O base
- Removing the Option Adapter from the Processor

Tools Required Flat-head screwdriver.

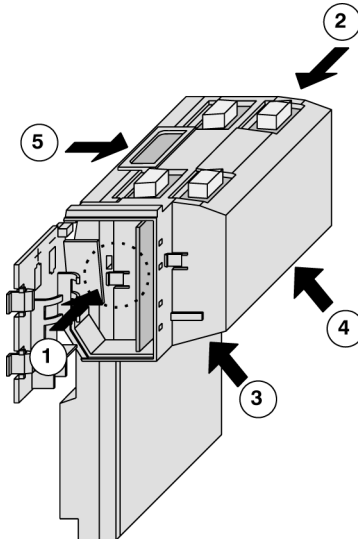
Procedure 1 Follow the steps in the table below to remove the assembled Option Adapter and M1 Processor Adapter from the I/O base.

Step	Action
1	Make sure that the power is off by removing the terminal connectors from the I/O base.
2	Remove the assembled unit from its wall or DIN rail mounting surface.
	<p>CAUTION</p> <p>EXPOSED CIRCUITRY IN BATTERY COMPARTMENT</p> <p>Use care when you insert a screwdriver in the battery compartment so that you do not scratch any exposed elements.</p> <p>Failure to observe this precaution can result in equipment damage.</p>

Continued on next page

Disassembling a Module with an Option Adapter, Continued

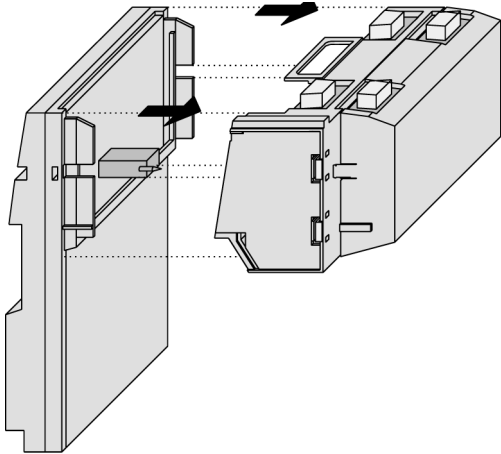
Procedure 1, Continued

Step	Action
3	<p>Open the battery door and use a flat-head screwdriver to release snaps 1 and 2 as shown in the illustration below.</p>  <p>The diagram shows a perspective view of a rectangular module. Callout 1 points to a snap on the left side of the front panel. Callout 2 points to a snap on the top surface. Callout 3 points to a snap on the bottom edge of the front panel. Callout 4 points to a snap on the right side of the front panel. Callout 5 points to a rectangular opening on the top surface, with an arrow indicating the direction to lift the top cover.</p>
4	<p>Once snaps 1 and 2 have been disengaged, use the screwdriver to release snaps 3 and 4 on the front of the assembly.</p>

Continued on next page

Disassembling a Module with an Option Adapter, Continued

Procedure 1,
Continued

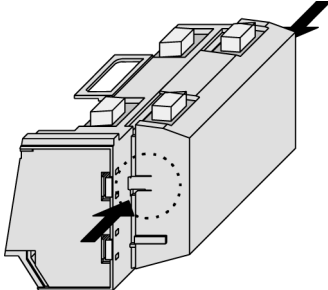
Step	Action
5	<p>Gently lift the stirrup on the back of the option adapter with your fingers until it disengages from the bottom of the I/O base. Then lift the Option Adapter and M1 assembly from the I/O base.</p> 
6	<p>Follow the directions in the next procedure to remove the Option Adapter from the Processor.</p>

Continued on next page

Disassembling a Module with an Option Adapter, Continued

Procedure 2

Follow the steps in the table below to remove the Option Adapter from the M1 processor.

Step	Action
1	Use a screwdriver to push the clips on both sides of the adapter inward. 
2	Lift off the adapter.

Section 3.3

Installing Terminal Connectors

Overview

Purpose This section describes how to use terminal connector coding keys and how to install and remove terminal connectors.

In This Section This section contains the following topics:

For This Topic...	See Page...
Using Terminal Connector Coding Keys	60
Inserting Terminal Connectors	61
Removing a Terminal Connector	62

Using Terminal Connector Coding Keys

Overview

This section describes how to use terminal connector coding keys. It also provides an illustrated example of coded terminals.

How Coding Keys Work

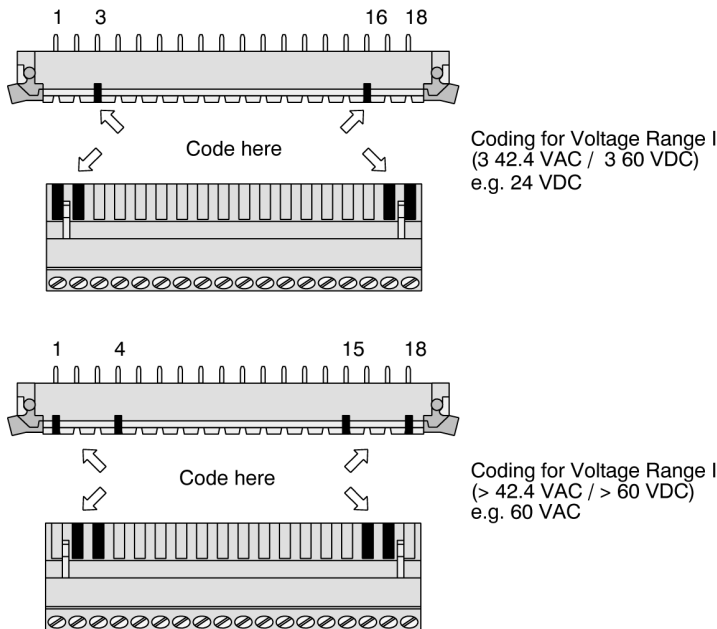
Each I/O base has a series of slots into which you can insert one or more of the coding keys. Each terminal connector has a similar series of slots into which you can insert one or more of the coding tabs. When a key and a tab are inserted into slots that should mate, the I/O base and the connector cannot be physically connected.



Note: For maximum protection, key coding is required during installation.

Example

An example of a key-coded screw-in terminals is shown in the figure below.



Inserting Terminal Connectors

Overview

This section contains safety precautions and a diagram illustrating how to insert terminal connectors in a TSX Momentum I/O base.



WARNING

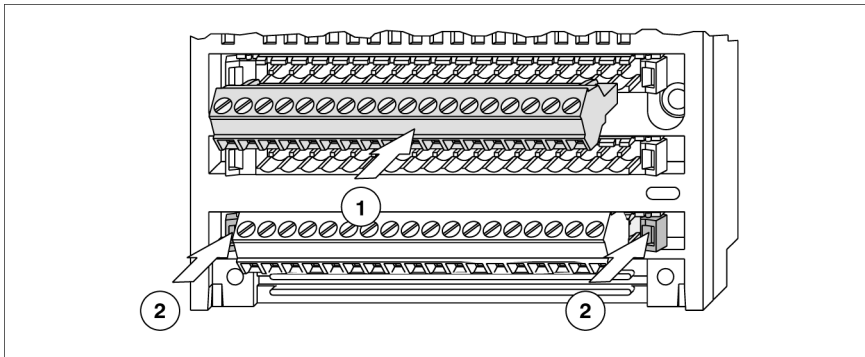
ELECTRICAL VOLTAGES PRESENT

Electrical voltages are present when the I/O base is under power. Make sure that power is not present while you are handling the coding keys on the I/O base and on the terminal connectors.

Failure to observe this precaution can result in severe injury or equipment damage.

Inserting a Terminal Connector

Install the terminal connectors by pushing them into the coded pin connectors (row 1 ... 3 of the I/O base).



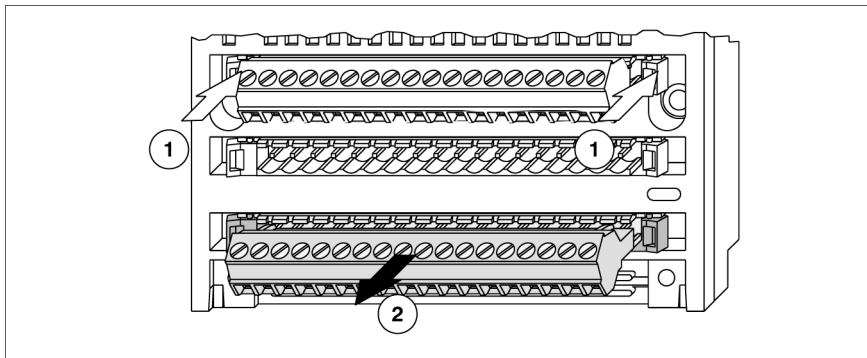
Removing a Terminal Connector

Overview

This section describes how to remove a terminal connector from a TSX Momentum I/O base.

Diagram

To remove a terminal connector, press the two tabs at the ends of the row (labeled 1 in the figure below).



Section 3.4

Busbars

Attaching a Busbar

Overview

This section describes how to attach a busbar to an I/O base.

General

An optional busbar may be inserted into the fourth row of an I/O base. Busbars provide a common connection for the field devices and serve as protective distribution connectors, for instance to PE. Each row of terminals on the busbar is connected internally. There is no connection to the I/O base.



Note: See the internal pin connections and field wiring diagrams associated with your I/O base to determine whether or not you need a busbar and which busbar best suits your needs.

Busbar Types

Depending on the I/O base and the type and number of field devices to which it is connected, a 1-, 2-, or 3-row busbar may be used. Busbars are separately orderable items; they are not shipped with the I/O bases. They are available in either screw-in and spring-clip versions.

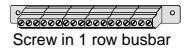
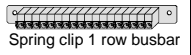
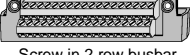


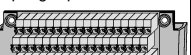
Screw Size

For a screw-in type busbar, use the two, self-tapping Phillips head machine screws provided, to fasten it to the I/O base.

Continued on next page

Attaching a Busbar, Continued

Busbar Numbers

Busbar Type	Part Number	# of Rows	Wire Size
Screw-in	170 XTS 006 01	1	One or two wires up to 10 AWG (4 mm ²)
	170 XTS 005 01	2	One or two wires up to 14 AWG (1.5 mm ²)
	170 XTS 004 01	3	
Spring-clip	170 XTS 007 01	1	 Screw in 1 row busbar  Spring clip 1 row busbar
	170 XTS 008 01	2	 Screw in 2 row busbar  Spring clip 2 row busbar
	170 XTS 003 01	3	 Screw in 3 row busbar  Spring clip 3 row busbar

Section 3.5

Labels

Labeling the Components in the Assembly

Overview

A fill-in label is shipped with each I/O base. This label should be attached to the face of the Communication Adapter or M1 Processor Adapter that you mount on that base.

This section describes the label and provides an illustrated example.

Fill-In Label

A completed label provides information about the assembled module and its I/O field devices that can be used by service and maintenance personnel.

The model number of the I/O base is pre-screened onto the fill-in label directly above the color code. The cutout area above the I/O model number allows the pre-screened model number of the adapter to show through.



Note: An Option Adapter may also be used in the assembled module. You will find its model number printed in the upper left corner of Option Adapter housing.

Continued on next page

Labeling the Components in the Assembly, Continued

Example of a Fill-In Label

A sample fill-in label is illustrated in the diagram below. The numbered pointers in the diagram refer to the descriptions in the table that follows.

The diagram shows a rectangular label for a MODICON TSX Momentum I/O base. The label is divided into two main sections. The top section is a grid with 16 columns, each labeled with a number from 1 to 16 at the bottom. The columns are grouped under three headers: 'Plant' (columns 1-4), 'Station' (columns 5-10), and 'Addr.' (columns 11-16). A bracket labeled '1' spans the top of these three sections. To the right of the grid is a vertical section containing the following text: 'MODICON', 'TSX Momentum', the Telemecanique logo, a cutout window, '170 ADM 350 10', another cutout window, '24 VDC IN-16 PT', and '24 VDC OUT-16 PT'. Numbered pointers are placed around the label: '2' points to the first cutout window, '3' points to the text '170 ADM 350 10', '4' points to the second cutout window, '5' points to the text '24 VDC OUT-16 PT', '6' points to the first column of the grid, and '7' points to the first row of the grid.

No.	Description
1	Fields for plant name, station name and network address
2	Cutout—the model number of the Adapter shows through
3	Model Number of the I/O base
4	Color code of the I/O base
5	Short description of the I/O base
6	Field for the symbol name of inputs
7	Field for the symbol name of outputs

Dimensions and Mounting Instructions

4

At a Glance

Purpose This chapter gives dimensions of assembled TSX Momentum devices and describes how to mount them on a DIN rail or wall.

In This Chapter Use the table below to locate topics in this chapter:

Topic	See Page...
Dimensions of Assembled TSX Momentum Devices	68
Standard Adapter on a Typical Base	69
Standard Adapter on a Discrete VAC Base	70
Processor and Option Adapter on a Typical Base	71
Processor and Option Adapter on a Discrete VAC Base	72
Mounting TSX Momentum Devices	73

Dimensions of Assembled TSX Momentum Devices

Overview

This section contains general information about the dimensions of TSX Momentum assemblies.

Dimension Factors

The following factors influence the dimensions of the assembly:

- The type of I/O base
 - Use of an Option Adapter
 - Use of busbars
-

Mandatory Vertical Clearances

The vertical clearances illustrated in the dimension drawings must be maintained to assure proper heat dissipation.

Horizontal Clearances

In all cases, maintain 1 in of clearance between Momentum devices and the edge of the cabinet.

Standard Adapter on a Typical Base

Introduction

This section provides dimensions for a standard Processor Adapter or Communications Adapter mounted on a typical analog or VDC I/O base.

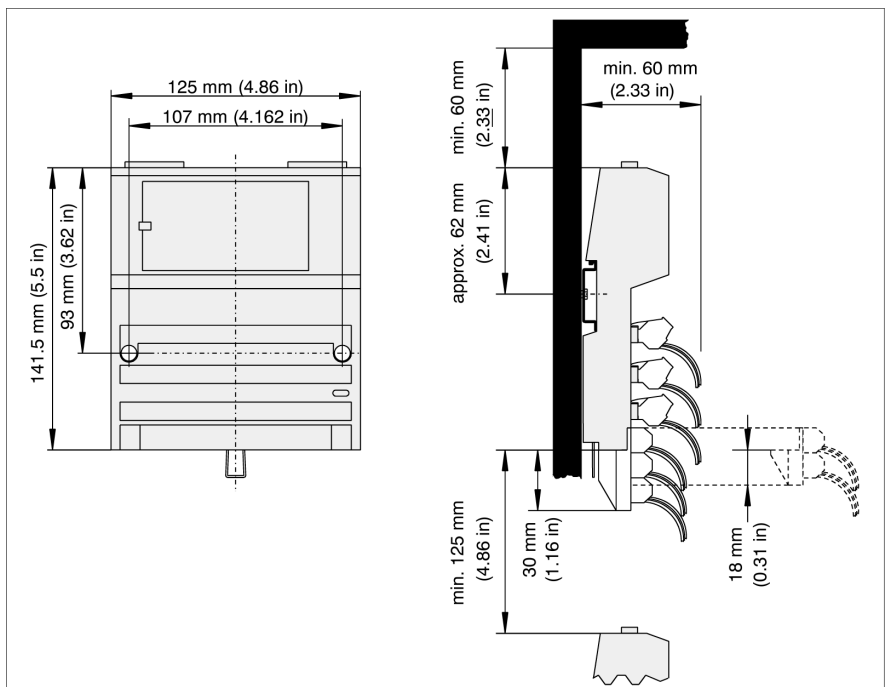
Notes

The wiring from the terminal connectors dictates the minimum depth (60 mm) of this assembly.

The figure on the right shows an additional 30 mm length dimension for an optional three-row busbar.

Illustration

The following illustration shows dimensions for this assembly:



Standard Adapter on a Discrete VAC Base

Introduction

If you are using a discrete VAC I/O base such as a 170 ADI 540 50 or a 170 ADO 540 50, refer to the drawing below for your dimensions.

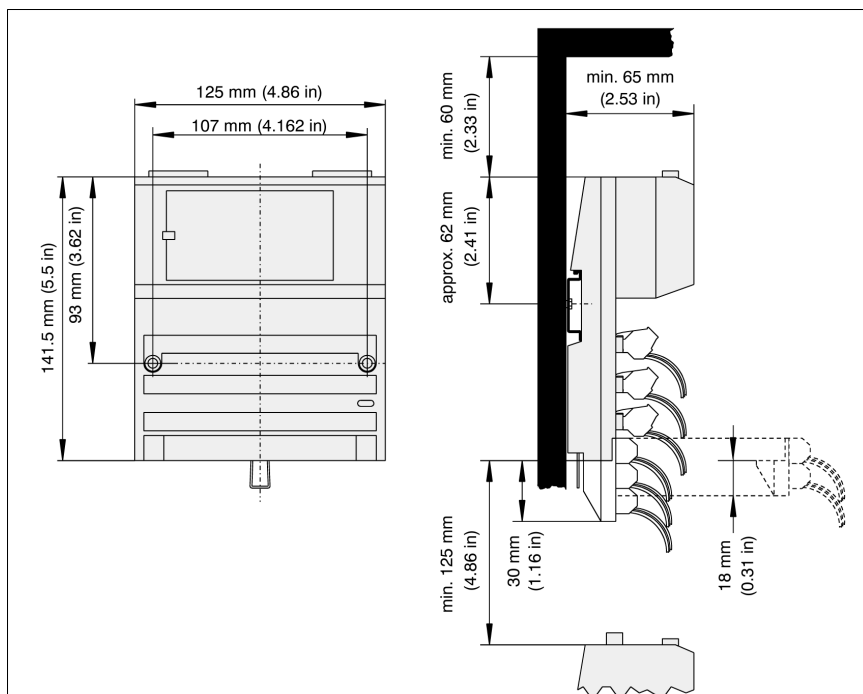
Notes

The minimum depth dimension (65 mm) is determined by the unit housings, not the wiring terminals.

The figure on the right shows an addition 30 mm length dimension for an optional three-row busbar.

Illustration

The following illustration shows dimensions for this assembly:



Processor and Option Adapter on a Typical Base

Introduction

This section provides dimensions for a Processor Adapter and an Option Adapter mounted on a typical analog or VDC I/O base.

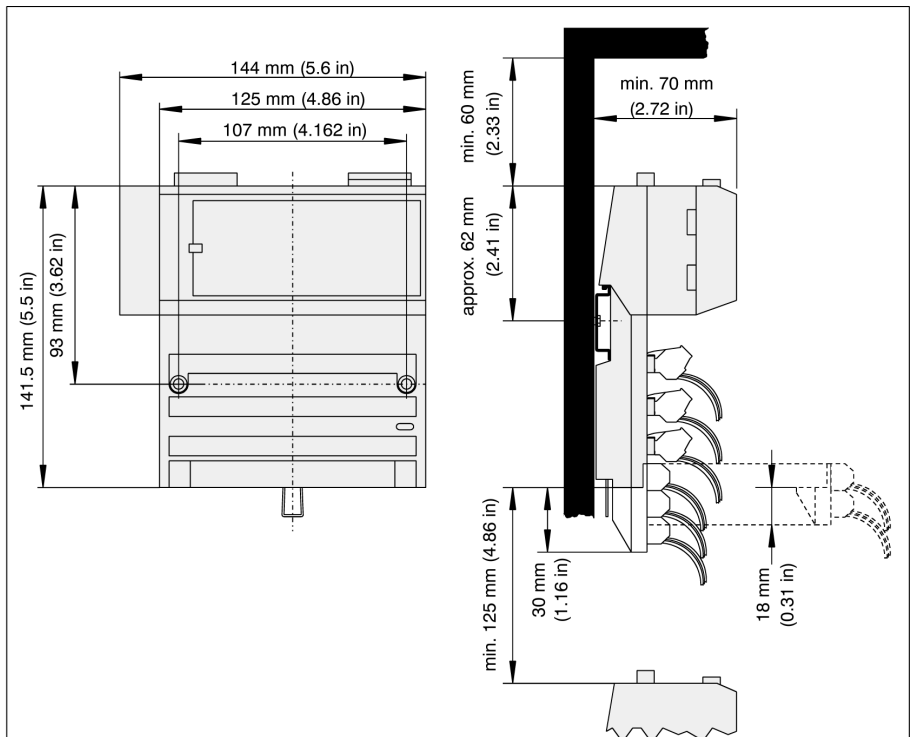
Notes

The Option Adapter adds to the width of this assembly (total 144 mm).

The figure on the right shows an addition 30 mm length dimension for an optional three-row busbar.

Illustration

The following illustration provides dimensions for this assembly:



Processor and Option Adapter on a Discrete VAC Base

Introduction

This section provides dimensions for using Processor and Option Adapters with a discrete VAC base.

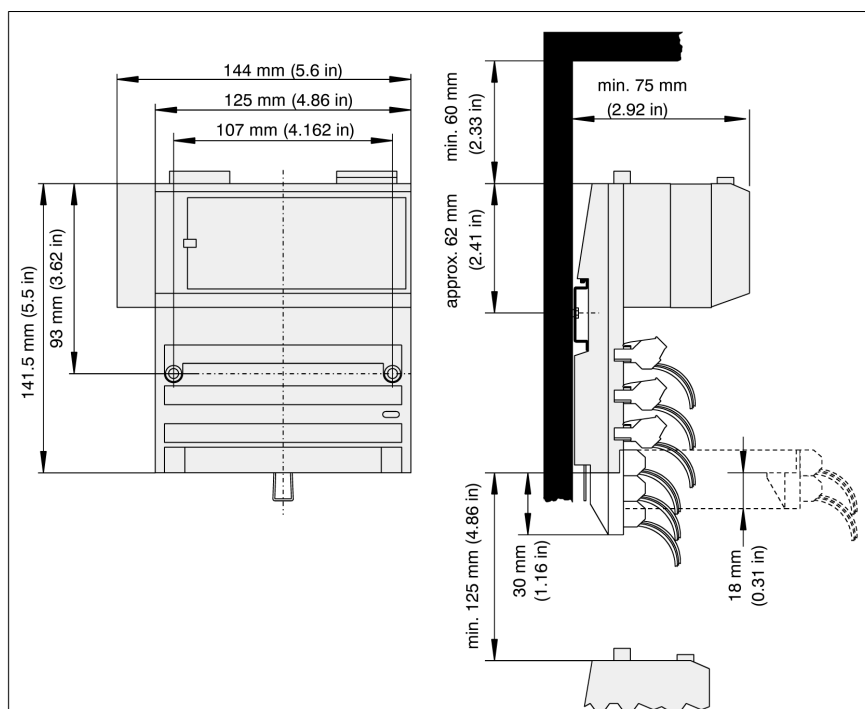
Notes

The minimum depth (75 mm) includes both the Option Adapter and the built-in extender ring on the I/O base.

The figure on the right shows an addition 30 mm length dimension for an optional three-row busbar.

Illustration

The following illustration shows dimensions for this assembly:



Mounting TSX Momentum Devices

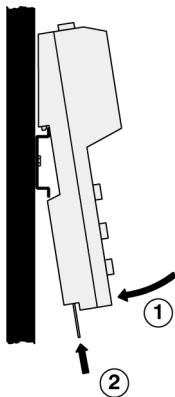
Overview This section contains guidelines for installation and drawings which illustrate how to mount a TSX Momentum assembly on a DIN rail or wall.

Guidelines TSX Momentum components are designed as open equipment per IEC 1131, 1.4.20. Open equipment should be installed in industry-standard enclosures, and access should be restricted to authorized personnel.

Chassis Ground Contact springs on the back of the I/O base establish electrical contact (chassis ground) with the DIN rail mounting track.

To establish chassis ground in a wall-mount situation, you will need to obtain two mounting screws for each unit. The body of the screws should be 4mm (0.16 in) in diameter and at least 25mm (0.97 in) long. The head of the screw must not exceed 8mm (0.31 in) in diameter.

Mounting on a DIN Rail The numbers in the following illustration refer to the steps in the procedure below.



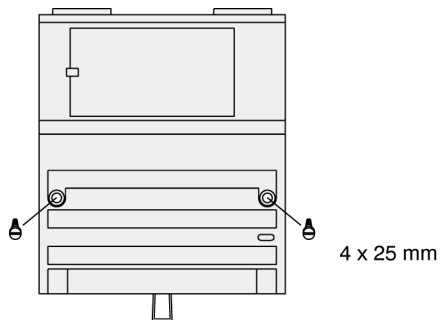
Step	Action
1	Hook the plastic tabs on the back of the device onto the DIN rail and swing the module down to rest against the rail.
2	Push the locking tab upward to secure the device in place.

Continued on next page

Mounting TSX Momentum Modules, Continued

Mounting on a Wall

Secure the device to the wall with two screws, as shown in the illustration below. The head of the screws must not exceed 8mm (0.31 in) in diameter.



Power and Grounding Guidelines

5

At a Glance

Purpose This chapter provides information about circuits and grounding.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Planning the Layout and Separation of Circuits	1	76
Protective Actuator Circuit	2	84
Grounding	3	89

Section 5.1

Planning the Layout and Separation of Circuits

Overview

Purpose

This section contains information to help you plan your circuit layout, including:

- Voltage types
 - Guidelines for structuring your power supply system
 - Guidelines for selecting power supplies
 - Examples of a single power supply configuration
-

In This Section

This section contains the following topics:

For This Topic...	See Page...
Voltage Types	77
Structuring Your Power Supply System	78
Selecting Power Supplies	80
Single Power Supply Configuration	81

Voltage Types

Introduction	In planning your circuit layout, you have to differentiate between operating voltage, input voltage and output voltage.
Operating Voltage	The operating voltage feeds the internal logic of the individual I/O bases. (Abbreviations: L+ / M- for direct current; L1 / N for alternating current)
Input Voltage	The input voltage supplies the sensors. (Abbreviations, where the leading numbers specify the groups: 1L+ / 1M-, 2L+ / 2M-, ... for direct current; 1L1 / 1N, 2L1 / 2N, ... for alternating current)
Output Voltage	The output voltage drives the actuators. (Abbreviations equivalent to those for input voltage)
Common Reference Potential	When two or more circuits have a common reference potential (i.e., they are not isolated), their corresponding reference conductors are abbreviated identically– for example, L+ / M- and 1L+ / M- are used when L+ and 1L+ are not isolated.

Structuring Your Power Supply System

Overview This section contains guidelines for planning and wiring your power supply system.

Use Separate Power Supply for Outputs Operating voltage and input voltage can be derived from one power supply (PS). We recommend that the output voltage be drawn from a separate power supply (e.g., 10 A or 25 A, referred to as PS1 and PS2).

A separate output voltage supply prevents interferences caused by switching processes from affecting the voltage supply to the electronics. Where larger output currents are involved, provide additional power supplies for the output voltage (PS3, ...).

Use Star Configuration Each I/O base should be fed by the power supply in star configuration, i.e., separate leads from the power supply to each module.



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP/POWER-DOWN SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagrams. An unprotected module may be subject to short circuits and/or power-up/power-down spikes.

Failure to observe this precaution can result in injury or equipment damage.

Avoid Induction Loops Do not create any induction loops. (This can be caused by laying out the supply conductors L+/M-, ... in pairs.)

Avoid Series Connections The series connections often found in automatic circuit breakers should be avoided, since they increase the inductive component in the output-voltage leads.

Continued on next page

**I/O Devices are
Potential-
Isolated**

The potential relationships of the bus adapters are designed so that the individual I/O stations form potential-isolated islands (e.g., by isolating the incoming remote bus of InterBus). Potential balancing is not necessary.

Selecting Power Supplies

Introduction This section provides guidelines for selecting power supplies.

Using Three-Phase Bridges Unfiltered three-phase bridges can be used in 24 VDC power supplies for the I/O bases, the sensors, and the actuators. In view of the maximum permissible ripple of 5%, monitoring for phase failure is necessary. For single-phase rectification, the 24 VDC must be buffered to ensure conformance to the specifications in *System Specifications* on page 595 (20...30V; max. ripple 5 %).



CAUTION
POTENTIAL FOR DANGEROUS VOLTAGE LEVELS

You must electrically isolate the AC-to-DC converter between the input (primary) and output (secondary). Otherwise, dangerous voltage levels can be propagated to the output if the AC-to-DC converter fails.

Failure to observe this precaution can result in injury or equipment damage.

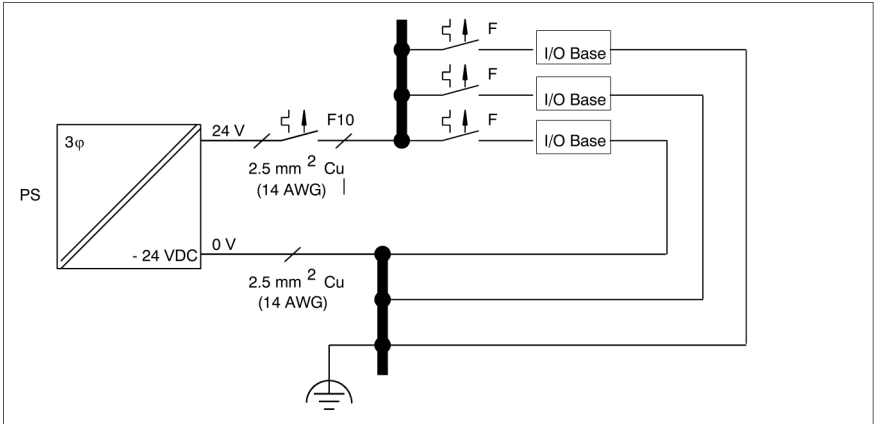
Provide Reserve Capacity Startup transients, extra long cables, and low cross-sectional efficiency can lead to voltage supply breakdowns. You should therefore select power supplies with enough reserve capacity and select the proper cable lengths and cross sections.

Single Power Supply Configuration

Introduction This section contains illustrations of a sample circuit layout, potential bundling and potential isolation for a single power supply configuration.

Fusing in Circuit Layout Each of the following circuit branches must be fuse-protected (F in the figure below). In the case of long lines, the circuit branch must be provided with a 1N5646A suppressor diode circuit. This protection selectively shuts off a circuit branch through the associated fuse even if the diode is short-circuited.

Illustration The following illustration shows a sample circuit layout for a single power supply configuration.



Label	Description
F	Automatic circuit breaker or fuse (see appropriate field wiring illustration in I/O base description)
F10	Optional circuit breaker (with over-voltage protection, CROSS REF)
PS	Power Supply 24 VDC, max. 25 A

Continued on next page

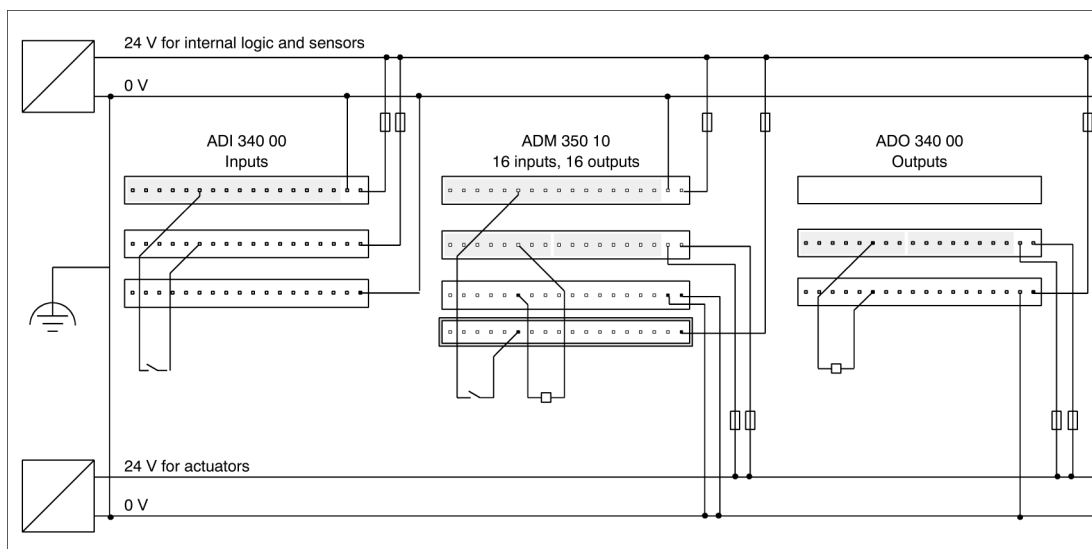
Single Power Supply Configuration, Continued

Fusing in Wiring Illustrations

The fuses shown in the illustrations below must be selected on the basis of the type and number of the sensors and actuators used.

Potential Bundling

In this example, the output voltage is drawn from a separate power supply.

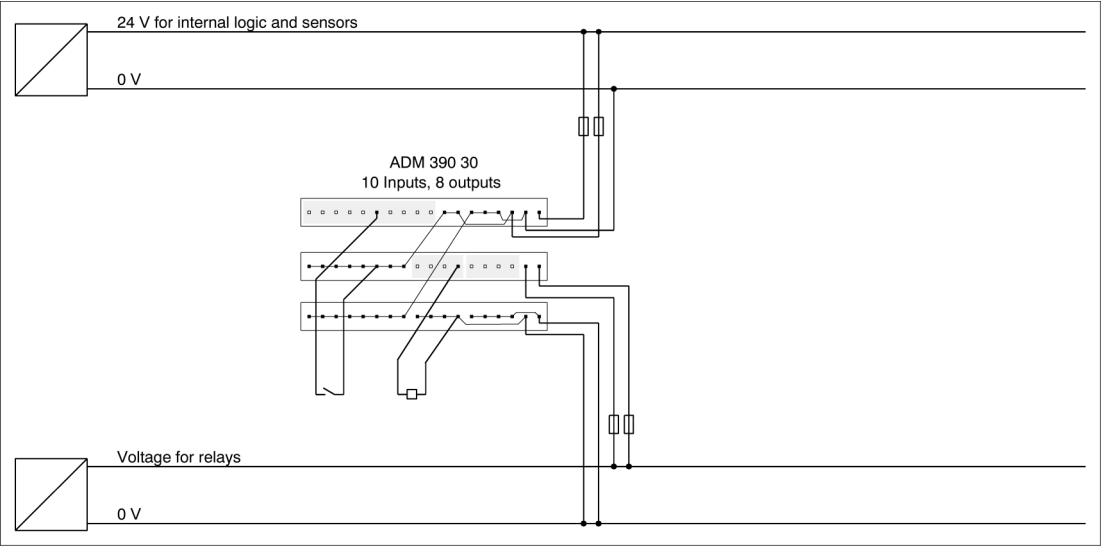


Continued on next page

Single Power Supply Configuration, Continued

Potential Isolation

In this example, the output voltage is drawn from a separate power supply



Section 5.2

Protective Actuator Circuit

Overview

Purpose

This section discusses specific cases when an external load-protective circuit is required for DC actuators and for AC actuators.

Output bases are equipped with safety diodes or RC combinations which generally provide adequate noise and interference protection (standard circuitry), to protect the circuitry and relay outputs. An external load-protective circuit is therefore required in the following specific cases only (and may already have been installed by the manufacturer).

In This Section

This section contains the following topics:

For This Topic...	See Page...
Protective Circuits for DC Actuators	85
Protective Circuits for AC Actuators	87

Protective Circuits for DC Actuators

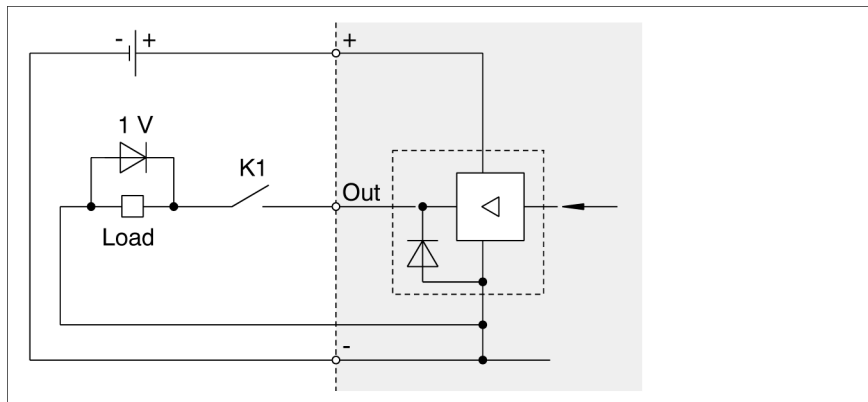
Overview	This section discusses specific cases when inductive loads at output points require additional protective circuits (directly on the actuator) and provides two examples or protective circuitry.
Case 1	When there are contacted circuit elements (e.g. for safety interlocks) in the output conductors.
Case 2	When the leads are very long.
Case 3	Where inductive actuators are operated via relay contacts of the I/O base. (To extend contact life and for EMC considerations.)
Protective Circuit Types	In all three cases, the protective circuit may be a clamping diode, a varistor or an RC combination.

Continued on next page

Protective Circuits for DC Actuators, Continued

Example

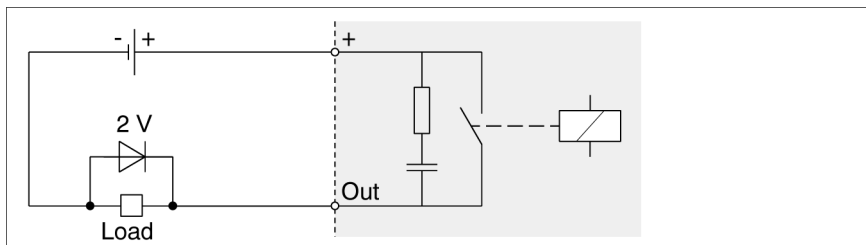
An example of a protective circuit for inductive DC actuators is illustrated below:



Label	Description
K1	Contact, e.g., for safety interlocks
1 V	Clamping diode as the protective circuit

Further Example

Another example of a protective circuit for inductive DC actuators is illustrated below:



Label	Description
2 V	Clamping diode as the protective circuit

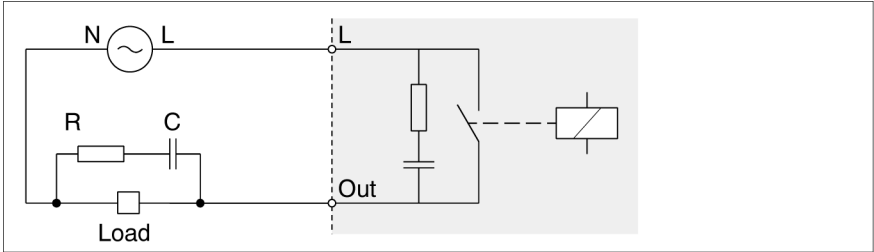
See *Suggested Component Values for AC and DC Actuators* on page 88.

Continued on next page

Protective Circuits for AC Actuators

Overview To reduce noise potentials and for EMC considerations you may need to equip the inductive actuators with varistors or noise suppressors, e.g., anti-interference capacitors, at the point of interference.

Example An example of a protective circuit for inductive AC actuators is illustrated below:



Label	Description
L, N	Phase (L1, L2, L3) and Reference Conductor
RC	RC Combination as the Protective Circuit (rated per manufacturer's specifications)

See *Suggested Component Values for AC and DC Actuators* on page 88.

Suggested Component Values for AC and DC Actuators

Suggested Values Only

The clamping diode forward current rating must be equal to or greater than load current. Diode PIV rating must be three or four times greater than supply voltage at 24 VDC and 8 ... 10 times greater than supply voltage at 110 VDC. The unpolarized (AC) snubber capacitor should have a rating two or three times greater than the supply voltage. Values may be:

Load Inductance	Capacitance
25 ... 70 mH	0.50 microF
70 ... 180 mH	25 microF
180 mH	10 microF

Snubber resistors may be 1 ... 3 Ohms, 2 W. Resistor values should be increased up to 47 Ohms, .5 W for R_L exceeding 100 Ohms.

Section 5.3

Grounding

Overview

Purpose

This section describes how to ground TSX Momentum devices, DIN rail terminals and cabinets, and analog I/O lines.

In This Section

This section contains the following topics:

For This Topic...	See Page...
Grounding TSX Momentum Devices	90
Grounding DIN Rail Terminals and Cabinets	93
Grounding Analog I/O Lines	94

Grounding TSX Momentum Devices

Overview

This section describes how to provide two types of grounding for assembled TSX Momentum devices:

- Functional earth (FE), used to discharge high frequency disturbances, guaranteeing proper EMC behavior
 - Protective earth (PE), used for protection against personal injuries according to IEC and VDE
-

Grounding Momentum Devices

Momentum devices consist of an I/O base assembled with a Communications Adapter or a Processor Adapter and possibly an Option Adapter. The PE of the adapters is electrically connected with the PE of the I/O base; you do not have to provide any further grounding of the adapter.

Grounding Guidelines

Follow these guidelines:

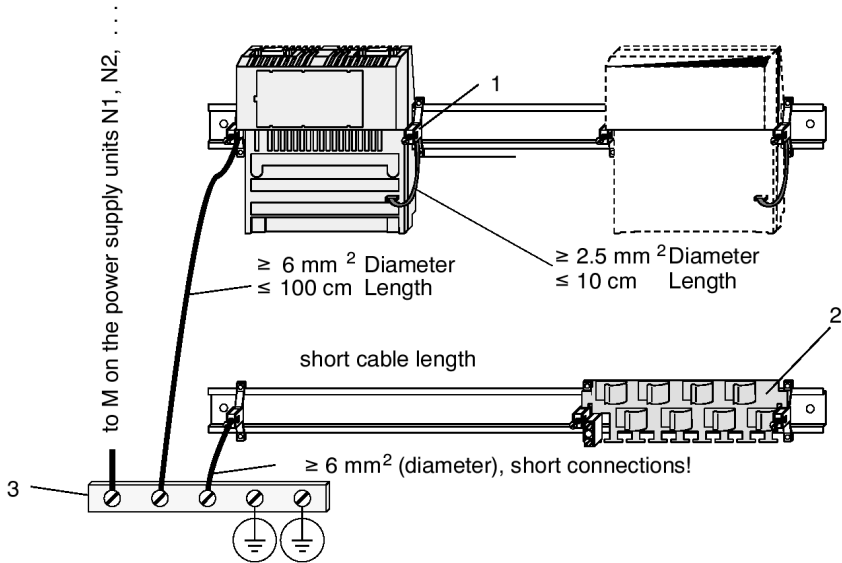
- Be sure you establish good ground contacts.
 - Connect the grounding screw to protective earth (PE) for AC and DC modules.
-

Continued on next page

Grounding TSX Momentum Devices, Continued

Cable Specifications

When you are using ground cable up to 10 cm (4 in) long, its diameter should be at least 6 mm (23 AWG). When longer cables are used, larger cable diameters are required, as shown in the following illustration:



Label	Description
1	Grounding clamp, such as EDS 000
2	Cable Grounding Rail (424 244 739), an optional component for grounding lines close to PE/FE rail
3	PE/FE rail in the cabinet or PE/FE screw in terminal cabinet

Continued on next page

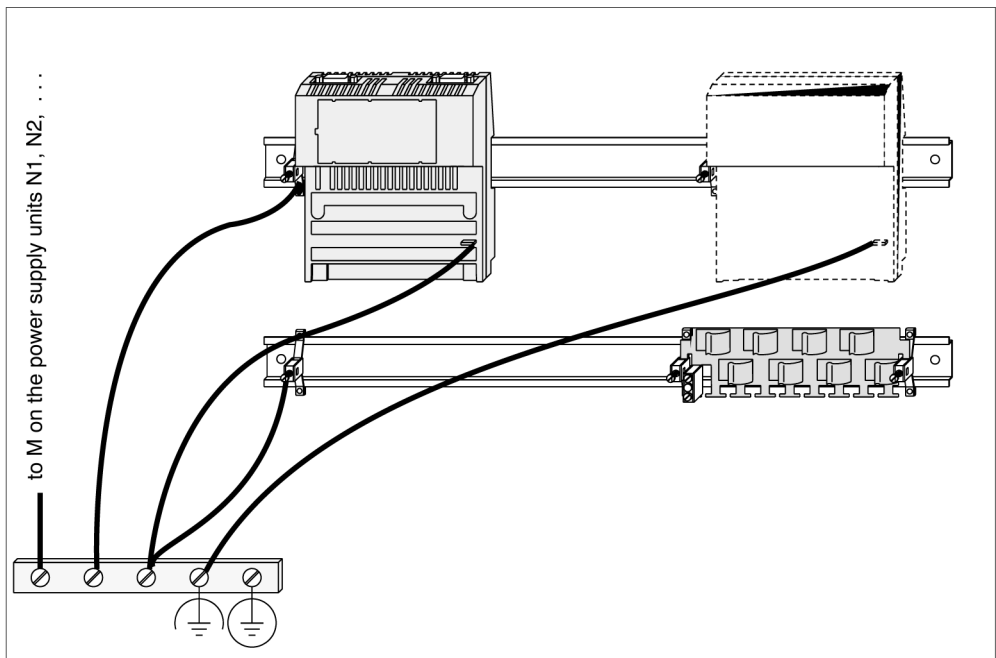
Grounding the TSX Momentum Devices, Continued

Grounding Scheme

The illustration below illustrates properly grounding modules and tracks.



Note: The lower DIN rail shows a Cable Grounding Rail (424 244 739), an optional component for grounding analog lines. For a procedure for grounding analog I/O lines, see *Grounding Analog I/O Lines* on page 94.



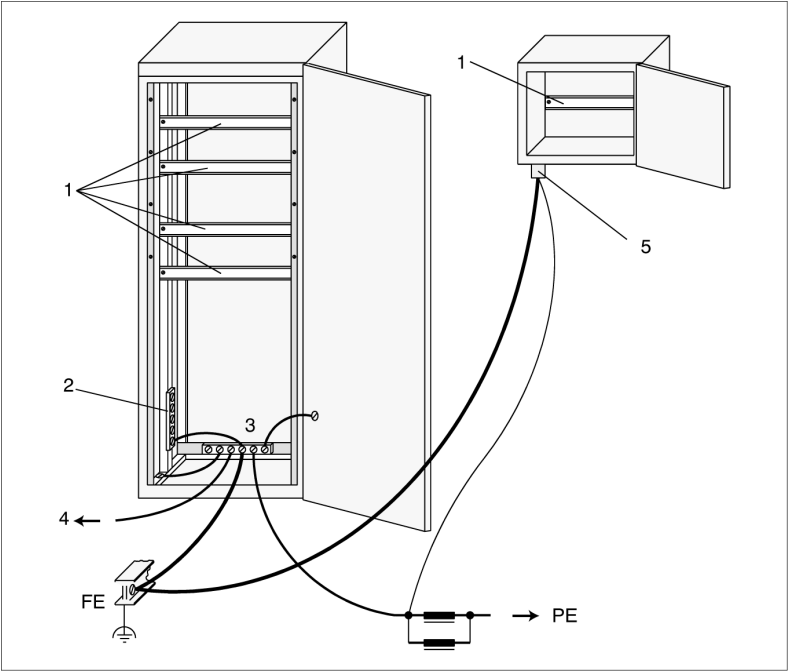
Grounding DIN Rail Terminals and Cabinets

Overview

This section shows how to ground DIN rail terminals and cabinets.

Illustration

The following illustration shows how to ground DIN rail terminals and cabinets:



Label	Description
1	DIN rail for connecting the TSX Momentum device and its accessories
2	Reference conductor system or rail (solid copper or connected terminals)
3	Grounding bar in the cabinet
4	Next cabinet
5	Grounding screw (PE/FE) in cabinet
FE	Functional earth
PE	Protective earth

Grounding Analog I/O Lines

Overview

Analog wires must be grounded directly when entering the cabinet. You may use commercial cleats or clamps or an analog cable grounding rail. This section describes both approaches.

Principle

High frequency interference can only be discharged via big surfaces and short cable lengths.

Guidelines

Follow these wiring guidelines:

- Use shielded, twisted-pair cabling
- Expose the shielding on one side (for instance, at the console exit)
- Make sure the track is properly grounded (see *Grounding TSX Momentum Devices* on page 90)

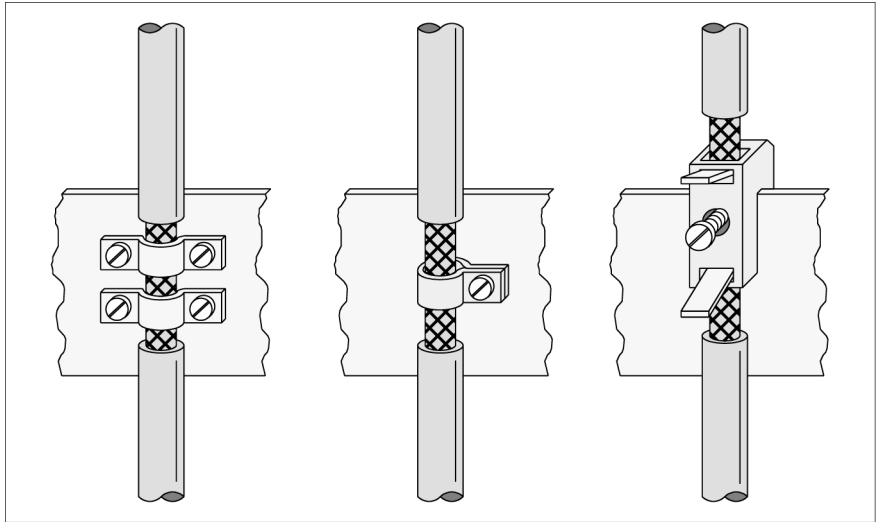
Grounding of the bus cable is determined by the bus adapter used. Look for details in your bus adapter manual.

Continued on next page

Grounding Analog I/O Lines, Continued

Using Cleats or Clamps

Cleats or clamps can be mounted directly on the ground rail (PE/FE rail) in the cabinet, as shown in the illustration below. Be sure the cleats or clamps make proper contact.



Continued on next page

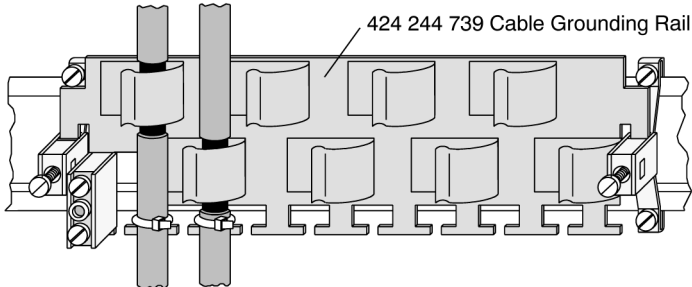
Grounding Analog I/O Lines, Continued

Using an Analog Cable Grounding Rail

Follow the steps in the table below to ground shielded analog I/O lines using an analog cable grounding rail (424 244 739).

Step	Action
1	Remove the shielding insulation at the level of the corresponding cable cleat.
2	Push the cable end with the exposed shielding into the cable cleat, making contact with the track.
3	Use cable clips to provide traction relief for the individual cables.

Result: The grounded lines should look like this:



The diagram illustrates the installation of the 424 244 739 Cable Grounding Rail. It shows a horizontal rail with multiple cable cleats. Two cables are shown with their shielding insulation removed and pushed into the cleats. Cable clips are used to provide traction relief for the individual cables. A label points to the rail with the text '424 244 739 Cable Grounding Rail'.

I/O Base Descriptions



At a Glance

Purpose This part provides descriptions of each I/O base.

In This Part This part contains the following chapters:

For Information On ...	See Chapter ...	On Page...
170 AAI 030 00 Analog 8 Channel Differential Input Module Base	6	99
170 AAI 140 00 Analog 16 Channel Single-Ended Input Module Base	7	119
170 AAI 520 40 Analog 4 Channel RTD, Therm. and Mv Input Module Base	8	137
170 AAO 120 00 Analog 4 Channel Output Module Base 0 - 20 mA	9	165
170 AAO 921 00 Analog 4 Channel Output Module Base 4 ... 20 mA	10	183
170 ADI 340 00 24 VDC - 16 Pt. Discrete Input Module Base	11	201
170 ADI 350 00 24 VDC - 32 Pt. Discrete Input Module Base	12	217
170 ADI 540 50 120 VAC - 16 Point Discrete Input Module Base	13	233
170 ADM 350 10 24 VDC - 16 Pt. In / 16 Pt. Out Module Base	14	249

Continued on next page

At a Glance, Continued

In This Part, Continued

For Information On ...	See Chapter ...	On Page...
170 ADM 350 11 24 VDC - 16 Pt. In / 16 Pt. Out Module Base	15	267
170 ADM 370 10 24 VDC - 16 Pt. In / 8 Pt. Out @ 2 Amp. Module Base	16	285
170 ADM 390 10 24 VDC - 16 Pt. In / 12 Pt. Out Monitored Module Base	17	305
170 ADM 390 30 24 VDC - 10 Pt. In / 8 Pt. Relay Out Module Base	18	325
170 ADM 540 80 120 VAC - 6 Pt. In / 3 Pt. Out Discrete MCC Module Base	19	343
170 ADM 690 50, 170 ADM 690 51 120 VAC - 10 Pt. In / 8 Pt. Out Module Bases	20	381
170 ADO 340 00 24 VDC - 16 Pt. Discrete Output Module Base	21	407
170 ADO 350 00 24 VDC - 32 Pt. Discrete Output Module Base	22	423
170 ADO 530 50 120 VAC - 8 Point Discrete Output @ 2A Module Base	23	441
170 ADO 540 50 120 VAC - 16 Point Discrete Output Module Base	24	459
170 ADO 730 50 230 VAC - 8 Point Discrete Output @ 2A Module Base	25	477
170 ADO 740 50 230 VAC - 16 Point Discrete Output Module Base	26	495
170 AMM 090 00 Analog 4 Ch. In / 2 Ch. Out Module Base w/ 24 VDC I/O Pts	27	513
170 ANR 120 90 Analog 6 Ch. In / 4 Ch. Out Module Base w/ 24 VDC I/O pts	28	549
170 CPS 110 00 TIO Power Supply Module	29	577

170 AAI 030 00

Analog 8 Channel Differential

Input Module Base

6

At a Glance

Purpose This chapter describes the 170 AAI 030 00 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	100
Wiring	2	105
Configuration	3	110
Analog/Digital Relation	4	115

Section 6.1

Module Overview

Introduction

Purpose This section describes the front panel components of the 170 AAI 030 00 TSX Momentum I/O base and provides specifications.

In This Section This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	101
Specifications	103

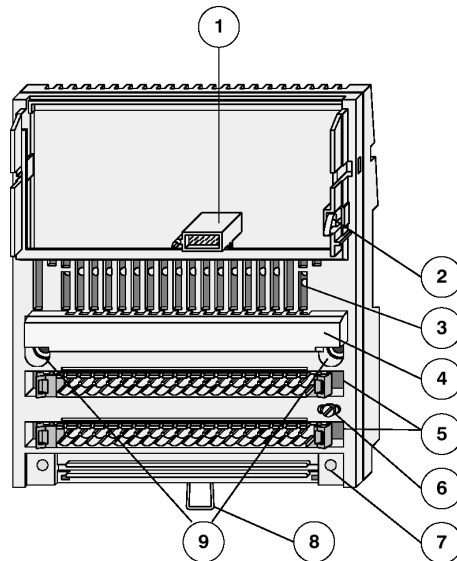
Front Panel Components

Overview

This section contains a photograph of the front panel of the 170 AAI 030 00 I/O base and a description of the LEDs.

Front Panel Illustration

The front panel of the I/O base is shown in the illustration below:



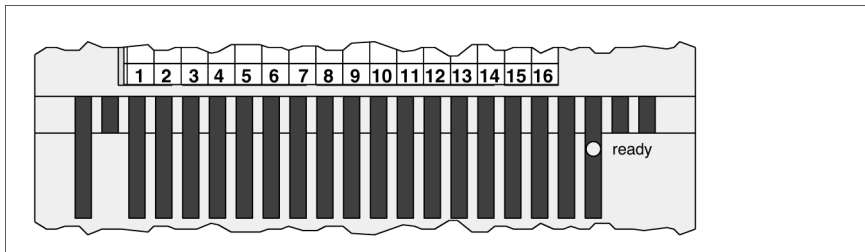
Label	Description
1	Internal interface (ATI) connector
2	Locking and ground contact for the adapter
3	LED status display
4	Protective cover
5	Sockets for the terminal connectors
6	Grounding screw
7	Busbar mounting slot
8	Locking tab for DIN rail mount
9	Mounting holes for panel mount

Continued on next page

Front Panel Components, Continued

LED Illustration

This I/O base has one LED, the ready indicator shown in the illustration below.



LED Descriptions

The ready indicator is described in the table below.

Indicator	Condition	Message
Ready	Green	Module is ready to communicate. Operating voltage for internal logic is present and self-test has been passed.
	Off	Module not ready.

Specifications

Overview

This section contains specifications for the 170 AAI 030 00 I/O base.

General Specifications

The following table contains general specifications for the I/O base:

Module type	8 analog inputs
Input voltage range	+/- 10 V, +/- 5 V, 1 ... 5 V
Input current range	+/- 20 mA, 4 ... 20 mA
Supply voltage	24 VDC
Supply voltage range	20 ... 30 VDC
Supply current consumption	max. 362 mA at 24 VDC
Power dissipation	3.73 W typical 6.58 W maximum
I/O map	8 input words 2 output words
Isolation	
Between channels	200 VDC, 1 min
Between base supply and ground	500 VDC, 1 min
Between input channels and ground	500 VDC, 1 min
Fuses	
Internal (not user-replaceable)	2 A slow-blow
External (recommended)	500 mA fast-blow
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500 V
Emissions	EN 50081-2 (limitation A)
Agency approvals	UL, CUL, CE
Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54 in)
Length	141.5 mm (5.5 in) no busbar
Weight	215 g (0.45 lb)

Continued on next page

Specifications, Continued

Analog Inputs

The following tables contain specifications for analog inputs.

Surge tolerance: input voltage input current	+/- 30 VDC +/- 25 mA
Number of channels	8
Format of transmitted data	full 16 bits signed (2's complement)
Protection	polarity inversion
Error indication	none
Common mode rejection	250 VAC @ 47 ... 63 Hz or 100 VDC channel-to-ground
Update time for the inputs (in ms)	1.33 + n x 1.33 n = number of declared channels
Filtering	low pass with cutoff frequency 18 kHz

Range	+/- 10 V	+/- 5 V	1 ... 5 V	+/- 20 mA	4 ... 20 mA
Input impedance	20 MOhm	20 MOhm	20 MOhm	250 Ohm	250 Ohm
Error at 25 deg. C	0.27% PE*	0.21% PE*	0.13% PE*	0.32% PE*	0.28% PE*
Error at 60 deg. C	0.32% PE*	0.26% PE*	0.19% PE*	0.41% PE*	0.38% PE*
Temperature drift (60 deg. C)	14 ppm PE*/ deg. C	14 ppm PE*/ deg. C	18 ppm PE*/ deg. C	24 ppm PE*/ deg. C	30 ppm PE*/ deg. C
Resolution	14 bits + sign	14 bits + sign	15 bits	14 bits + sign	15 bits



Note: *Not to be confused with Protective Earth. PE is used here as a European notation for full scale, with the following values:
 10 V in range of +/- 10 V
 5 V in range of +/- 5 V
 4 V in range of 1 ... 5 V
 20 mA in range of +/- 20 mA
 16 mA in range of 4 ... 20 mA

Section 6.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring illustrations for the 170 AAI 030 00 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	106
Field Wiring Guidelines	107
Wiring Illustrations	109

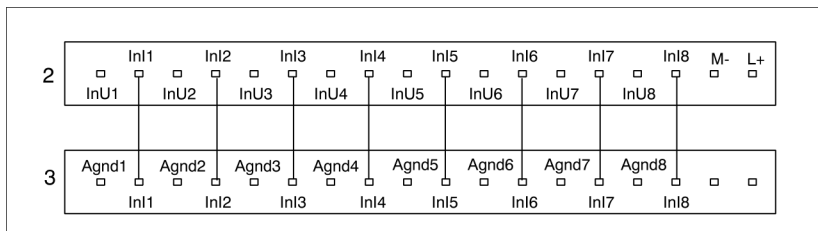
Internal Pin Connections

Overview

This section contains an illustration showing the internal connections between terminals on the I/O base.

Illustration

The following illustration shows the internal connections between terminals.



Field Wiring Guidelines

Overview

This section contains wiring guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Mapping Terminal Blocks

Mapping terminal blocks is described in the table below.

Row	Terminal No.	Description	Function
2	1, 3, 5, 7, 9,11, 13, 15	InU1 ... InU8	Voltage input, channel 1 ... 8
	2, 4, 6, 8, 10, 12, 14, 16	InI1 ... InI8	Current input, channel 1 ... 8
	17	M-	- return (of operating voltage)
	18	L+	+ 24 VDC Operating voltage
3	1, 3, 5, 7, 9,11, 13, 15	Agnd1 ... Agnd8	Analog ground, channel 1 ... 8
	2, 4, 6, 8, 10, 12, 14, 16	InI1 ... InI8	Current input, channel 1 ... 8



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring illustration. An unprotected module may be subject to short circuits and/or power-up spikes.

Failure to observe this precaution can result in injury or equipment damage.

Continued on next page

Field Wiring Guidelines, Continued

Signal Protection To protect the signal from external noise induced in serial or common mode, we recommend the following precautions:

- Use shielded twisted-pair cables with a minimum conductor cross section of 0.22 mm².
 - Connect the cable shield to ground via the Cable Grounding Rail (part number 424 244 739).
 - You may combine the analog inputs on this I/O base in one multi-pair cable provided the same ground is used.
 - When wiring the voltage supply, use sensors that do not have ground reference.
-

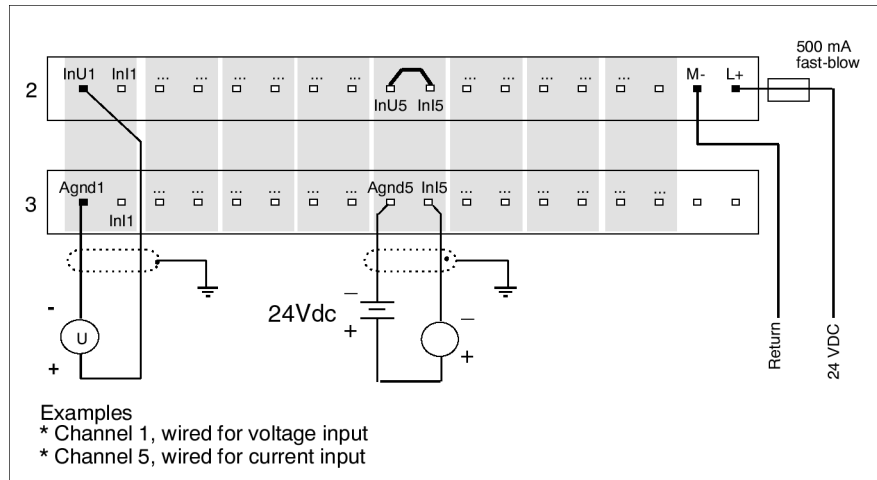
Wiring Illustrations

Overview

This section contains an illustration to assist you in wiring the I/O base.

Illustration

The illustration below shows an example of wiring for voltage input and for current input.



Section 6.3

Configuration

Configuration Overview

Introduction The 170 AAI 030 00 TSX Momentum I/O base supports 8 analog inputs.

I/O Map The I/O base must be mapped as eight contiguous input words and two contiguous output words, as follows:

Word	Input Data	Output Data
1	Value, input channel 1	Parameters for input channels 1 ... 4
2	Value, input channel 2	Parameters for input channels 5 ... 8
3	Value, input channel 3	Not used
4	Value, input channel 4	Not used
5	Value, input channel 5	Not used
6	Value, input channel 6	Not used
7	Value, input channel 7	Not used
8	Value, input channel 8	Not used

In This Section This section contains the following topics:

For This Topic...	See Page...
Analog Channel Parameters	111
Analog Inputs	113

Analog Channel Parameters

Overview

Parameters must be set for all of the analog channels before the module can be commissioned. This section provides the codes for setting the parameters and gives examples of parameter settings.



Note: If you set new parameters for the module, always send a complete set of parameters (all channels, inputs and outputs), even if you only want to change a single parameter. Otherwise the module will refuse the new parameters and continue working with the old ones.

Key

This section focuses on output words 1 and 2, as highlighted in the table below:

Word	Input Data	Output Data
1	Value, input channel 1	Parameters for input channels 1 ... 4
2	Value, input channel 2	Parameters for input channels 5 ... 8
3	Value, input channel 3	Not used
4	Value, input channel 4	Not used
5	Value, input channel 5	Not used
6	Value, input channel 6	Not used
7	Value, input channel 7	Not used
8	Value, input channel 8	Not used

Continued on next page

Analog Channel Parameters, Continued

Illustration

Parameters are set by entering a four-bit code in output words 1 and 2, as follows:

Output Word 1 (Register 4x)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
for input channel 4				for input channel 3				for input channel 2				for input channel 1			

Output Word 2 (Register 4x+1)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
for input channel 8				for input channel 7				for input channel 6				for input channel 5			

Codes for Analog Input Parameters

Use the following codes to set the parameters for each analog input channel:

Code (binary)	Code (hex)	Parameter
0000	0	Reserved value (see note below)
0010	2	+/-5V and +/-20mA input range
0011	3	+/-10V input range
0100	4	Channel inactive
1010	A	1 ... 5V and 4 ... 20 mA input range



Note: The 0000 reserved value is more a control than a parameter. It forces the I/O base into a default condition where it continues to receive field inputs according to the previous channel parameters.

Analog Inputs

Overview

This section describes how to interpret the value of the analog input channels.

Key

This section describes input words 1 ... 8, as highlighted in the table below:

Word	Input Data	Output Data
1	Value, input channel 1	Parameters for input channels 1 ... 4
2	Value, input channel 2	Parameters for input channels 5 ... 8
3	Value, input channel 3	Not used
4	Value, input channel 4	Not used
5	Value, input channel 5	Not used
6	Value, input channel 6	Not used
7	Value, input channel 7	Not used
8	Value, input channel 8	Not used

Bit Assignments

The following table tells how bits are assigned:

Analog-to-digital conversion	Carried out on 14 bits + sign for bipolar input ranges, 15 bits for unipolar ranges
Bit 15	Sign bit
Bits 14 ... 0	Input channel values

Continued on next page

Analog Inputs, Continued

Analog Input Values

Mapping of analog input values is shown below.

Input Word 1 (Register 3x, analog value returned on channel 1)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Input Word 2 (Register 3x+1, analog value returned on channel 2)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Input Word 3 (Register 3x+2, analog value returned on channel 3)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1

Input Word 8 (Register 3x+7, analog value returned on channel 8)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Broken Wire Indication

Broken wire detection is possible for the 4 ... 20 mA range. In this case, a current signal that is less than 2 mA on one of the inputs is detected as a broken wire. The input word of that channel returns the value -32,768. A broken wire indication has the following binary format:

Broken wire indication in an input word															
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Section 6.4

Analog/Digital Relation

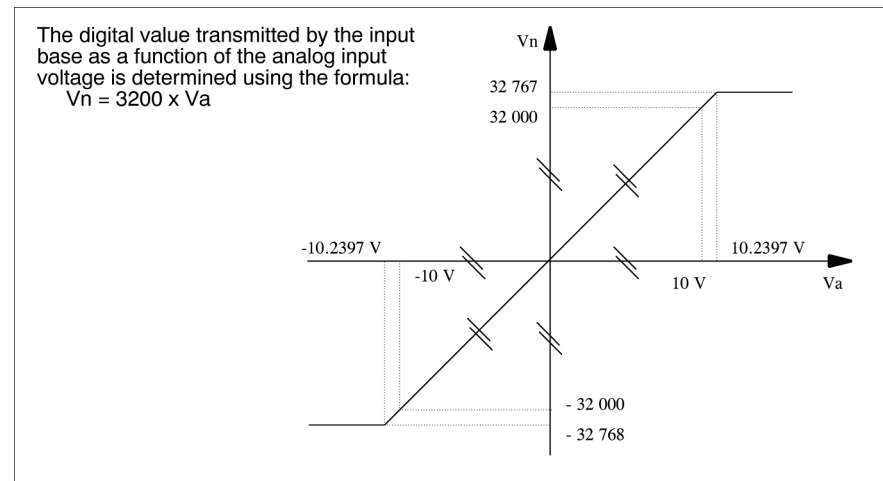
Input Measuring Ranges

Overview

This section contains illustrations explaining the analog/digital relation for the three input measuring ranges.

+/- 10 V

The following illustration shows the analog/digital relation at +/- 10 V:



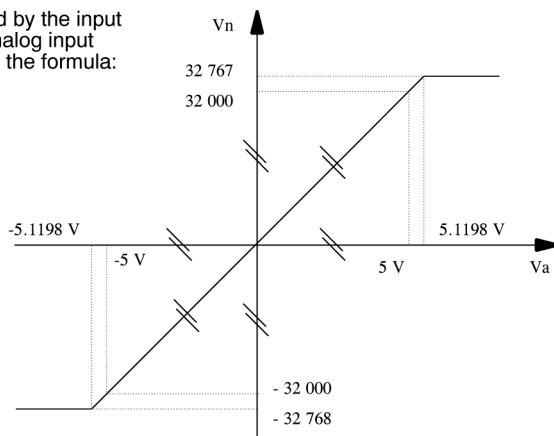
Continued on next page

Input Measuring Ranges, Continued

+/- 5 V

The following illustration shows the analog/digital relation at +/- 5 V:

The digital value transmitted by the input base as a function of the analog input voltage is determined using the formula:
 $V_n = 6400 \times V_a$

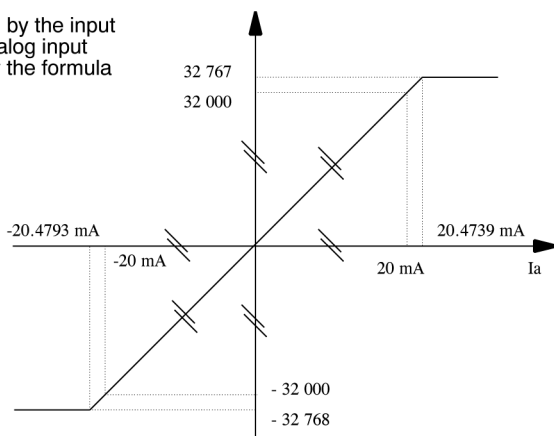


+/- 20 mA

The following illustration shows the analog/digital relation for the input measuring range +/- 20 mA.

The digital value transmitted by the input base as a function of the analog input current (I_a) is determined by the formula

$$V_n = 1600 \times I_a$$



Continued on next page

Input and Output Ranges, Continued

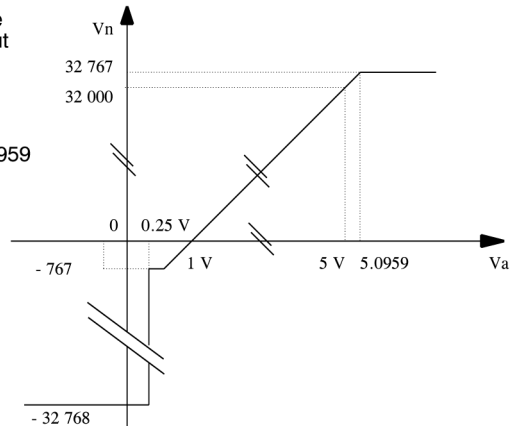
1 ... 5 V

The following illustration shows the analog/digital relation for the input measuring range 1 ... 5 V. .

The digital value transmitted by the input base as a function of the input voltage (V_a) is determined by the formula:

$$V_n = 8000 \times V_a - 8000$$

in the voltage range: 0.9041 ... 5.0959



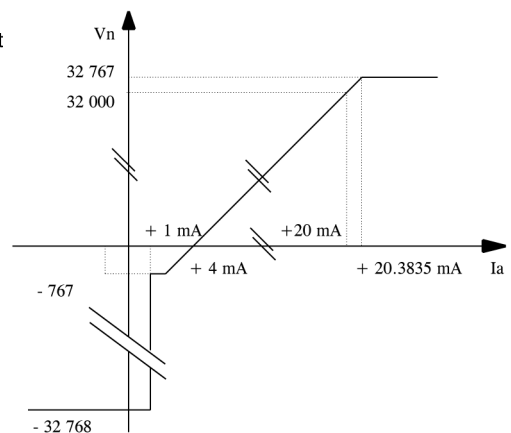
4 ... 20 mA

The following illustration shows the analog/digital relation at 4 ... 20 mA current:

The digital value transmitted by the input base as a function of the input current (I_a) is determined using the formula:

$$V_n = 2000 \times I_a - 8000$$

in the current range:
3.6165 ... 20.3835 mA



170 AAI 140 00

Analog 16 Channel Single-Ended

Input Module Base

7

At a Glance

Purpose This chapter describes the 170 AAI 140 00 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	120
Wiring	2	125
Configuration	3	130
Analog/Digital Relation	4	135

Section 7.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 AAI 140 00 TSX Momentum I/O base and provides specifications.

In This Section

This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	121
Specifications	123

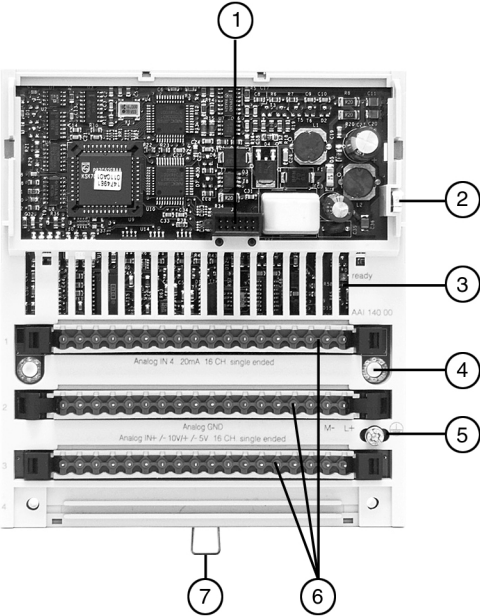
Front Panel Components

Overview

This section contains a photograph of the front panel of the 170 AAI 140 00 I/O base and a description of the LEDs.

Front Panel

The front panel of the I/O base is shown in the photograph below:

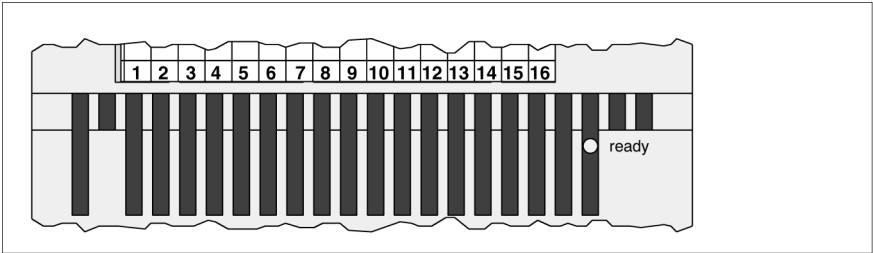


Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Sockets for the terminal connectors
7	Locking tab for DIN rail mount

Continued on next page

Front Panel Components, Continued

LED Illustration This I/O base has one LED, the ready indicator shown in the illustration below.



LED Descriptions

The ready indicator is described in the table below.

Indicator	Condition	Message
Ready	Green	Module is ready to communicate. Operating voltage for internal logic is present and self-test has been passed.
	Off	Module not ready.

Specifications

Overview

This section contains specifications for the 170 AAI 140 00 I/O base.

General Specifications

The following table contains general specifications for the I/O base:

Module type	16 analog inputs
Input voltage range	+/- 10 V, +/- 5 V
Input current range	4 ... 20 mA
Supply voltage	24 VDC
Supply voltage range	20...30 VDC
Supply current consumption	max. 305 mA at 24 VDC
Power dissipation	4.95 W typical 5.55 W maximum
I/O map	16 input words 4 output words
Isolation	
Between channels	None
Between base supply and ground	500 Vcc, 1 min
Between input channels and ground	1780 VAC, 1 min
Fuses	
Internal (not user-replaceable)	2 A slow-blow
External (recommended)	500 mA fast-blow (Wickmann 19193-500 mA or equivalent)
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V
Emissions	EN 50081-2 (limitation A)
Agency approvals	UL, CUL, CE

Continued on next page

Specifications, Continued

General Specifications, Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54 in)
Length	141.5 mm (5.5 in) (no busbar)
Weight	215 g (0.45 lb)

Analog Inputs

The following tables contain specifications for analog inputs.

Surge tolerance: input voltage input current	+/-30 VDC +/-25 mA
Number of channels	16
Format of transmitted data	full 16 bits signed (2's complement)
Protection	polarity inversion
Error indication	none
Common mode rejection	250 VAC @ 47...63Hz or 100 VDC Channel-to-ground
Update time for the inputs (in ms)	$1 + 1.5 \times n$ n = number of declared channels
Filtering	low pass with cutoff frequency 10 kHz

Range	+/-10V	+/-5V	4 ... 20 mA
Input impedance	> 2.2 MOhm	> 2.2 MOhm	< 250 Ohm
Error at 25 deg. C	0.15% PE*	0.15% PE*	0.25% PE*
Error at 60 deg. C	0.25% PE*	0.25% PE*	0.45% PE*
Temperature drift (60 deg. C)	30ppmPE*/deg.C	30ppmPE*/deg.C	60ppmPE*/deg.C
Resolution	12 bits + sign	12 bits + sign	12 bits



Note: *Not to be confused with Protective Earth. PE is used here as a European notation for full scale, with the following values:
 10 V in range of +/- 10 V
 5 V in range of +/- 5 V
 16 mA in range of 4 ... 20 mA

Section 7.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 AAI 140 00 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	126
Field Wiring Guidelines	127
Wiring Diagrams	129

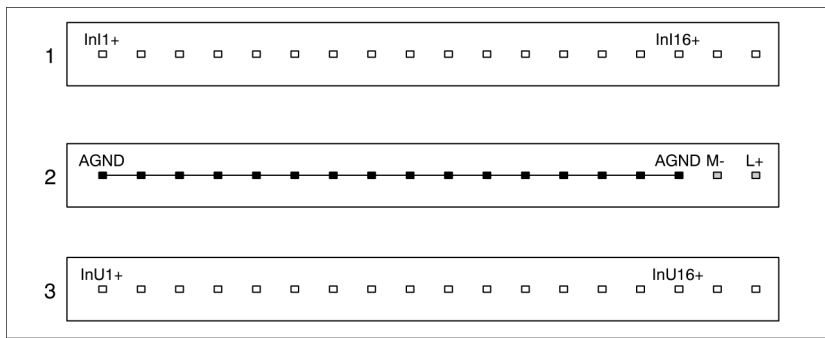
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections between terminals on the I/O base.

Diagram

The following illustration shows the internal connections between terminals.



Field Wiring Guidelines

Overview

This section contains wiring guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Mapping of Terminal Blocks

Mapping of terminal blocks is described in the table below.

Row	Terminal No.	Description	Function
1	1 ... 16	In1+ ... In16+	Input current mode, channel 1 ... 16
	17, 18	-	Not used
2	1...16	AGND	Analog ground connections (0 V input)
	17	M-	-Return (of operating voltage)
	18	L+	+24 VDC Operating voltage
3	1 ... 16	InU1+ ... InU16+	Input voltage mode, channel 1 ... 16
	17, 18	-	Not used



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Continued on next page

Field Wiring Guidelines, Continued

Signal Protection To protect the signal from external noise induced in serial or common mode, we recommend the following precautions:

- Use shielded twisted-pair cables with a minimum conductor cross section of 0.22 mm².
 - Connect the cable shield to ground via the Cable Grounding Rail (part number 424 244 739).
 - You may combine the analog inputs on this I/O base in one multi-pair cable provided the same ground is used.
 - When wiring the voltage supply, use sensors that do not have ground reference.
-

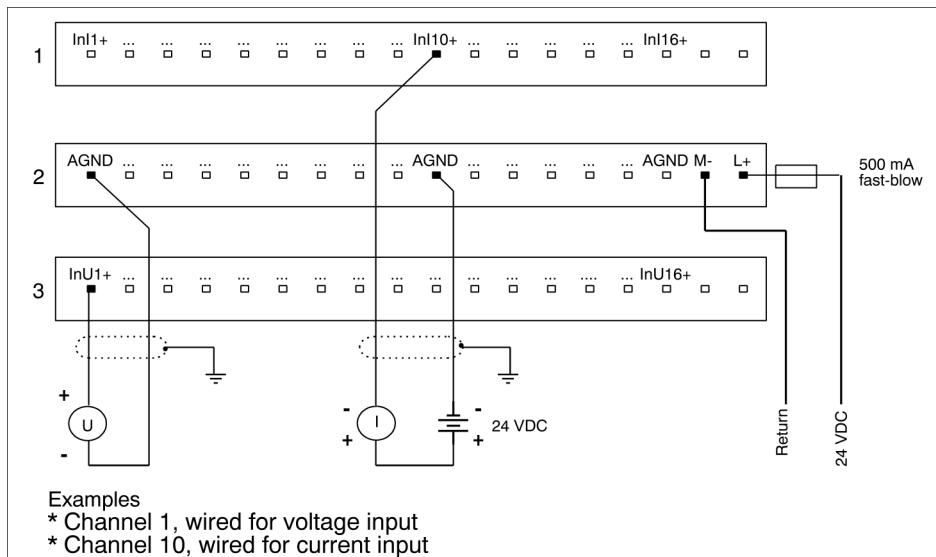
Wiring Diagrams

Overview

This section contains a diagram to assist you in wiring this I/O base for voltage input and current input.

Diagram

The diagram below shows an example of wiring for voltage input and for current input.



Section 7.3

Configuration

Configuration Overview

Introduction The 170 AAI 140 00 TSX Momentum I/O base supports 16 analog inputs.

I/O Map The I/O base must be mapped as 16 contiguous input words and four contiguous output words, as follows:

Word	Input Data	Output Data
1 = LSW	Value, input channel 1	Parameters for input channels 1 ... 4
2	Value, input channel 2	Parameters for input channels 5 ... 8
3	Value, input channel 3	Parameters for input channels 9 ... 12
4	Value, input channel 4	Parameters for input channels 13 ... 16
5 ... 15	Value, input channel 5 ... 15	Not used
16 = MSW	Value, input channel 16	Not used

In This Section This section contains the following topics:

For This Topic...	See Page...
Analog Channel Parameters	131
Analog Inputs	133

Analog Channel Parameters

Overview

Parameters must be set for all of the analog channels before the module can be commissioned. This section provides the codes for setting the parameters and gives examples of parameter settings.



Note: If you set new parameters for the module, always send a complete set of parameters (all channels, inputs and outputs), even if you only want to change a single parameter. Otherwise the module will refuse the new parameters and continue working with the old ones.

Key

This section focuses on output words 1 ... 4, as highlighted in the table below:

Word	Input Data	Output Data
1 = LSW	Value, input channel 1	Parameters for input channels 1 ... 4
2	Value, input channel 2	Parameters for input channels 5 ... 8
3	Value, input channel 3	Parameters for input channels 9 ... 12
4	Value, input channel 4	Parameters for input channels 13 ... 16
5 ... 15	Value, input channel 5 ... 15	Not used
16 = MSW	Value, input channel 16	Not used

Continued on next page

Analog Channel Parameters, Continued

Diagram

Parameters are set by entering a four-bit code in output words 1 ... 4 as follows:

Output Word 1 (Register 4x)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
for input channel 4				for input channel 3				for input channel 2				for input channel 1			

Output Word 2 (Register 4x+1)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
for input channel 8				for input channel 7				for input channel 6				for input channel 5			

Output Word 3 (Register 4x+2)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
for input channel 12				for input channel 11				for input channel 10				for input channel 9			

Output Word 4 (Register 4x+3)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
for input channel 16				for input channel 15				for input channel 14				for input channel 13			

Codes for Analog Input Parameters

Use the following codes to set the parameters for each analog input channel:

Code (binary)	Code (hex)	Parameter
0000	0	Reserved value (see note below)
1010	A	+/-5V input range
1011	B	+/-10V input range
1100	C	Channel inactive
1110	E	4...20mA



Note: The 0000 reserved value is more a control than a parameter. It forces the I/O base into a default condition where it continues to receive field inputs according to the previous channel parameters.

Analog Inputs

Overview

This section describes how to interpret the value of the analog input channels.

Key

This section describes input words 1 through 16, as highlighted in the table below:

Word	Input Data	Output Data
Word 1 = LSW	Value, input channel 1	Parameters for input channels 1 ... 4
Word 2	Value, input channel 2	Parameters for input channels 5 ... 8
Word 3	Value, input channel 3	Parameters for input channels 9 ... 12
Word 4	Value, input channel 4	Parameters for input channels 13 ... 16
Word 5 ... 15	Value, input channel 5 ... 15	Not used
Word 16 = MSW	Value, input channel 16	Not used

Bit Assignments

The following table tells how bits are assigned:

Analog-to-digital conversion	Carried out on 12 bits + sign
Bit 15	Sign bit
Bits 14 ... 3	Input channel values
Bits 2 ... 0	Unused. Because these bits are always 0, the value of the word changes in increments of 8.

Continued on next page

Analog Inputs, Continued

Analog Input Values

Mapping of analog input values is shown below.

Input Word 1 (Register 3x, analog value returned on channel 1)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Input Word 2 (Register 3x+1, analog value returned on channel 2)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Input Word 3 (Register 3x+2, analog value returned on channel 3)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1

1

1

Input Word 16 (Register 3x+15, analog value returned on channel 16)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Broken Wire Indication

Broken wire detection is possible for the 4 ... 20 mA range. In this case, a current signal that is less than 2 mA on one of the inputs is detected as a broken wire. The input word of that channel returns the value -32,768. A broken wire indication has the following binary format:

Broken wire indication in an input word															
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Section 7.4

Analog/Digital Relation

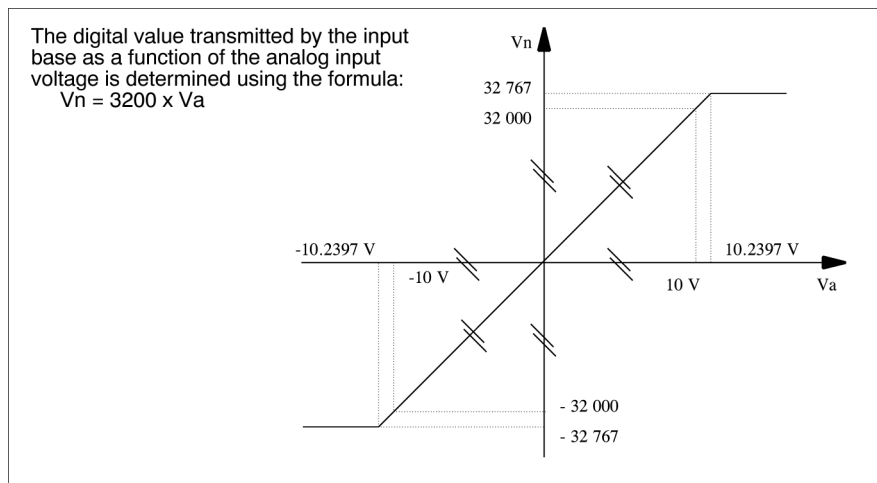
Input Measuring Ranges

Overview

This section contains diagrams explaining the analog/digital relation for the three input measuring ranges.

+/- 10 V

The following diagram shows the analog/digital relation at +/- 10 V:



Continued on next page

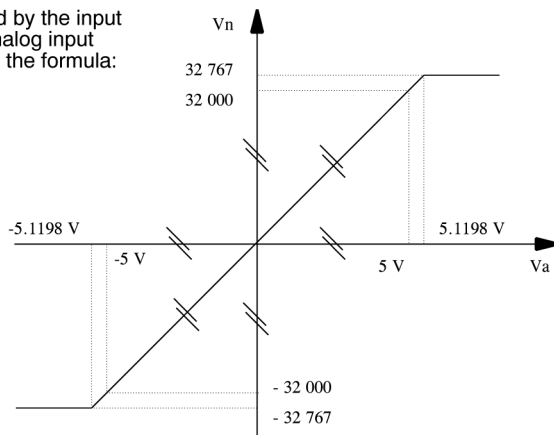
Input Measuring Ranges, Continued

+/- 5 V

The following diagram shows the analog/digital relation at +/- 5 V:

The digital value transmitted by the input base as a function of the analog input voltage is determined using the formula:

$$V_n = 6400 \times V_a$$



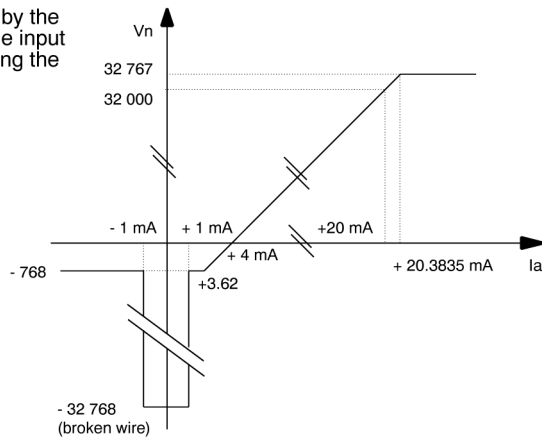
4 ... 20 mA

The following diagram shows the analog/digital relation at 4 ... 20 mA current:

The digital value transmitted by the input base as a function of the input current (I_a) is determined using the formula:

$$V_n = 2000 \times I_a - 8000$$

in the current range
3.6165 ... 20.3835 mA



170 AAI 520 40

Analog 4 Channel RTD, Therm. and Mv Input Module Base

8

At a Glance

Purpose This chapter describes the 170 AAI 520 40 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	138
Wiring	2	150
Configuration	3	155
Analog/Digital Relation	4	163

Section 8.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 AAI 520 40 TSX Momentum I/O base and provides specifications.

In This Section

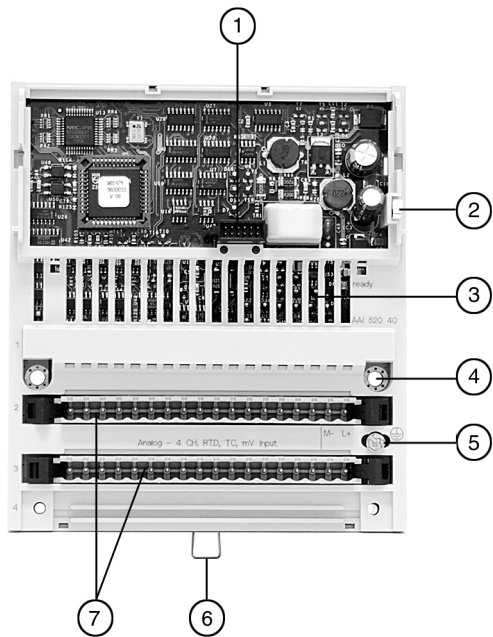
This section contains the following topics:

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Front Panel Components	139
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Front Panel Components

Overview This section contains a photograph of the front panel of the 170 AAI 520 40 analog input base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:

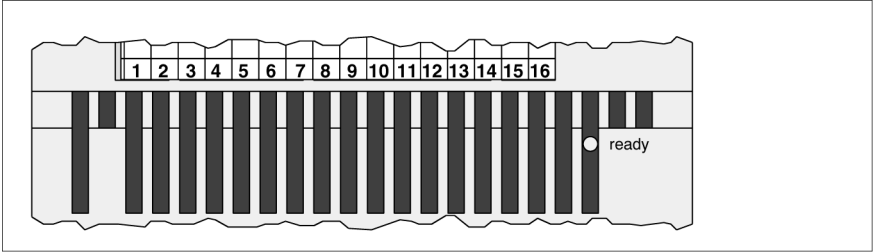


Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Locking tab for DIN rail mount
7	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration This I/O base has one LED, the ready indicator shown in the illustration below.



LED Descriptions

The ready indicator is described in the table below.

Indicator	Condition	Message
Ready	Green	Module is ready to communicate. Operating voltage for internal logic is present and self-test has been passed.
	Off	Module not ready

Specifications

Overview

This section contains specifications for the 170 AAI 520 40 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	4 analog inputs
Input range	
mV	+/- 100 mV, +/- 25 mV
RTD	Pt100, Pt 1000, Ni100 or Ni1000
Thermocouple	B, E, J, K, N, R, S or T
Supply voltage	24 VDC
Supply voltage range	20...30 VDC
Supply current consumption	max. 330 mA at 24 VDC
Power dissipation	3.5 W typical 5.5 W maximum
I/O map	4 input words 4 output words
Isolation	
Between channels	400 VDC
Between base supply and ground	500 Vcc, 1 min
Between input channels and ground	1780 VAC, 1 min
Common mode channel/ground voltage	+/-100 VDC, 250 VAC
Common mode voltage between channels	200 VDC, 115 VAC single- or three-phase or 250 VAC single phase
Common mode rejection between channel and ground	135 dB DC, 145 dB AC 50 Hz, 155 dB AC 60 Hz
Common mode rejection between channels	120 dB DC, 130 dB AC 50 Hz, 140 dB AC 60 Hz
Serial-mode rejection	35 dB AC 50 Hz, 45 dB AC 60 Hz
Input protection	+/- 30 VDC

Continued on next page

Specifications, Continued

General Specifications, Continued

Fuses	
Internal (not user-replaceable)	2 A slow-blow
External (recommended)	500 mA fast-blow (Wickmann 19193-500 mA or equivalent)
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V
Emissions	EN 50081-2 (limitation A)
Agency approvals	UL, CUL, CE
Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54 in)
Length	141.5 mm (5.5 in) with no or one busbar
Weight	215 g (0.45 lb)

Analog Inputs

The following table contains specifications for analog inputs.

Surge tolerance: input voltage	+/-30 V	
Number of channels	4 differential inputs	
Format of transmitted data	full 16 bits signed (2's complement)	
Current source	0.125 mA (for Pt1000 or Ni 1000 probe)	
Current source	0.125 mA (for Pt1000 or Ni 1000 probe)	1.25 mA (for Pt 100 or Ni 100 probe)
Update time for the inputs	500 ms	
Voltage range	+/-25 mV	+/-100 mV
Input impedance	> 10 MOhm	> 10 MOhm
Error at 25 deg. C	+/- 21 microV	+/- 27 microV
Error at 60 deg. C	+/- 46 microV	+/- 94 microV
Resolution	15 bits + sign	15 bits + sign

Continued on next page

Specifications, Continued

RTD Ranges The following tables contain specifications for RTD ranges.

Range	Pt100 (IEC751)	Pt100 (US/JIS)	Pt1000 (IEC751)	Pt1000 (US/JIS)
Input Span	-200...+850 deg. C -328...+1562 deg. F	-200...+510 deg. C -328...+950 deg. F	-200...+850 deg. C -328...+1562 deg. F	-200...+510 deg. C -328...+950 deg. F
Resolution of conversion	0.029...0.043 deg. C 0.052...0.077 deg. F	0.029...0.037 deg. C 0.053...0.067 deg. F	0.029...0.043 deg. C 0.052...0.077 deg. F	0.029...0.037 deg. C 0.053...0.067 deg. F
Display resolution	0.1 deg. C 0.1 deg. F	0.1 deg. C 0.1 deg. F	0.1 deg. C 0.1 deg. F	0.1 deg. C 0.1 deg. F

Max. error at 25 deg. C in deg. C (1)	wiring 2/4 wires	wiring 3 wires	wiring 2/4 wires	wiring 3 wires	wiring 2/4 wires	wiring 3 wires	wiring 2/4 wires	wiring 3 wires
-200 deg. C	0.2 [0.7]	0.4 [0.8]	0.2 [0.7]	0.4 [0.8]	0.2 [0.6]	0.4 [0.8]	0.2 [0.6]	0.4 [0.8]
-100 deg. C	0.2 [0.9]	0.4 [1.0]	0.2 [0.9]	0.4 [1.0]	0.3 [0.8]	0.4 [1.0]	0.3 [0.8]	0.4 [1.0]
0 deg. C	0.3 [1.1]	0.4 [1.2]	0.3 [1.1]	0.4 [1.2]	0.3 [1.0]	0.4 [1.2]	0.3 [1.0]	0.4 [1.2]
100 deg. C	0.3 [1.2]	0.4 [1.4]	0.3 [1.3]	0.4 [1.4]	0.3 [1.2]	0.4 [1.4]	0.3 [1.2]	0.4 [1.4]
200 deg. C	0.3 [1.4]	0.4 [1.5]	0.3 [1.4]	0.4 [1.5]	0.3 [1.4]	0.5 [1.5]	0.3 [1.4]	0.5 [1.6]
300 deg. C	0.3 [1.6]	0.5 [1.8]	0.3 [1.7]	0.5 [1.8]	0.3 [1.6]	0.5 [1.8]	0.4 [1.6]	0.5 [1.8]
400 deg. C	0.3 [1.8]	0.5 [2.0]	0.3 [1.8]	0.5 [2.0]	0.4 [1.8]	0.5 [2.0]	0.4 [1.8]	0.5 [2.0]
500 deg. C	0.3 [2.1]	0.5 [2.2]	0.3 [2.1]	0.5 [2.2]	0.4 [2.0]	0.5 [2.2]	0.4 [2.0]	0.5 [2.2]
600 deg. C	0.4 [2.3]	0.5 [2.5]			0.4 [2.3]	0.5 [2.4]		
700 deg. C	0.4 [2.5]	0.5 [2.7]			0.4 [2.5]	0.6 [2.7]		
800 deg. C	0.4 [2.7]	0.6 [2.9]			0.5 [2.8]	0.6 [2.9]		

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Specifications, Continued

RTD Ranges, Continued

Max. error at 25 deg. C in degr. F (1)	wiring 2/4 wires	wiring 3 wires	wiring 2/4 wires	wiring 3 wires	wiring 2/4 wires	wiring 3 wires	wiring 2/4 wires	wiring 3 wires
-300 deg. F	0.4 [1.3]	0.5 [1.5]	0.4 [1.3]	0.5 [1.5]	0.4 [1.2]	0.6 [1.4]	0.4 [1.1]	0.6 [1.4]
-100 deg. F	0.4 [1.6]	0.6 [1.9]	0.4 [1.6]	0.6 [1.9]	0.5 [1.5]	0.6 [1.8]	0.5 [1.5]	0.6 [1.8]
100 deg. F	0.5 [2.0]	0.6 [2.3]	0.5 [2.0]	0.6 [2.2]	0.5 [1.9]	0.7 [2.2]	0.5 [1.9]	0.7 [2.2]
300 deg. F	0.5 [2.4]	0.6 [2.6]	0.5 [2.3]	0.6 [2.6]	0.5 [2.3]	0.7 [2.6]	0.5 [2.2]	0.7 [2.5]
500 deg. F	0.5 [2.8]	0.7 [3.0]	0.5 [2.7]	0.7 [3.0]	0.5 [2.7]	0.8 [3.0]	0.5 [2.7]	0.7 [3.0]
700 deg. F	0.6 [3.1]	0.7 [3.4]	0.5 [3.1]	0.7 [3.4]	0.6 [3.1]	0.8 [3.4]	0.6 [3.1]	0.8 [3.4]
900 deg. F	0.6 [3.6]	0.8 [3.9]	0.6 [3.5]	0.8 [3.8]	0.6 [3.5]	0.8 [3.9]	0.6 [3.5]	0.8 [3.8]
1100 deg. F	0.6 [4.0]	0.9 [4.3]			0.7 [4.0]	0.9 [4.4]		
1300 deg. F	0.7 [4.6]	0.9 [4.8]			0.7 [4.5]	1.0 [4.8]		
1500 deg. F	0.7 [5.0]	0.9 [5.3]			0.8 [5.0]	1.1 [5.3]		
Max. resistance per cable	50 Ohms with 4 wires	20 Ohms (2)	500 Ohms with 4 wires	20 Ohms (2)	500 Ohms with 4 wires	200 Ohms (2)	500 Ohms with 4 wires	200 Ohms (2)

(1) The values shown in brackets correspond to the maximum errors for temperatures in the range 0 ... 60 deg. C or 32 and 140 deg. F.

(2) Matching of line resistance for 3-conductor cables is < 0.02%.

Continued on next page

Specifications, Continued

RTD Ranges, Continued

Range	Ni100 DIN43760	Ni1000 DIN43760
Input Span	-60...+250 deg. C -76...+482 deg. F	-60...+250 deg. C -76...+482 deg. F
Resolution of conversion	0.026...0.012 deg. C 0.047...0.022 deg. F	0.026...0.0120 deg. C 0.047...0.022 deg. F
Display resolution	0.1 deg. C 0.1 deg. F	0.1 deg. C 0.1 deg. F

Maximum error at 25 deg. C in degr. C (1)	wiring 2/4 wires	wiring 3 wires	wiring 2/4 wires	wiring 3 wires
-50 deg. C	0.3 [0.8]	0.3 [1.0]	0.3 [0.8]	0.4 [0.9]
0 deg. C	0.2 [0.8]	0.3 [1.0]	0.3 [0.8]	0.3 [0.9]
50 deg. C	0.2 [0.8]	0.3 [0.9]	0.3 [0.8]	0.3 [0.9]
100 deg. C	0.2 [0.8]	0.3 [0.9]	0.3 [0.8]	0.3 [0.9]
150 deg. C	0.2 [0.8]	0.3 [0.9]	0.2 [0.8]	0.3 [0.9]
200 deg. C	0.2 [0.8]	0.3 [0.9]	0.2 [0.8]	0.3 [0.8]
250 deg. C	0.2 [0.8]	0.3 [0.8]	0.2 [0.8]	0.3 [0.8]
Max. error at 25 deg. C (77 deg. F)	wiring 2/4 wires	wiring 3 wires	wiring 2/4 wires	wiring 3 wires
0 deg. F	0.4 [1.4]	0.5 [1.6]	0.4 [1.3]	0.6 [1.6]
100 deg. F	0.4 [1.4]	0.5 [1.6]	0.4 [1.4]	0.5 [1.5]
200 deg. F	0.4 [1.4]	0.5 [1.5]	0.4 [1.4]	0.5 [1.5]
300 deg. F	0.4 [1.4]	0.5 [1.5]	0.4 [1.4]	0.5 [1.5]
400 deg. F	0.4 [1.4]	0.5 [1.5]	0.4 [1.4]	0.5 [1.5]
Max. resistance per cable	1000 Ohms with 4 wires	200 Ohms (2)	1000 Ohms with 4 wires	200 Ohms (2)

(1) The values shown in brackets correspond to the maximum errors for temperatures in the range 0...60 deg. C or 32 and 140 deg. F.

(2) Matching of line resistance for 3-wire cables is < 0.02%.

Continued on next page

Specifications, Continued

Thermocouples The following table contains specifications for thermocouples in degrees C.

Range	B	E	J	K	N	R	S	T
Input Span	0.0 +1802.0	-270.0 +1000.0	-210.0 +1200.0	-270.0 +1372.0	-270.0 +1300.0	-50.0 +1769.0	-50.0 +1769.0	-270.0 +400.0
Resolution of conversion	0.78... ...0.07	1.12... ...0.04	0.15... ...0.05	0.83... ...0.30	1.67... ...0.03	0.26... ...0.08	0.24... ...0.09	0.50... ...0.02
Display resolution	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Max. error at 25 deg. C in deg. C (1)								
-200 deg. C		5.8 [11.8]		6.9[14.6]	8.0[18.3]			6.8[14.8]
-100 deg. C		3.4 [6.7]		3.6 [7.5]	4.0 [8.9]			4.0 [8.4]
0 deg. C		2.7 [5.3]	2.8 [5.5]	2.9 [6.0]	3.3 [7.3]	6.4[13.1]	6.3[12.8]	3.0 [6.3]
100 deg. C		2.5 [4.8]	2.7 [5.2]	2.9 [5.8]	3.1 [6.6]	4.7 [9.5]	4.8 [9.6]	2.6 [5.4]
200 deg. C		2.4 [4.5]	2.7 [5.3]	3.2 [6.2]	2.8 [6.1]	4.2 [8.2]	4.4 [8.5]	2.4 [4.9]
300 deg. C		2.4 [4.5]	2.9 [5.5]	3.1 [6.1]	2.7 [5.8]	3.9 [7.7]	4.1 [8.1]	2.3 [4.7]
400 deg. C		2.4 [4.5]	3.0 [5.7]	3.2 [6.2]	2.8 [5.7]	3.8 [7.4]	4.0 [7.9]	
500 deg. C		2.4 [4.6]	3.1 [5.7]	3.3 [6.3]	2.8 [5.7]	3.7 [7.2]	4.1 [7.8]	
600 deg. C	5.1 [9.5]	2.7 [4.8]	3.1 [5.7]	3.4 [6.5]	2.8 [5.8]	3.7 [7.0]	4.1 [7.7]	
700 deg. C	4.5 [8.4]	2.8 [5.0]	3.0 [5.5]	3.6 [6.7]	3.0 [5.9]	3.7 [6.9]	4.1 [7.7]	
800 deg. C	4.2 [7.7]	3.0 [5.3]		3.8 [7.0]	3.0 [6.1]	3.7 [6.9]	4.1 [7.6]	
900 deg. C	4.0 [7.2]			4.0 [7.5]	3.2 [6.3]	3.7 [6.7]	4.1 [7.5]	
1000 deg. C	3.8 [6.8]			4.2 [7.8]	3.3 [6.5]	3.7 [6.7]	4.1 [7.5]	
1100 deg. C	3.6 [6.5]			4.5 [8.2]	3.6 [6.8]	3.7 [6.7]	4.2 [7.5]	
1200 deg. C	3.6 [6.3]			4.7 [8.7]	3.7 [7.1]	3.7 [6.7]	4.2 [7.5]	
1300 deg. C	3.6 [6.2]					3.9 [6.8]	4.3 [7.7]	
1400 deg. C	3.6 [6.2]					4.0 [6.9]	4.4 [7.8]	
1500 deg. C	3.6 [6.1]					4.1 [7.1]	4.6 [8.1]	
1600 deg. C	3.8 [6.3]					4.3 [7.4]	4.8 [8.3]	
1700 deg. C	3.8 [6.5]							

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Specifications, Continued

Thermocouples, Continued

Range	B	E	J	K	N	R	S	T
Overflow code	+ 1802.1	+ 1000.1	+ 1200.1	+ 1372.1	+ 1300.1	+ 1769.1	+ 1769.1	+ 400.1
Underflow code	- 0.1	- 270.1	- 210.1	- 270.1	- 270.1	- 50.1	- 50.1	- 270.1
Wiring default code	- 0.2	- 270.2	- 210.2	- 270.2	- 270.2	- 50.2	- 50.2	- 270.2

(1) The values shown in brackets correspond to the maximum errors for temperatures in the range 0...60 deg. C or 32 and 140 deg. F.

Range	B	E	J	K	N	R	S	T
Input span	-32.0 +3275.6	-454.1 +1832.0	-346.1 +2192.0	-454.1 +2501.6	-454.1 +2372.0	-58.1 +3216.2	-58.1 +3216.2	-454.1 +752.0
Resolution of conversion	1.40... ...0.12	2.01... ...0.07	0.27... ...0.09	1.50... ...0.05	3.00... ...0.05	0.47... ...0.15	0.43... ...0.16	0.90... ...0.04
Display resolution	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Continued on next page

Specifications, Continued

Thermocouples, Continued

Max. error at 77 deg. F	B	E	J	K	N	R	S	T
-300 deg. F		9.1 [18.5]		10.8 [22.3]	11.9 [27.5]			10.9 [23.5]
-200 deg. F								7.8[17.1]
-100 deg. F		5.7[11.1]		6.1[12.4]	6.6[14.6]			6.5[13.8]
0 deg. F			5.1[10.0]			12.7 [26.0]	12.3 [25.2]	5.6 [11.9]
100 deg. F		4.7[9.2]		5.1[10.5]	5.8[12.8]			5.0[10.7]
200 deg. F			4.9[9.4]			8.6[17.4]	8.7[17.5]	4.7[9.8]
300 deg. F		4.4[8.3]		5.5[10.9]	5.2[11.5]			4.4[9.2]
400 deg. F			4.9[9.5]			7.5[14.8]	7.8[15.3]	4.3[8.8]
500 deg. F		4.3[8.1]		5.7[11.2]	5.1[10.8]			4.3[8.5]
600 deg. F			5.3[9.9]			6.9[13.6]	7.4[14.4]	4.2[8.3]
700 deg. F		4.4[8.1]		5.7[11.2]	4.9[10.5]			4.1[8.2]
800 deg. F			5.5[10.3]			6.8[13.1]	7.3[14.2]	
900 deg. F		4.6[8.3]		5.9[11.3]	5.1[10.4]			
1000 deg. F			5.5[10.3]			6.7[12.8]	7.4[14.0]	
1100 deg. F	9.2[17.1]	4.8[8.7]		6.1[11.7]	5.1[10.4]			
1200 deg. F			5.5[10.0]			6.7[12.6]	7.3[13.8]	
1300 deg. F	8.1[15.1]	5.0[9.1]		6.5[12.1]	5.3[10.6]			
1400 deg. F			5.3[9.8]			6.6[12.4]	7.3[13.7]	
1500 deg. F	7.4[13.7]	5.4[9.6]		6.9[12.9]	5.6[11.1]			
1600 deg. F						6.6[12.3]	7.3[13.7]	
1700 deg. F	7.1[12.8]			7.3[13.5]	5.8[11.5]			
1800 deg. F						6.7[12.1]	7.3[13.6]	
1900 deg. F	6.7[12.0]			7.8[14.2]	6.2[11.9]			
2000 deg. F						6.7[12.0]	7.4[13.6]	

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Specifications, Continued

Thermocouples, Continued

Max. error at 77 deg. F	B	E	J	K	N	R	S	T
2100 deg. F	6.5[11.5]			8.2[15.1]	6.6[12.4]			
2200 deg. F						6.8[11.9]	7.6[13.6]	
2300 deg. F	6.4[11.3]			8.9[16.2]	7.0[13.1]			
2400 deg. F						6.8[12.0]	7.8[13.8]	
2500 deg. F	6.4[11.1]							
2600 deg. F						6.9[11.9]	8.0[14.2]	
2700 deg. F	6.5[11.1]							
2800 deg. F						6.9[11.9]	8.3[14.7]	
2900 deg. F	6.6[11.3]							
3000 deg. F						7.0[12.0]	8.8[15.4]	
3100 deg. F	6.6[11.7]							
Overflow code	+3275.7	+1832.1	+2192.1	+2501.7	+2372.1	+3216.3	+3216.3	+752.1
Underflow code	+31.9	-454.2	-346.2	-454.2	-454.2	-58.2	-58.2	-454.2
Wiring default code	+31.8	-454.3	-346.3	-454.3	-454.3	-58.3	-58.3	-454.3

(1) The values shown in brackets correspond to the maximum errors for temperatures in the range 0...60 deg. C or 32 and 140 deg. F.

Section 8.2

Wiring

Introduction

Purpose

This section describes internal pin connections and field wiring guidelines and provides a wiring diagram for the 170 AAI 520 40 TSX Momentum I/O base.

In This Section

This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	151
Field Wiring Guidelines	152
Wiring Diagrams	154

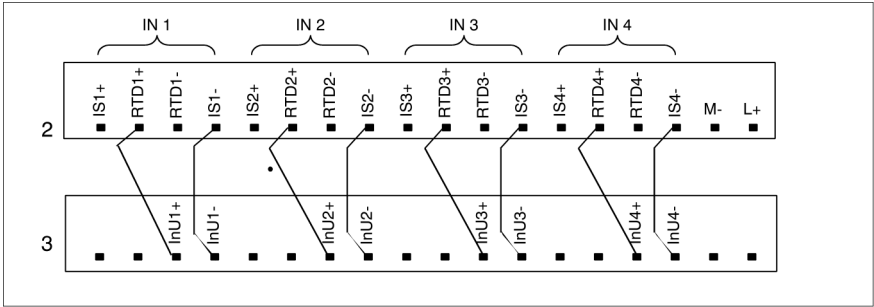
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections between terminals on the I/O base.

Diagram

The following illustration shows the internal connections between terminals.



Field Wiring Guidelines

Overview

This section contains wiring guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Mapping Terminal Blocks

Mapping terminal blocks is described in the table below.

Row	Terminal	Description	Function
2	1, 5, 9, 13	IS1+, IS2+ IS3+, IS4+	+ current source output, Channels 1 ... 4
	2, 6, 10, 14	RTD1+, RTD2+ RTD3+, RTD4+	+ RTD input Channels 1 ... 4
	3, 7, 11, 15	RTD1-, RTD2- RTD3-, RTD4-	- RTD input Channels 1 ... 4
	4, 8, 12, 16	IS1-, IS2- IS3-, IS4-	- current source output, Channels 1 ... 4
	17	M-	- power supply return
	18	L+	Module power supply +24V
3	1, 2, 5, 6, 9, 10, 13, 14, 17	-	Not used
	3, 7, 11, 15	InU1+, InU2+ InU3+, InU4+	+ thermocouple or voltage mode input, channels 1 ... 4
	4, 8, 12, 16	InU1-, InU2- InU3-, InU4-	- thermocouple or voltage mode input, channels 1 ... 4
	17, 18	-	Not used

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Field Wiring Guidelines, Continued

Signal Protection To protect the signal from external noise induced in serial or common mode, we recommend the following precautions:

- Use shielded twisted-pair cables with a minimum conductor cross section of 0.22 mm².
 - Connect the cable shield to ground via the Cable Grounding Rail (part number 424 244 739).
 - You may combine the analog inputs on this I/O base in one multi-pair cable provided the same ground is used.
 - When wiring the voltage supply, use sensors that do not have ground reference.
-

Thermocouple Measurement Precautions

For thermocouple measurements (except with thermocouple B), observe the following precautions to obtain the accuracies indicated in the performance tables:

- Wait 45 min. after powering up the base (the time required for the module to warm up to the temperature balance needed for internal cold junction compensation) prior to taking any measurements
 - The air circulation must not exceed a rate of 0.1 m/s; air circulation in excess of this amount will affect the thermal balance inside the base
 - Keep the rate of temperature fluctuations outside the base to less than 10 deg./hr
 - Keep the distance between the base and any heat source greater than 100 mm
-

Wiring Diagrams

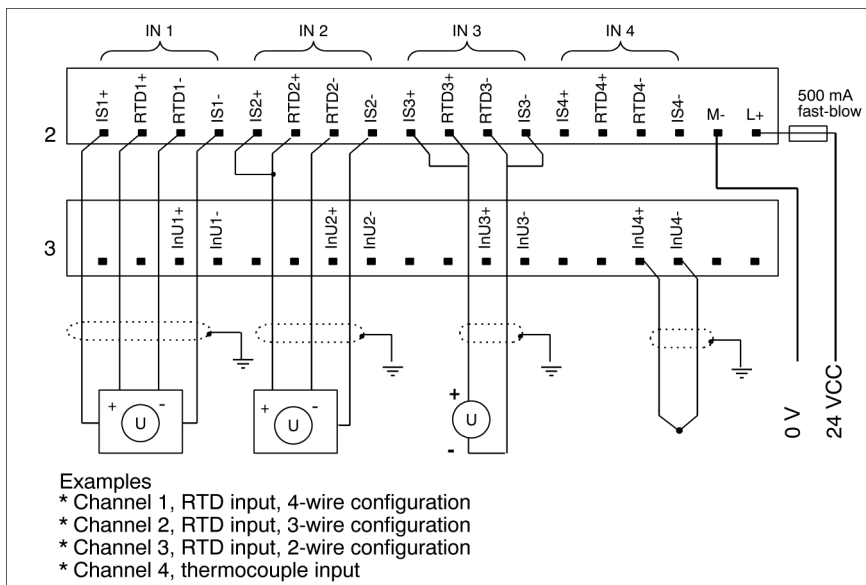
Overview

This section contains a wiring diagram to assist you in wiring the following types of devices:

- RTD 4-wire configuration
- RTD 3-wire configuration
- RTD 2-wire configuration
- Thermocouple input

Diagram

Wiring examples are shown in the diagram below:



Section 8.3 Configuration

Configuration Overview

Overview The 170 AAI 520 40 analog input base supports four analog input channels.

I/O Map This I/O base should be I/O mapped as four contiguous input words and four contiguous output words, as shown in the table below.

Word	Input Data	Output Data
Word 1 = LSW	Value, input channel 1	Parameters for input channel 1
Word 2	Value, input channel 2	Parameters for input channel 2
Word 3	Value, input channel 3	Parameters for input channel 3
Word 4 = MSW	Value, input channel 4	Parameters for input channel 4

In This Section This section contains the following topics:

For This Topic...	See Page...
Analog Channel Parameters	156
Analog Inputs	162

Analog Channel Parameters

Overview

Parameters must be set for all of the analog channels before the module can be commissioned. This section provides the codes for setting the parameters and gives examples of parameter settings.



Note: If you set new parameters for the module, always send a complete set of parameters (all channels, inputs and outputs), even if you only want to change a single parameter. Otherwise the module will refuse the new parameters and continue working with the old ones.

Key

This section focuses on output words 1 ... 4, as highlighted in the table below:

Word	Input Data	Output Data
Word 1 = LSW	Value, input channel 1	Parameters for input channel 1
Word 2	Value, input channel 2	Parameters for input channel 2
Word 3	Value, input channel 3	Parameters for input channel 3
Word 4 = MSW	Value, input channel 4	Parameters for input channel 4

Diagram

Parameters are set by entering a four-bit code in output words 1 ... 4 as follows:

Output Word 1 (Register 4x to parameterize input channel 1)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Output Word 2 (Register 4x+1 to parameterize input channel 2)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Output Word 3 (Register 4x+2 to parameterize input channel 3)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Output Word 4 (Register 4x+3 to parameterize input channel 4)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Continued on next page

Analog Channel Parameters, Continued

Parameters

For each input channel, you may set the following parameters:

Parameter	Options
Input range	Type B,E,J,K,N,R,S or T thermocouple (according to IEC584 standard, June1989) with internal cold junction compensation
RTD	Pt100 or Pt1000 RTDs (according to IEC751, June 1986; or JIS C1604, January 1989), and Ni100 or Ni1000 RTDs (according to DIN standard 43.760, September 1987), with 2-, 3- or 4 wires
Low voltage range	+/-100 mV or +/-25 mV
Broken-wire detection	Enabled or disabled

A 0000 reserved value may also appear in an output word as a control rather than a parameter. It forces the I/O base into a default condition where it continues to receive field inputs according to the previous received-channel parameters.

Thermocouple Parameter Codes

Use the following codes to set your choice of parameters:

Input range	Temperature unit	Broken-wire detection	Parameter code (hex)
Thermocouple B	1/10 degrees C	disabled	2201
		enabled	2301
	1/10 degrees F	disabled	2281
		enabled	2381
Thermocouple E	1/10 degrees C	disabled	1202
		enabled	1302
	1/10 degrees F	disabled	1282
		enabled	1382

Continued on next page

Analog Channel Parameters, Continued

Thermocouple Parameter Codes, Continued

Use the following codes to set your choice of parameters:

Input range	Temperature unit	Broken-wire detection	Parameter code (hex)
Thermocouple J	1/10 degrees C	disabled	1203
		enabled	1303
	1/10 degrees F	disabled	1283
		enabled	1383
Thermocouple K	1/10 degrees C	disabled	1204
		enabled	1304
	1/10 degrees F	disabled	1284
		enabled	1384
Thermocouple N	1/10 degrees C	disabled	1205
		enabled	1305
	1/10 degrees F	disabled	1285
		enabled	1385
Thermocouple R	1/10 degrees C	disabled	2206
		enabled	2306
	1/10 degrees F	disabled	2286
		enabled	2386
Thermocouple S	1/10 degrees C	disabled	2207
		enabled	2307
	1/10 degrees F	disabled	2287
		enabled	2387
Thermocouple T	1/10 degrees C	disabled	2208
		enabled	2308
	1/10 degrees F	disabled	2288
		enabled	2388

Continued on next page

Analog Channel Parameters, Continued

RTD Parameter Codes

Use the following codes to set your choice of parameters:

Input range	Wiring configuration	Temperature unit	Broken-wire detection	Parameter code (hex)
IEC PT100 RTD	2- or 4-wire	1/10 degrees C	disabled	0A20
			enabled	0B20
		1/10 degrees F	disabled	0AA0
			enabled	0BA0
	3-wire	1/10 degrees C	disabled	0E20
			enabled	0F20
		1/10 degrees F	disabled	0EA0
			enabled	0FA0
IEC PT1000 RTD	2- or 4-wire	1/10 degrees C	disabled	0221
			enabled	0321
		1/10 degrees F	disabled	02A1
			enabled	03A1
	3-wire	1/10 degrees C	disabled	0621
			enabled	0721
		1/10 degrees F	disabled	06A1
			enabled	07A1
US/JIS PT100 RTD	2- or 4-wire	1/10 degrees C	disabled	0A60
			enabled	0B60
		1/10 degrees F	disabled	0AE0
			enabled	0BE0
	3-wire	1/10 degrees C	disabled	0E60
			enabled	0F60
		1/10 degrees F	disabled	0EE0
			enabled	0FE0

Continued on next page

Analog Channel Parameters, Continued

RTD Parameter Codes, Continued

Input range	Wiring configuration	Temperature unit	Broken-wire detection	Parameter code (hex)
US/JIS PT1000 RTD	2- or 4-wire	1/10 degrees C	disabled	0261
			enabled	0361
		1/10 degrees F	disabled	02E1
			enabled	03E1
	3-wire	1/10 degrees C	disabled	0661
			enabled	0761
		1/10 degrees F	disabled	06E1
			enabled	07E1
DIN Ni100 RTD	2- or 4-wire	1/10 degrees C	disabled	0A23
			enabled	0B23
		1/10 degrees F	disabled	0AA3
			enabled	0BA3
	3-wire	1/10 degrees C	disabled	0E23
			enabled	0F23
		1/10 degrees F	disabled	0EA3
			enabled	0FA3
DIN Ni1000 RTD	2- or 4-wire	1/10 degrees C	disabled	0222
			enabled	0322
		1/10 degrees F	disabled	02A2
			enabled	03A2
	3-wire	1/10 degrees C	disabled	0622
			enabled	0722
		1/10 degrees F	disabled	06A2
			enabled	07A2

Continued on next page

Analog Channel Parameters, Continued

Low Voltage Parameter Codes

Use the following codes to set your choice of parameters:

Input range	Broken-wire detection	Parameter code (hex)
+/-25mV	disabled	2210
	enabled	2310
+/-100mV	enabled	1211
	disabled	1311

Analog Inputs

Overview

This section describes how to interpret the value of the analog input channels.

Key

This section describes input words 1 ... 4, as highlighted in the table below.

Word	Input Data	Output Data
Word 1 = LSW	Value, input channel 1	Parameters for input channel 1
Word 2	Value, input channel 2	Parameters for input channel 2
Word 3	Value, input channel 3	Parameters for input channel 3
Word 4 = MSW	Value, input channel 4	Parameters for input channel 4

Analog Input Values

Mapping of analog input values is shown below.

Input Word 1 (Register 3x, analog value returned on channel 1)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Input Word 2 (Register 3x+1, analog value returned on channel 2)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Input Word 3 (Register 3x+2, analog value returned on channel 3)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Input Word 4 (Register 3x+3, analog value returned on channel 4)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Broken Wire Indication

A broken wire indication has the following format.

Broken wire indication in an input word															
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Section 8.4

Analog/Digital Relation

RTD, Thermocouple and mV Input Measuring Ranges

Overview

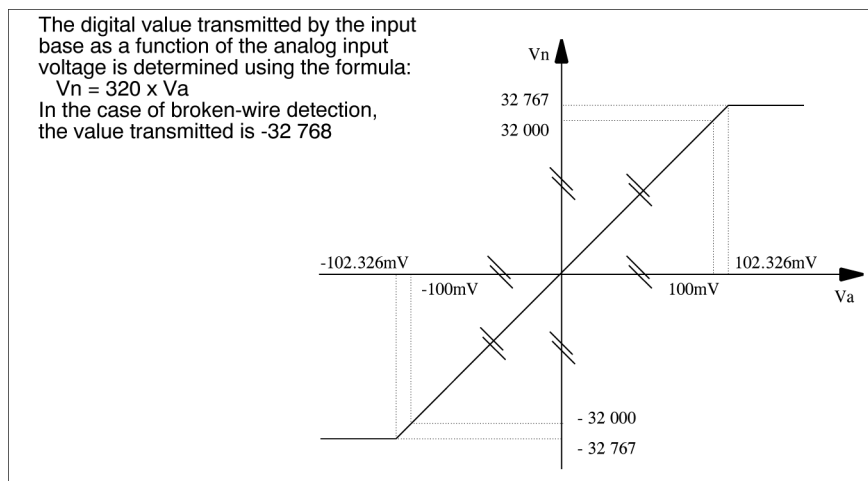
This section contains information about the analog/digital relation for the various input measuring ranges.

RTD or Thermocouple

If a RTD or thermocouple input range is chosen, the digital value transmitted is the temperature value expressed as either a tenth of a degree Centigrade or a tenth of a degree Fahrenheit, depending on the temperature unit chosen in the configuration.

+/- 100 mV

This section contains a diagram showing the analog/digital relation at +/- 100 mV..



Continued on next page

RTD, Thermocouple and mV Input Measuring Ranges, Continued

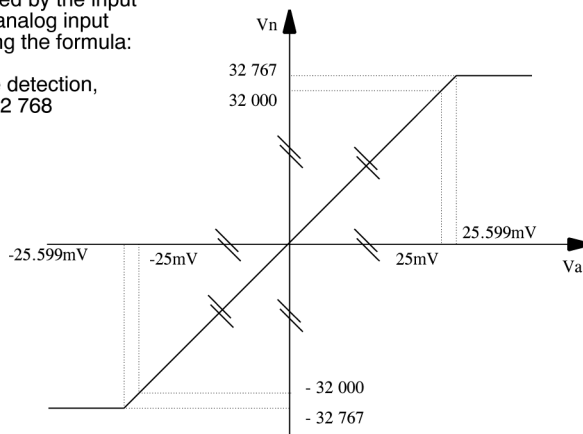
+/-25 mV

This section contains a diagram showing the analog/digital relation at +/- 25 mV.

The digital value transmitted by the input base as a function of the analog input voltage is determined using the formula:

$$V_n = 1280 \times V_a$$

In the case of broken-wire detection, the value transmitted is -32 768



170 AAO 120 00

Analog 4 Channel Output Module

Base 0 - 20 mA

9

At a Glance

Purpose This chapter describes the 170 AAO 120 00 TSX Momentum I/O base.

In This Chapter This chapter contains the following topics:

For This Topic...	See Section...	On Page...
Module Overview	1	166
Wiring	2	172
Configuration	3	177
Analog/Digital Relation	4	181

Section 9.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 AAO 120 00 TSX Momentum I/O base and provides specifications.

In This Section

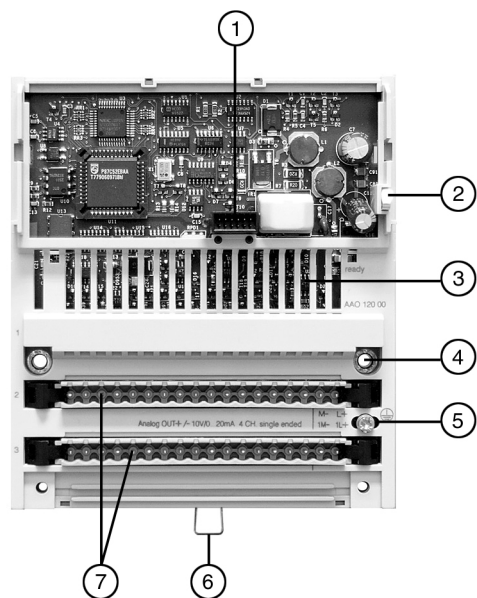
This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	167
Specifications	169

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 AAO 120 00 analog output base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:

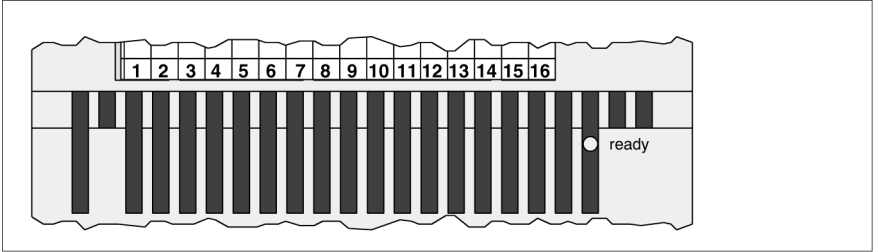


Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Locking tab for DIN rail mount
7	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration This I/O base has one LED, the ready indicator shown in the illustration below.



LED Descriptions

The ready indicator is described in the table below.

Indicator	Condition	Message
Ready	Green	Module is ready to communicate. Operating voltage for internal logic is present and self-test has been passed.
	Off	Module not ready

Specifications

Overview

This section contains specifications for the 170 AAO 120 00 I/O base.

General Specifications

The following table contains general specifications for this I/O base:

Module type	4 analog outputs
Output range	+/-10 V 0...20mA
Supply voltage	24 VDC
Supply voltage range	20...30 VDC
Supply current consumption (base)	max. 530 mA at 24 VDC
Supply current consumption (actuators)	max 150 mA at 24 VDC (+/-5%)
Power dissipation	5.6 W typical 8.5 W maximum
I/O map	5 output words
Isolation	
Between channels	no
Between base power supply and ground	500 Vcc, 1 min
Between channels and ground	1780 VAC, 1 min
Output protections	short circuits (in voltage) circuits open in current polarity inversion
Base power supply protection	+/- 30 V (voltage or current output)
Common mode rejection	250 VAC @ 47 ... 63 or 250 VDC Channel-to-ground

Continued on next page

Specifications, Continued

General Specifications, Continued

Fuses	
Internal (not user-replaceable)	2 A slow-blow
External (actuator power supply)	250 mA fast-blow (Wickmann 19193-250 mA or equivalent)
External (operating voltage)	630 mA fast-blow (Wickmann 19193-630 mA or equivalent)
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V
Emissions	EN 50081-2 (limitation A)
Agency approvals	UL, CSA, CE
Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54 in)
Length	141.5 mm (5.5 in) with no or one busbar
Weight	215 g (0.45 lb)



Note: The 24 VDC actuator power supply is protected in the same way as the analog outputs (different from the base power supply).

Continued on next page

Specifications, Continued

Analog Outputs

The following table contains specifications for analog outputs.

Number of channels	4	
Format of transmitted data	full 16 bits signed (2's complement)	
Protection (base and actuators)	polarity inversion	
Range	+/-10 V	0 ... 20 mA (current source or sink)
Load impedance	1 KOhm minimum	600 Ohms maximum
Capacitive load	< 1 micro F	< 1 micro F
Error at 25 deg. C	0.2% PE*	0.3% PE*
Error at 60 deg. C	0.25% PE*	0.4% PE*
Temperature drift (60 deg. C)	10ppmPE*/ deg. C	30ppmPE*/ deg. C
Resolution	12 bits + sign	12 bits + sign
Update time for the 4 outputs	< 2 ms	



Note: *Not to be confused with Protective Earth. PE is used here as a European notation for full scale, with the following values:
 10 V in range of +/- 10 V
 20mA in range of 0 ... 20 mA

Section 9.2

Wiring

Introduction

Purpose

This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 AAO 120 00 TSX Momentum I/O base.

In This Section

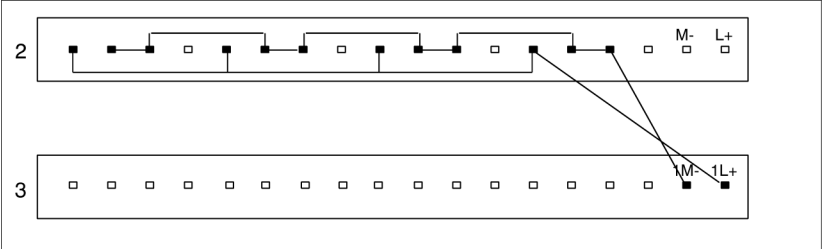
This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	173
Field Wiring Guidelines	174
Wiring Diagrams	176

Internal Pin Connections

Overview This section contains a diagram showing the internal connections between terminals on the I/O base.

Diagram The following illustration shows the internal connections between terminals.



Field Wiring Guidelines

Overview

This section contains wiring guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Mapping Terminal Blocks

Mapping terminal blocks is described in the table below.

Row	Terminal	Description	Function
2	4, 8, 12, 16	-	Not used
	1, 5, 9, 13	1L+	+24 V actuator power supply output
	2, 3, 6, 7, 10, 11, 14, 15	1M-	Actuator output supply neg. 0V return
	17	M-	Module power supply 0V
	18	L+	Module power supply +24V
3	1, 5, 9, 13	OUT1-, OUT2-, OUT3-, OUT4-	Output current mode (sink) Channels 1 ... 4
	2, 6, 10, 14	OUT1+, OUT2+, OUT3+, OUT4+	Output current mode (source), channels 1 ... 4
	3, 7, 11, 15	OutU1+, OutU2+, OutU3+, OutU4+	Output voltage mode, channels 1 ... 4
	4, 8, 12, 16	-	Not used
	17	1M-	0V neg. return of actuator supply output
	18	1L+	+24 V actuator power supply input

Continued on next page

Field Wiring Guidelines, Continued



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Fuse Required

The 250 mA fast-blow fuse shown in the wiring diagram on page 176 must be wired into the actuator power supply.

Signal Protection

To protect the signal from external noise induced in serial or common mode, we recommend the following precautions:

- Use shielded twisted-pair cables with a minimum conductor cross section of 0.22 mm².
 - Connect the cable shield to ground via the Cable Grounding Rail (part number 424 244 739).
 - You may combine the analog inputs on this I/O base in one multi-pair cable provided they have the same reference relative to ground.
 - The actuator power supply must be protected in the same way as the signal itself.
-

Wiring Diagrams

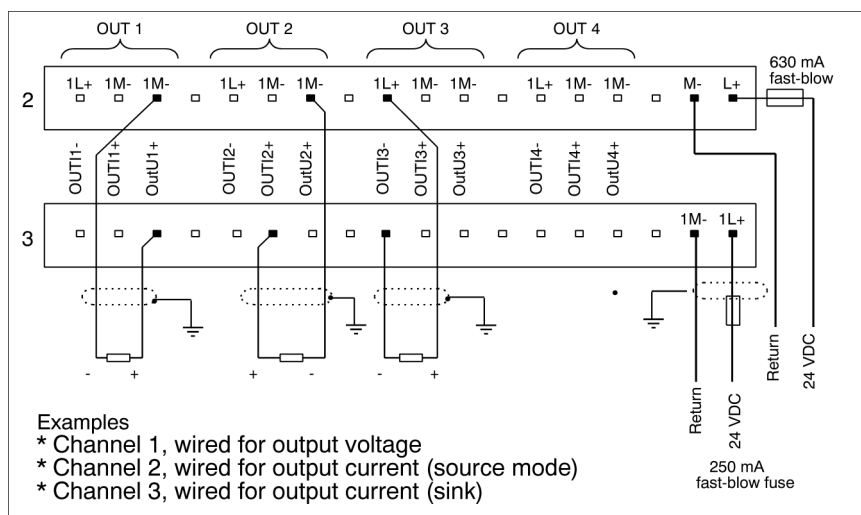
Overview

This section contains a diagram to assist you in wiring the following types of devices:

- Output voltage
- Output current (source mode)
- Output current (sink)

Diagram

Examples of wiring are shown in the diagram below:



Section 9.3

Configuration

Configuration Overview

Introduction The 170 AAO 120 00 TSX Momentum I/O base supports four analog output channels.

I/O Map The I/O base must be mapped as five contiguous output words, as follows:

Word	Output Data
Word 1 = LSW	Parameters for output channels 1 ... 4
Word 2	Value, output channel 1
Word 3	Value, output channel 2
Word 4	Value, output channel 3
Word 5 = MSW	Value, output channel 4

In This Section This section contains the following topics:

For This Topic...	See Page...
Analog Channel Parameters	178
Analog Outputs	180

Analog Channel Parameters

Overview

Parameters must be set for all of the analog channels before the module can be commissioned. This section provides the codes for setting the parameters and gives examples of parameter settings.



Note: If you set new parameters for the module, always send a complete set of parameters (all channels, inputs and outputs), even if you only want to change a single parameter. Otherwise the module will refuse the new parameters and continue working with the old ones.

Key

This section focuses on output word 1, as highlighted in the table below:

Word	Output Data
Word 1 = LSW	Parameters for output channels 1 ... 4
Word 2	Value, output channel 1
Word 3	Value, output channel 2
Word 4	Value, output channel 3
Word 5 = MSW	Value, output channel 4

Diagram

Parameters are set by entering a four-bit code in output word 1:

Output Word 1 (Register 4x, parameter word)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
for output channel 4				for output channel 3				for output channel 2				for output channel 1			

Continued on next page

Analog Channel Parameters, Continued

Parameter Codes Each 4-bit nibble in output word 1 must be configured with one of the following binary codes to define the channel parameters. Parameters must be set for all four channels before the module can be commissioned.

In each case, the x may be a 0 or a 1.

Code	Output Parameter	Function
0000	Reserved value	Forces the I/O base into a default condition where it continues to receive field inputs according to the previous received-channel parameters.
00x1	Default to zero	Sends a value to the base that causes it to apply zero at the field output.
01x1	Default to full scale	Sends a value to the base that causes it to apply the last received value at the field output.
10x1	Default to the last value	Sends a value to the base that causes it to apply full scale (+10 V or + 20 mA) at the field output.

Analog Outputs

Overview

This section describes how to interpret the value of the analog output channels.

Key

This section describes output words 2 ... 5, as highlighted in the table below.

Word	Output Data
Word 1 = LSW	Parameters for output channels 1 ... 4
Word 2	Value, output channel 1
Word 3	Value, output channel 2
Word 4	Value, output channel 3
Word 5 = MSW	Value, output channel 4

Diagram

The following diagrams explain how to interpret the value of output words 2 ... 5.

Output Word 2 (Register 4x+1, analog value sent on channel 1)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Output Word 3 (Register 4x+2, analog value sent on channel 2)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Output Word 4 (Register 4x+3, analog value sent on channel 3)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Output Word 5 (Register 4x+4, analog value sent on channel 4)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Section 9.4

Analog/Digital Relation

Output Measuring Ranges

Overview

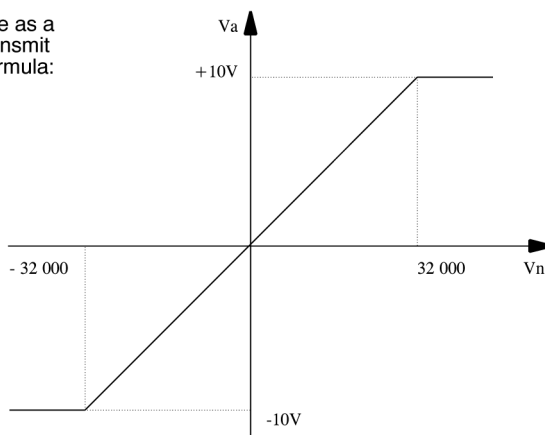
This section contains diagrams explaining the analog/digital relation for the voltage and current measuring ranges.

Voltage

The following diagram explains the analog/digital relation for voltage.

The value of the output voltage as a function of the digital value transmitted is determined using the formula:

$$V_a = 1/3200 \times V_n \text{ in Volts}$$



Continued on next page

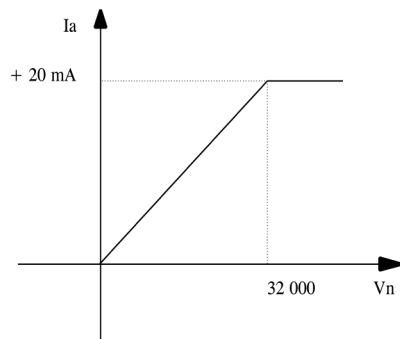
Output Measuring Ranges, Continued

Current

This following diagram explains the analog/digital relation for current.

The value of the output current as a function of the digital value transmitted is determined using the formula:

$$I_a = 1/1600 \times V_n \text{ in mA}$$



170 AAO 921 00
Analog 4 Channel Output Module
Base 4 ... 20 mA



At a Glance

Purpose This chapter describes the 170 AAO 921 00 TSX Momentum I/O base.

In This Chapter This chapter contains the following topics:

For This Topic...	See Section...	On Page...
Module Overview	1	184
Wiring	2	190
Configuration	3	195
Analog/Digital Relation	4	199

Section 10.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 AAO 921 00 TSX Momentum I/O base and provides specifications.

In This Section

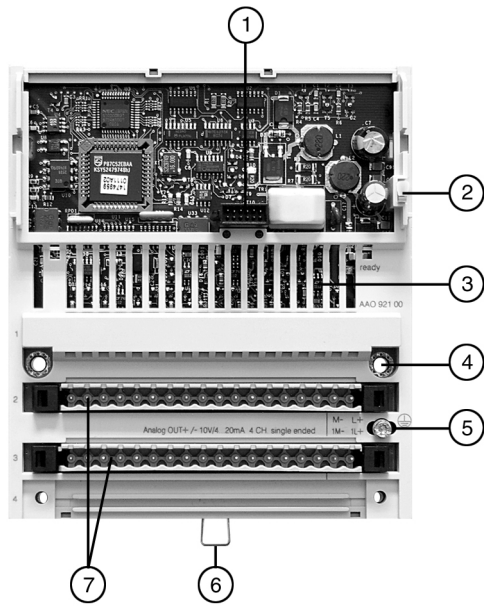
This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	185
Specifications	187

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 AAO 921 00 analog output base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:

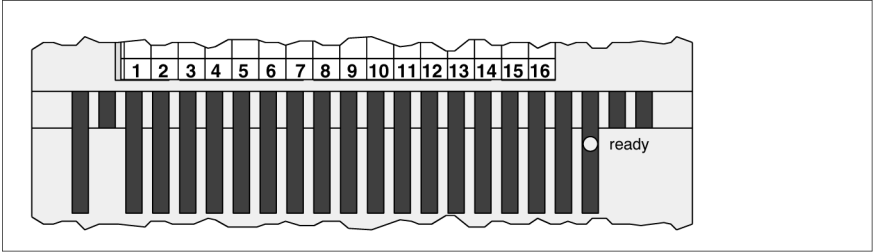


Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Locking tab for DIN rail mount
7	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration This I/O base has one LED, the ready indicator shown in the illustration below.



LED Descriptions

The ready indicator is described in the table below.

Indicator	Condition	Message
Ready	Green	Module is ready to communicate. Operating voltage for internal logic is present and self-test has been passed.
	Off	Module not ready

Specifications

Overview

This section contains specifications for the 170 AAO 921 00 I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	4 analog outputs
Output range	+/-10 V 4 ... 20mA
Supply voltage	24 VDC
Supply voltage range	20...30 VDC
Supply current consumption (base)	max. 530 mA at 24 VDC
Supply current consumption (actuators)	max 150 mA at 24 VDC (+/-5%)
Power dissipation	5.6 W typical 8.5 W maximum
I/O map	5 output words
Isolation	
Between channels	no
Between base power supply and ground	500 VDC, 1 min
Between channels and ground	1780 VAC, 1 min
Output protections	short circuits (in voltage) circuits open in current polarity inversion +/- 30 V (voltage or current output)
Common mode rejection	250 VAC @ 47 ... 63 or 250 VDC Channel-to-ground
Fuses	
Internal (not user-replaceable)	2 A slow-blow
External (actuator power supply)	250 mA fast-blow (Wickmann 19193-250 mA or equivalent)

Continued on next page

Specifications, Continued

General Specifications, Continued

EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V
Emissions	EN 50081-2 (limitation A)
Agency approvals	UL, CSA, CE
Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54 in)
Length	141.5 mm (5.5 in) with no or one busbar
Weight	215 g (0.45 lb)



Note: The 24 VDC actuator power supply is protected in the same way as the analog outputs (different from the base power supply).

Continued on next page

Specifications, Continued

Analog Outputs

The following tables contain specifications for analog outputs.

Number of channels	4	
Format of transmitted data	full 16 bits signed (2's complement)	
Protection (base and actuators)	polarity inversion	
Range	+/-10 V	4 ... 20 mA (current source or sink)
Load impedance	1 KOhm minimum	600 Ohms maximum
Capacitive load	< 1 micro F	< 1 micro F
Error at 25 deg. C	0.2% PE*	0.4% PE*
Error at 60 deg. C	0.25% PE*	0.5% PE*
Temperature drift (60 deg. C)	10ppm PE*/ deg. C	30ppm PE*/ deg. C
Resolution	12 bits + sign	12 bits + sign
Update time for the 4 outputs	2 ms	



Note: *Not to be confused with Protective Earth. PE is used here as a European notation for full scale, with the following values:
 10 V in range of +/- 10 V
 20 mA in range of 4 ... 20 mA

Section 10.2

Wiring

Introduction

Purpose

This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 AAO 921 00 TSX Momentum I/O base.

In This Section

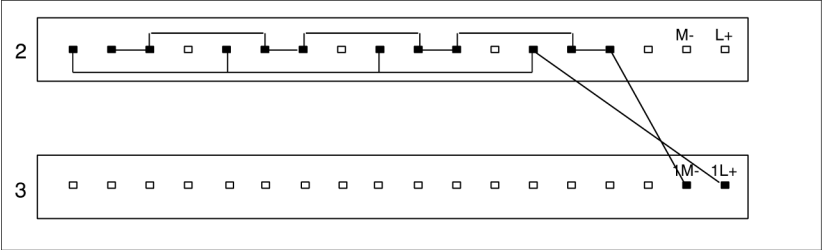
This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	191
Field Wiring Guidelines	192
Wiring Diagrams	194

Internal Pin Connections

Overview This section contains a diagram showing the internal connections between terminals on the I/O base.

Diagram The following illustration shows the internal connections between terminals.



Field Wiring Guidelines

Overview

This section contains wiring guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Mapping Terminal Blocks

Mapping terminal blocks is described in the table below.

Row	Terminal	Description	Function
2	4, 8, 12, 16	-	Not used
	1, 5, 9, 13	1L+	+24 V actuator power supply output
	2, 3, 6, 7, 10, 11, 14, 15	1M-	Actuator output supply neg. 0V return
	17	M-	Module power supply 0V
	18	L+	Module power supply +24V
3	1, 5, 9, 13	OUT11-, OUTI2-, OUTI3-, OUTI4-	Output current mode (sink) Channels 1 ... 4
	2, 6, 10, 14	OUTI1+, OUTI2+, OUTI3+, OUTI4+	Output current mode (source), channels 1 ... 4
	3, 7, 11, 15	OutU1+, OutU2+, OutU3+, OutU4+	Output voltage mode, channels 1 ... 4
	4, 8, 12, 16	-	Not used
	17	1M-	0V neg. return of actuator supply output
	18	1L+	+24 V actuator power supply input

Continued on next page

Field Wiring Guidelines

Fuse Required

The 250 mA fast-blow fuse shown in the wiring diagram on page 194 must be wired into the actuator power supply.



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Signal Protection

To protect the signal from external noise induced in serial or common mode, we recommend the following precautions:

- Use shielded twisted-pair cables with a minimum conductor cross section of 0.22 mm².
 - Connect the cable shield to ground via the Cable Grounding Rail (part number 424 244 739).
 - You may combine the analog inputs on this I/O base in one multi-pair cable provided they have the same reference relative to ground.
 - The actuator power supply must be protected in the same way as the signal itself.
-

Wiring Diagrams

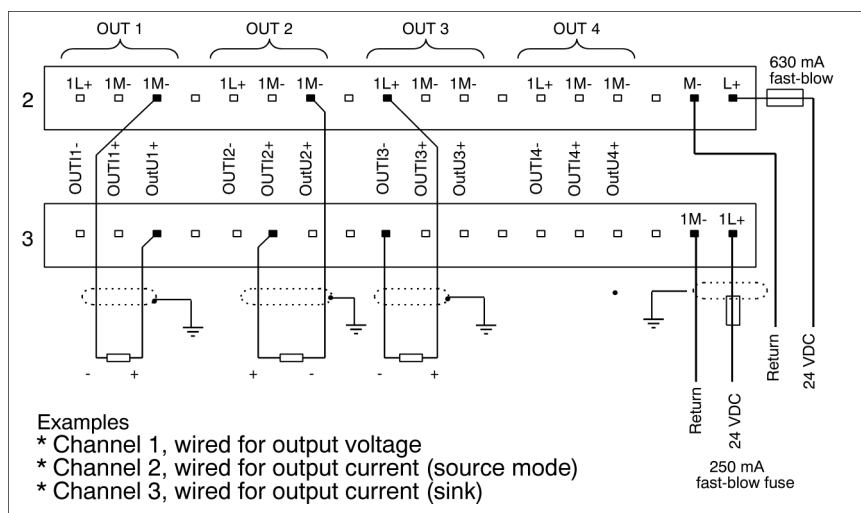
Overview

This section contains a wiring diagram to assist you in wiring the following types of devices:

- Output voltage
- Output current (source mode)
- Output current (sink)

Diagram

Examples of wiring are shown in the diagram below:



Section 10.3

Configuration

Configuration Overview

Introduction The 170 AAO 921 00 TSX Momentum I/O base has four analog output channels.

I/O Map The I/O base must be mapped as five contiguous output words, as follows:

Word	Output Data
Word 1 = LSW	Parameters for output channels 1 ... 4
Word 2	Value, output channel 1
Word 3	Value, output channel 2
Word 4	Value, output channel 3
Word 5 = MSW	Value, output channel 4

In This Section This section contains the following topics:

For This Topic...	See Page...
Analog Channel Parameters	196
Analog Outputs	198

Analog Channel Parameters

Overview

Parameters must be set for all of the analog channels before the module can be commissioned. This section provides the codes for setting the parameters and gives examples of parameter settings.



Note: If you set new parameters for the module, always send a complete set of parameters (all channels, inputs and outputs), even if you only want to change a single parameter. Otherwise the module will refuse the new parameters and continue working with the old ones.

Key

This section focuses on output word 1, as highlighted in the table below:

Word	Output Data
Word 1 = LSW	Parameters for output channels 1 ... 4
Word 2	Value, output channel 1
Word 3	Value, output channel 2
Word 4	Value, output channel 3
Word 5 = MSW	Value, output channel 4

Diagram

Parameters are set by entering a four-bit code in output word 1:

Output Word 1 (Register 4x, parameter word)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
for output channel 4				for output channel 3				for output channel 2				for output channel 1			

Continued on next page

Analog Channel Parameters, Continued

Parameter Codes Use the following codes to set the codes for each analog output channel. In each case, the *x* may be a 0 or a 1.

Code	Output Parameter	Function
0000	Reserved value	Forces the I/O base into a default condition where it continues to receive field inputs according to the previous received-channel parameters.
00x1	Default to zero	Sends a value to the base that causes it to apply zero at the field output.
01x1	Default to full scale	Sends a value to the base that causes it to apply the last received value at the field output.
10x1	Default to the last value	Sends a value to the base that causes it to apply full scale (+10 V or + 20 mA) at the field output.

Analog Outputs

Overview

This section describes how to interpret the value of the analog output channels.

Key

This section describes output words 3 and 4, as highlighted in the table below.

Word	Output Data
Word 1 = LSW	Parameters for output channels 1 ... 4
Word 2	Value, output channel 1
Word 3	Value, output channel 2
Word 4	Value, output channel 3
Word 5 = MSW	Value, output channel 4

Diagram

The following diagrams explain how to interpret the value of output words 2 ... 5.

Output Word 2 (Register 4x+1, analog value sent on channel 1)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Output Word 3 (Register 4x+2, analog value sent on channel 2)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Output Word 4 (Register 4x+3, analog value sent on channel 3)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Output Word 5 (Register 4x+4, analog value sent on channel 4)															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Section 10.4

Analog/Digital Relation

Output Measuring Ranges

Purpose

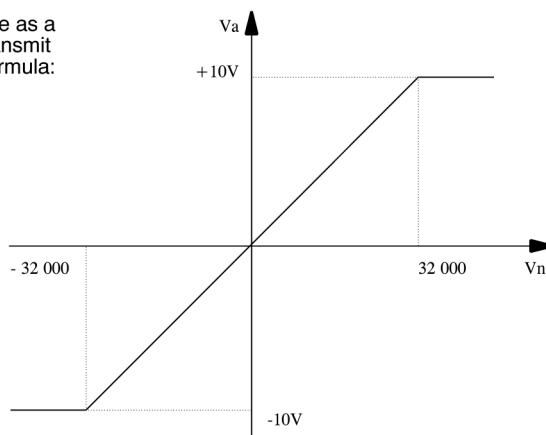
This section contains diagrams explaining the analog/digital relation for the voltage and current measuring ranges.

Voltage

The following diagram explains the analog/digital relation for voltage.

The value of the output voltage as a function of the digital value transmitted is determined using the formula:

$$V_a = 1/3200 \times V_n \text{ in Volts}$$



Continued on next page

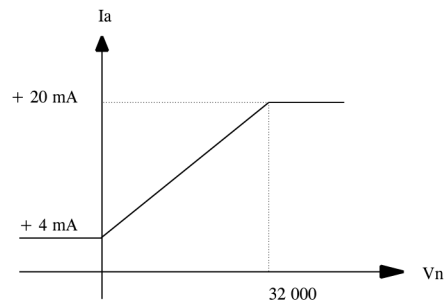
Output Measuring Ranges, Continued

Current

The following diagram shows the analog/digital relation for current.

The value of the output current as a function of the digital value transmitted is determined using the formula:

$$I_a = 1/20000 \times V_n + 4 \text{ in mA}$$



170 ADI 340 00
24 VDC - 16 Pt. Discrete Input
Module Base

11

At a Glance

Purpose This chapter describes the 170 ADI 340 00 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	202
Wiring	2	207
Configuration	3	214

Section 11.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 ADI 340 00 TSX Momentum I/O base and provides specifications.

In This Section

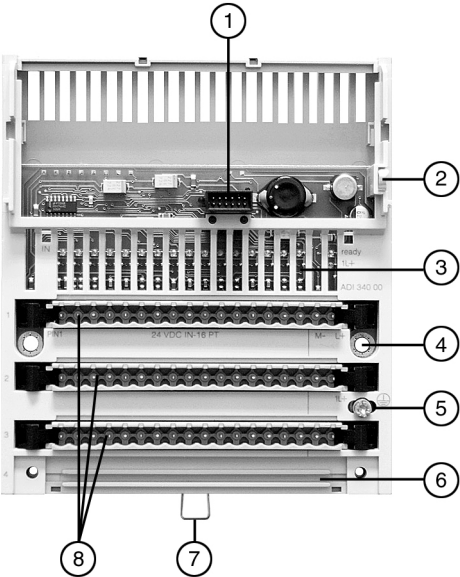
This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	203
Specifications	205

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADI 340 00 discrete input base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



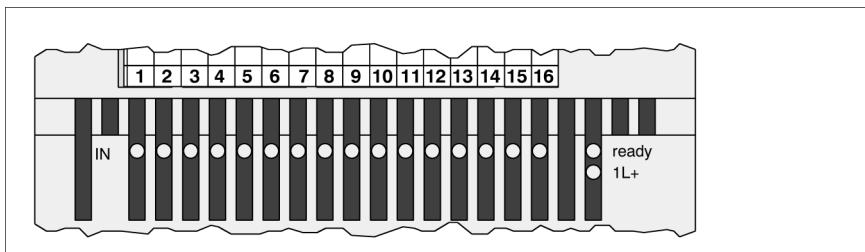
Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Busbar mounting slot
7	Locking tab for DIN rail mount
8	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below.

Indicator	Condition	Message
ready	Green	Module is ready to communicate; operating voltage for internal logic (5 V) is present.
	Off	Module not ready
1L+	Green	Input voltage 1L+ of inputs 1 ... 16 is present
	Off	Input voltage of inputs 1 ... 16 is not present
IN 1 ... 16	Green	Input status (an LED per input); input point active, i.e. input carries a 1 signal (logically ON)
	Off	Input status (an LED per input); input point inactive, i.e. input carries a 0 signal (logically OFF)

Specifications

Overview

This section contains specifications for the 170 ADI 340 00 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	16 discrete inputs in 1 group
Supply voltage	24 VDC
Supply voltage range	20...30 VDC
Supply current consumption	max. 250 mA at 24 VDC
Power dissipation	6 W + (# of input points on x .144 W)
I/O map	1 input word
Potential isolation	
Input to input	None
Field to communication interface	Defined by Communication Adapter type
Fuses	
Internal	None
External: operating voltage	315 mA fast-blow (Wickmann 19193-315 mA or 19194-315 mA or equivalent)
External: input voltage	According to the supply of the connected sensors—not to exceed 4A fast-blow
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V, 12 Ohm
Emmissions	EN 50081-2
Agency approvals	UL, CUL, CE

Continued on next page

Specifications, Continued

General Specifications, Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54in)
Length	141.5 mm (5.5in) no or one busbar 159.5 mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	190 g (0.42 lb)

Discrete Inputs

The following table contains specifications for discrete inputs:

Number of points	16
Number of groups	1
Point/group	16
Signal type	True High
IEC 1131 type	1+ (See Appendix on page 607 for definitions of IEC input types.)
ON voltage	+11 ... +30 VDC
OFF voltage	-3 ... +5 VDC
Input current	2.5 mA min. ON (6 mA at 24VDC) 1.2 mA maximum OFF
Input voltage range	-3 ... +30 VDC
Input resistance	4 kOhm
Response time	2.2 ms OFF to ON 3.3 ms ON to OFF

Section 11.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADI 340 00 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	208
Field Wiring Guidelines	209
Wiring Diagrams	211
Simplified Schematics	213

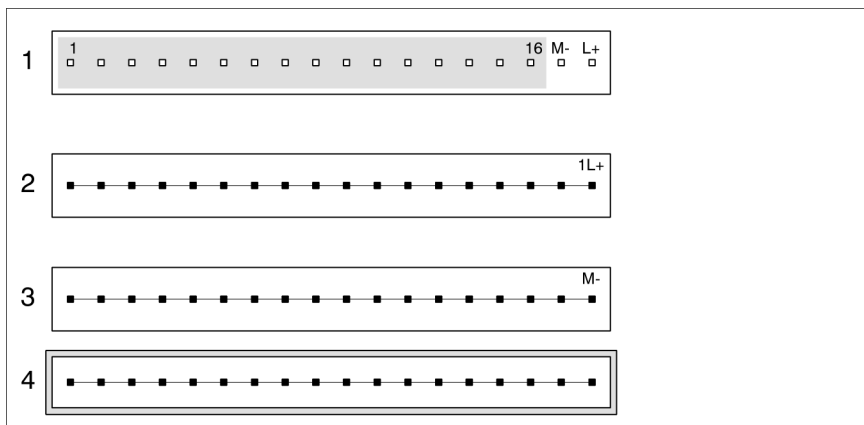
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals on the I/O base and an optional one-row busbar.

Diagram

Rows 1 through 3 show the internal connections between terminals on the I/O base. Row 4 shows the internal connections on the optional busbar.



Field Wiring Guidelines

Overview

Inputs are field wired to row 1 of the base. This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automations sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

If you are using 4-wire devices, you will need a 1-row busbar to connect them to protective earth (PE).

Type	Part Number
Screw-in	170 XTS 006 01
Spring-clip	170 XTS 007 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbar

A busbar may be attached to this I/O base to provide a fourth row for protective earth (PE).

Row	Terminal	Function
1	1...16	Inputs
	17	Return (M-)
	18	+ 24 VDC Operating voltage (L+)
2	1 ... 17	Sensor/input device voltages
	18	+ 24 VDC for inputs
3	1 ... 17	Returns for sensor/input devices (for 3- and 4-wire devices)
	18	Return for inputs
4	1 ... 18	Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Wiring Diagrams

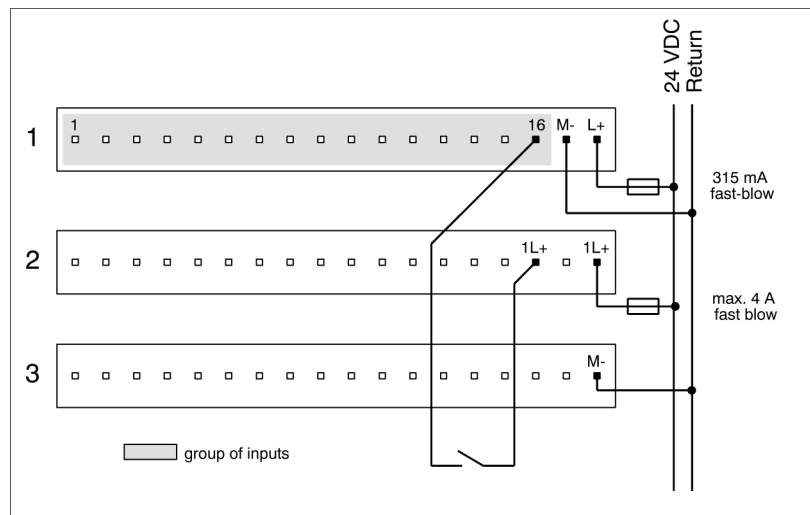
Overview

This section contains diagrams to assist you in wiring the following types of devices:

- 2-wire devices
- 3-wire devices
- 4-wire devices

Two-Wire Devices

The diagram below shows an example of wiring for two-wire devices.



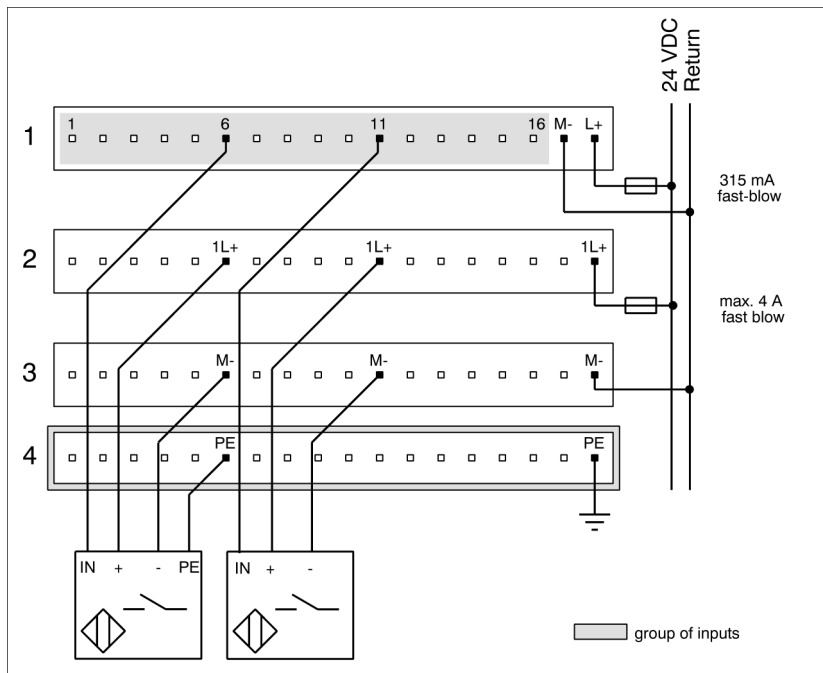
Continued on next page

Wiring Diagrams, Continued

Three- and Four-Wire Devices

The diagram below shows an example of wiring for three- and four-wire devices.

A 1-row busbar is used to provide PE for the 4-wire sensor. No busbar would be required if only 2- and/or 3-wire sensors were used.



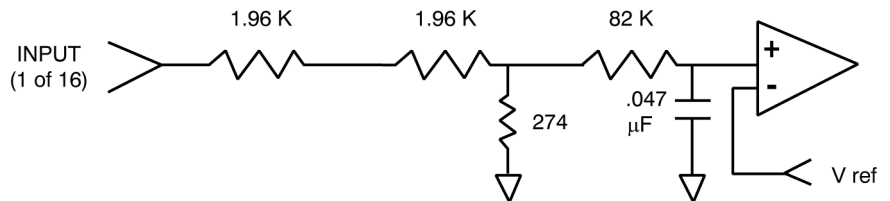
Simplified Schematics

Overview

This section contains a simplified schematic diagram of the field-side input circuitry.

Diagram

The following diagram shows the field-side input circuitry.



Section 11.3

Configuration

Discrete Inputs

Overview This I/O base supports sixteen discrete inputs. This section describes how to map I/O data between the I/O base and the CPU.

Number of Words Sixteen bits of discrete input data are returned from the base to the processor as one 16-bit word.

IEC vs. Ladder Logic In order to correctly field wire the inputs and map the input data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.

Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.

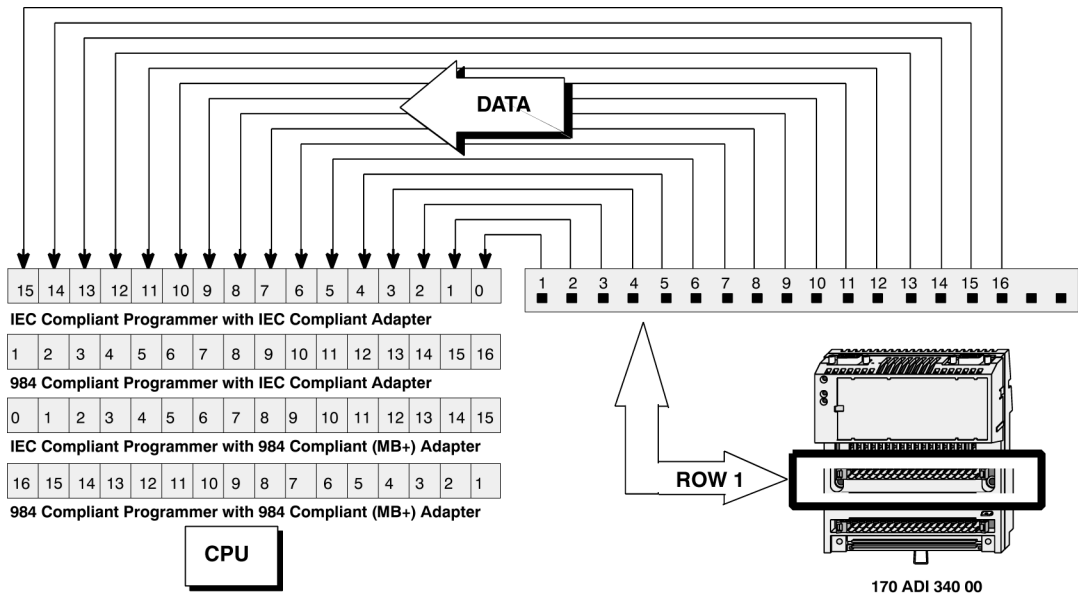
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Inputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADI 350 00

24 VDC - 32 Pt. Discrete Input

Module Base



At a Glance

Purpose This chapter describes the 170 ADI 350 00 TSX Momentum I/O base.

In This Chapter This chapter contains the following topics:

For This Topic...	See Section...	On Page...
Module Overview	1	218
Wiring	2	223
Configuration	3	230

Section 12.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 ADI 350 00 TSX Momentum I/O base and provides specifications.

In This Section

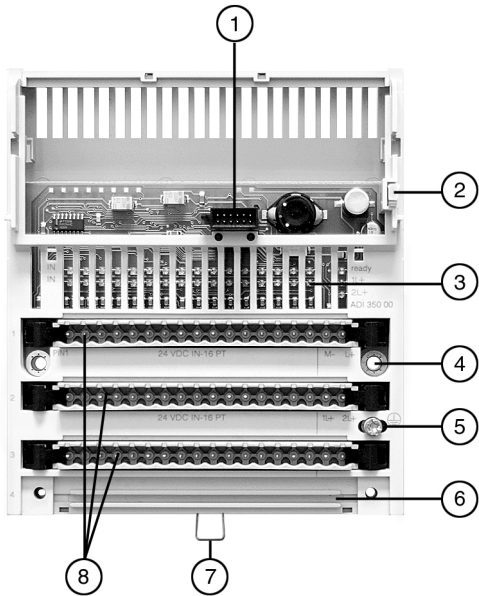
This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	219
Specifications	221

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADI 350 00 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



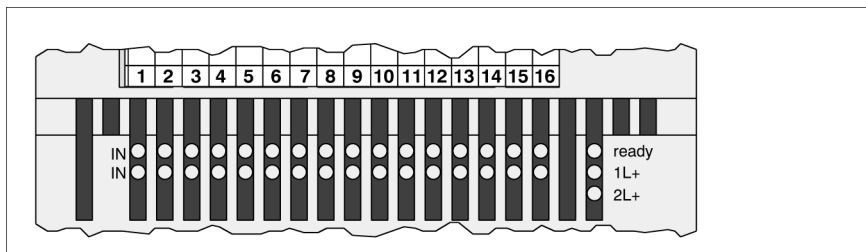
Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Busbar mounting slot
7	Locking tab for DIN rail mount
8	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below.

Indicator	Condition	Message
ready	Green	Ready to communicate; operating voltage for internal logic (5 V) is present
	Off	Module not ready
1L+	Green	Input voltage 1L+ of inputs 1 ... 16 (group 1) present
	Off	Input voltage of inputs 1 ... 16 (group 1) not present
2L+	Green	Input voltage 2L+ of inputs 17 ... 32 (group 2) present
	Off	Input voltage of inputs 17 ... 32 (group 2) not present
Upper row IN 1 ... 16	Green	Input status (an LED per input) group 1; input point active, i.e. input carries a 1 signal (logically ON)
	Off	Input status (an LED per input) group 1; input point inactive, i.e. input carries a 0 signal (logically OFF)
Middle row IN 1 ... 16	Green	Input status (an LED per input) group 2; input point active, i.e. input carries a 1 signal (logically ON)
	Off	Input status (an LED per input) group 2; input point inactive, i.e. input carries a 0 signal (logically OFF)

Specifications

Overview

This section contains the specifications for the 170 ADI 350 00 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for this module.

Module type	32 discrete inputs in 2 groups (16 inputs per group)
Supply voltage	24 VDC
Supply voltage range	20...30 VDC
Supply current consumption	max. 250 mA at 24 VDC
Power dissipation	6 W + (# of input points on x .144 W)
I/O map	2 input words
Potential isolation	
Input to input	None
Field to communication interface	Defined by Communication Adapter type
Fuses	
Internal	None
External: operating voltage	315 mA fast-blow (Wickmann 19193-315 mA or 19194-315 mA or equivalent)
External: input voltage	According to the supply of the connected sensors - not to exceed 4A fast-blow per group
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V, 12 Ohm
Emmissions	EN 50081-2
Agency approvals	UL, CUL, CE

Continued on next page

Specifications, Continued

General Specifications, Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54in)
Length	141.5 mm (5.5in) no or one busbar 159.5 mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	200 g (0.44 lb)

Discrete Inputs

The following table contains specifications for discrete inputs.

Number of points	32
Number of groups	1
Point/group	32
Signal type	True High
IEC 1131 type	1+ (See Appendix on page 607 for definitions of IEC input types.)
ON voltage	+11 ... +30 VDC
OFF voltage	-3 ... +5 VDC
Input current	2.5 mA min. ON (6 mA at 24VDC) 1.2 mA maximum OFF
Input voltage range	-3 ... +30 VDC
Input resistance	4 kOhm
Response time	2.2 ms OFF to ON 3.3 ms ON to OFF

Section 12.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADI 350 00 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	224
Field Wiring Guidelines	225
Wiring Diagrams	227
Simplified Schematics	229

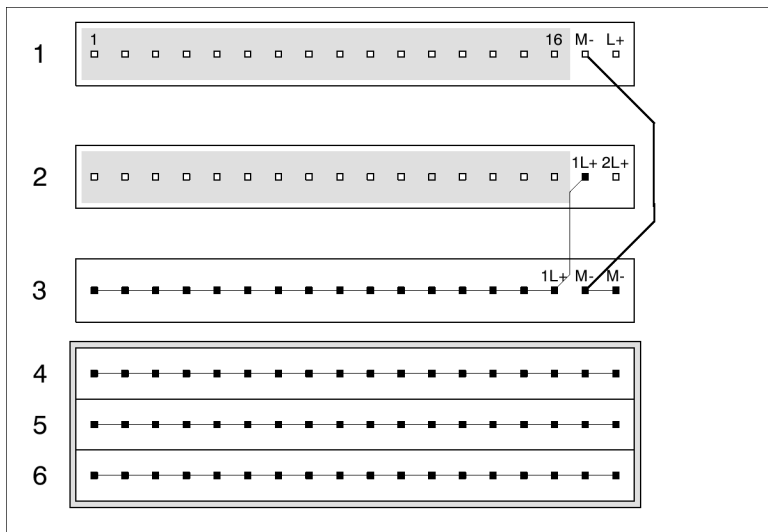
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals on the I/O base and an optional busbar.

Diagram

Rows 1 through 3 show the internal connections between terminals on the base. Rows 4 through 6 show internal connections on the optional busbar.



Field Wiring Guidelines

Overview This section contains guidelines and precautions.

Terminal Connector Required To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required Depending on the type of field devices you are using, you may need a 1-, 2-, or 3-row busbar. The following busbars are available from Schneider Automation:

Type	Number of Rows	Part Number
Screw-in	1-row	170 XTS 006 01
	2-row	170 XTS 005 01
	3-row	170 XTS 004 01
Spring-clip	1-row	170 XTS 007 01
	2-row	170 XTS 008 01
	3-row	170 XTS 003 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbars

The following table shows mapping terminal blocks and optional busbars..

Row	Terminal	Function
1	1...16	Inputs for group 1
	17	Return (M-)
	18	+ 24 VDC Operating voltage (L+)
2	1...16	Inputs for group 2
	17/18	24 VDC for input group 1 (1L+) and group 2 (2L+)
3	1 ... 16	Input voltage for inputs 1 ... 16
	17/18	Return (M-)
4	1 ... 18	Input voltage for inputs 17 ... 32
5	1 ... 18	Return (M-)
6	1 ... 18	Return (M-) or Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Wiring Diagrams

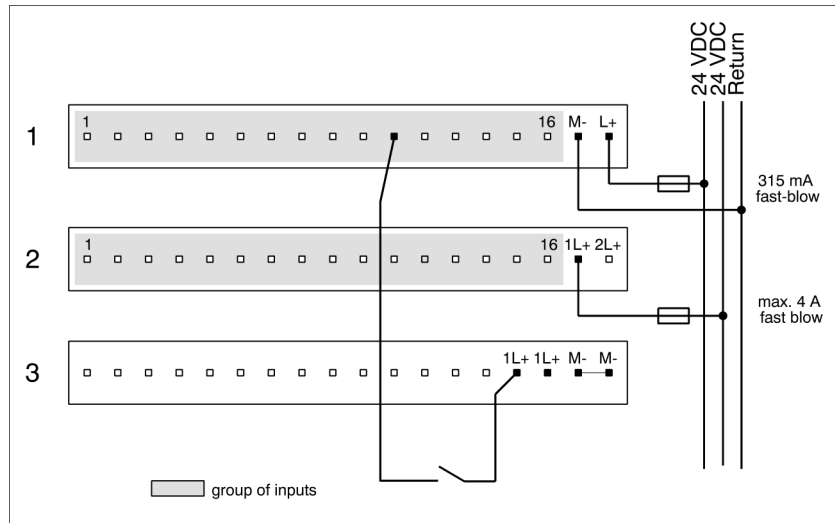
Overview

This section contains diagrams to assist you in wiring the following types of devices:

- Two-wire
- Three-wire

Two-Wire Devices

The diagram below shows an example of wiring for two-wire devices. This example uses an input from one group of input points. If you feed inputs using points from both input groups, you will need a busbar.

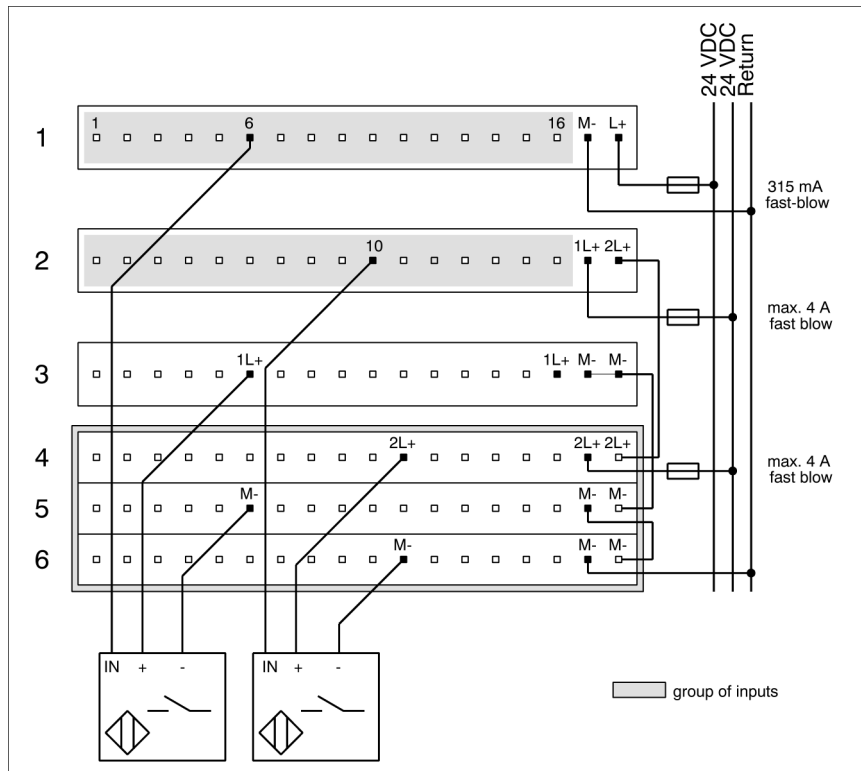


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Wiring Diagrams, Continued

Three-Wire Devices

The diagram below shows an example of wiring for three-wire devices.



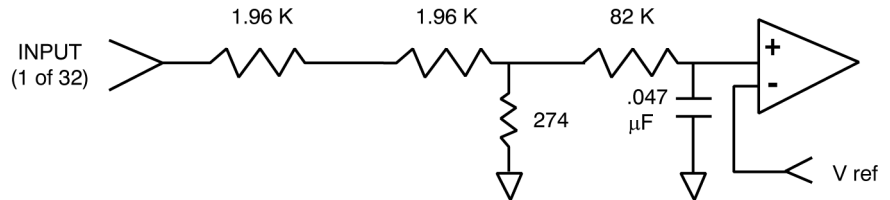
Simplified Schematics

Overview

This section contains a simplified schematic diagram of the field-side input circuitry.

Diagram

The following diagram shows the field-side input circuitry.



Section 12.3

Configuration

Discrete Inputs

Overview This I/O base supports 32 discrete inputs. This section describes how to map I/O data between the I/O base and the CPU.

Number of Words The base returns 32 discrete input data bits to the processor in two 16-bit words.

IEC vs. Ladder Logic In order to correctly field wire the inputs and map the input data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.

Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.

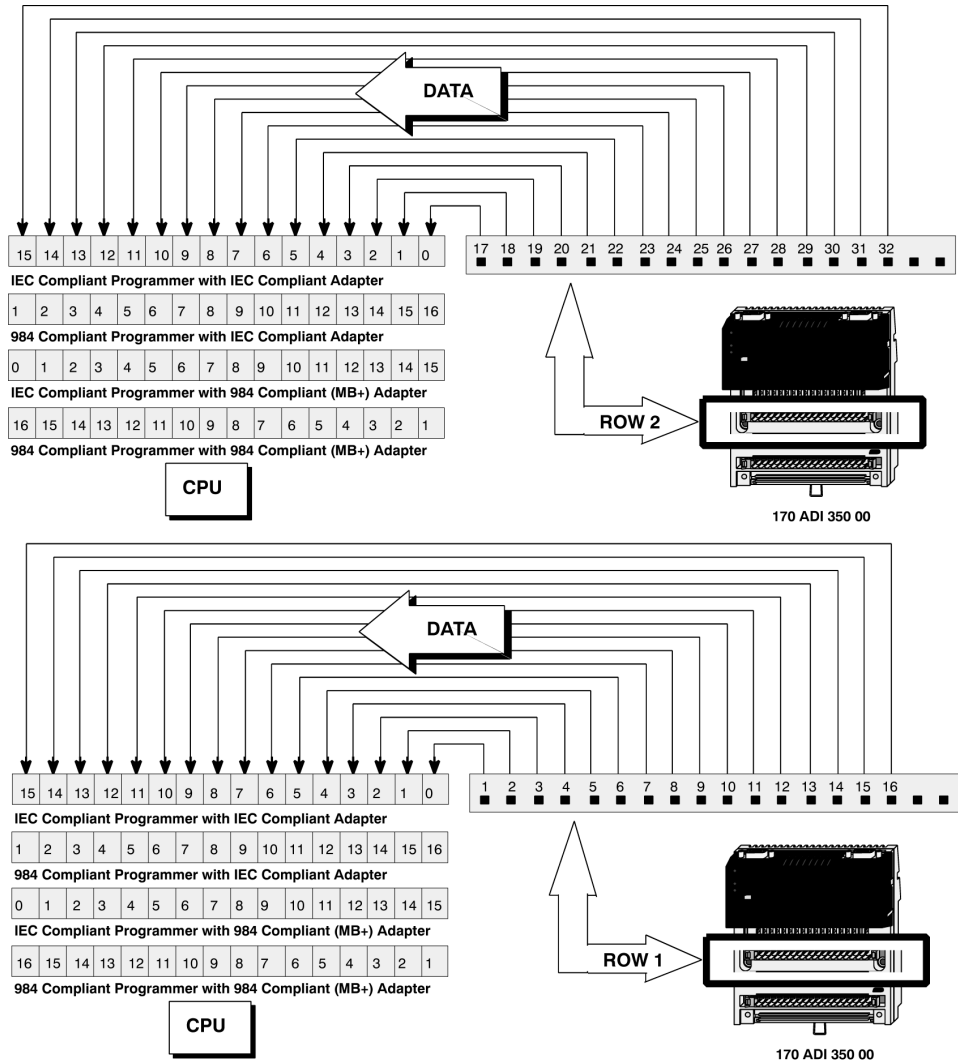
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.6

Continued on next page

Discrete Inputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADI 540 50

120 VAC - 16 Point Discrete Input

Module Base

At a Glance

Purpose This chapter describes the 170 ADI 540 50 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	234
Wiring	2	240
Configuration	3	247

Section 13.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 ADI 540 50 TSX Momentum I/O base and provides specifications.

In This Section

This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	235
Specifications	237

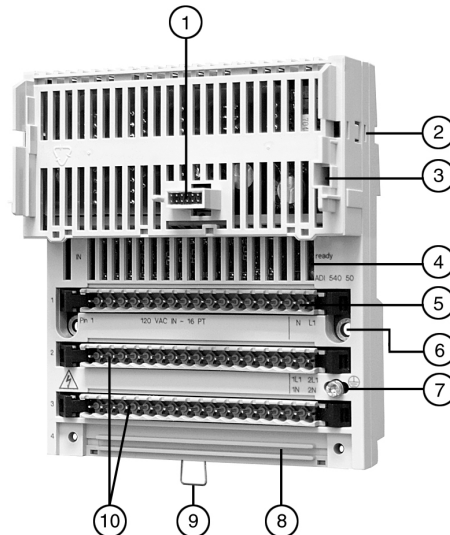
Front Panel Components

Overview

This section contains a photograph of the front panel of the 170 ADI 540 50 discrete I/O base and a description of the LEDs.

Front Panel

The front panel of the I/O base is shown in the photograph below:



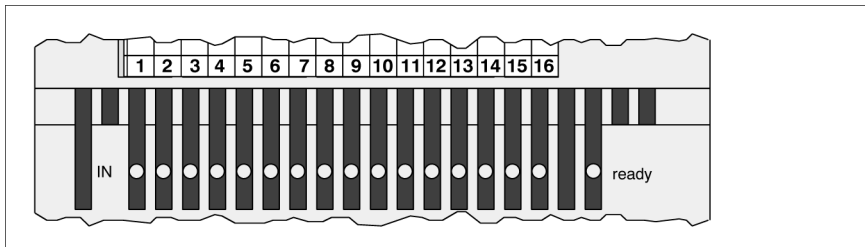
Label	Description
1	Internal interface (ATI) connector
2	Locking tab for the adapter
3	Ground contact for the adapter
4	LED status display
5	Module power and field inputs
6	Mounting holes for panel mount
7	Grounding screw
8	Busbar mounting slot
9	Locking tab for DIN rail mount
10	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below

Indicator	Condition	Message
ready	Green	Module is ready to communicate on network.
	Off	Module is not ready to communicate.
Upper row IN 1 ... 16	Green	Input status (an LED per input); input point active, i.e. input carries 1 signal (logically ON).
	Off	Input status (an LED per input); input point inactive, i.e. input carries 0 signal (logically OFF).

Specifications

Overview

This section contains specifications for the 170 ADI 540 50 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	16 discrete inputs in 2 groups
Supply voltage	120 VAC
Supply voltage range	85 ... 132 VAC RMS @ 47...63Hz
Supply current consumption	125 mA @ 120 VAC
Power dissipation	4 W + (# of input points on x .62 W)
I/O map	1 input word
Potential isolation	
Input to input	None
Group to group	1780 VAC
Field to communication adapter	1780 VAC
Fuses	
Internal (non-replaceable)	200 mA slow-blow
External (module power)	200 mA slow-blow (Wickmann 19195-200.mA or equivalent)
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 2 kV
Emmissions	EN 50011
Agency approvals	UL, CUL, CE FM class 1, div. 2 pending

Continued on next page

Specifications, Continued

General Specifications, Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	52 mm (2.05in)
Length	141.5 mm (5.5in) no or one busbar 159.5mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	284 g (10 oz)

Discrete Inputs

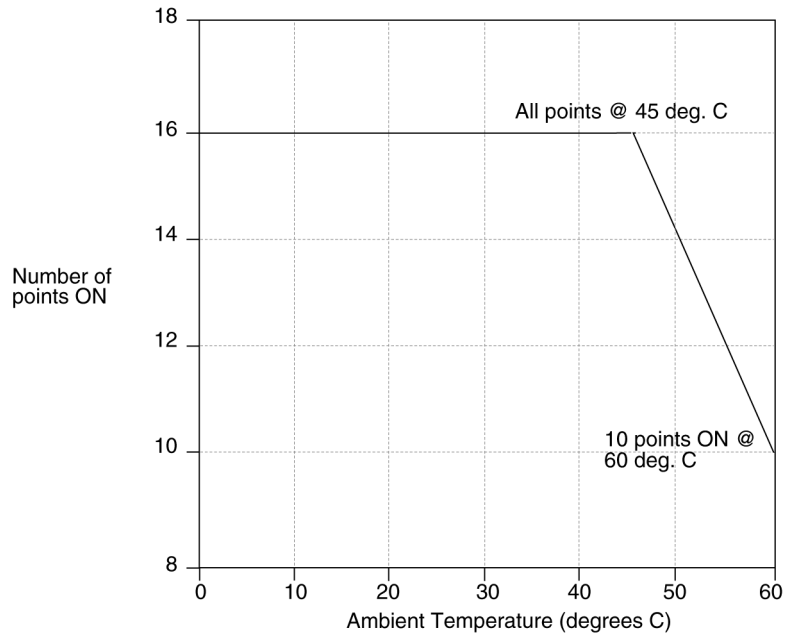
The following table contains specifications for discrete inputs.

Number of points	16
Number of groups	2
Points per group	8
Signal type	True High
Input current	10.0 mA minimum ON 2.0 mA maximum OFF
Input resistance (nominal)	9.5 k Ohms @ 50 Hz 7.5 k Ohms @ 60 Hz
Switching level	74 VAC minimum ON 20 VAC maximum OFF
Response time	35 ms @ 60 Hz ON to OFF 10 ms @ 60 Hz OFF to ON

Continued on next page

Specifications, Continued

Derating Curve The diagram below depicts the derating curve for this I/O base.



At 60 degrees C and maximum input voltage, the number of points allowed ON is 10.

Section 13.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADI 540 50 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	241
Field Wiring Guidelines	242
Wiring Diagrams	244
Simplified Schematics	246

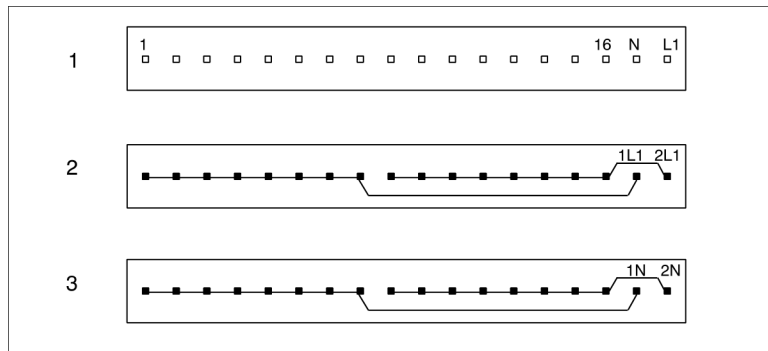
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections between terminals on the I/O base.

Diagram

The following diagram shows the internal connections between terminals on the base.



Field Wiring Guidelines

Overview

Inputs are field wired to row 1 of the base. This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Mapping Terminal Blocks

The following table shows mapping terminal blocks.

Row	Terminal	Function
1	1...16	Inputs
	17	Neutral - 120 VAC for module (N)
	18	Line - 120 VAC for module (L1)
2	1 ... 8	Input group 1 - line (1L1)
	9 ... 16	Input group 2 - line (2L1)
	17	Line for inputs group 1 (1L1)
	18	Line for inputs group 2 (2L1)
3	1 ... 8	Input group 1 - neutral (1N)
	9 ... 16	Input group 2 - neutral (2N)
	17	Neutral for inputs group 1 (1N)
	18	Neutral for inputs group 2 (2N)

Continued on next page

Field Wiring Guidelines, Continued



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Wiring Diagrams

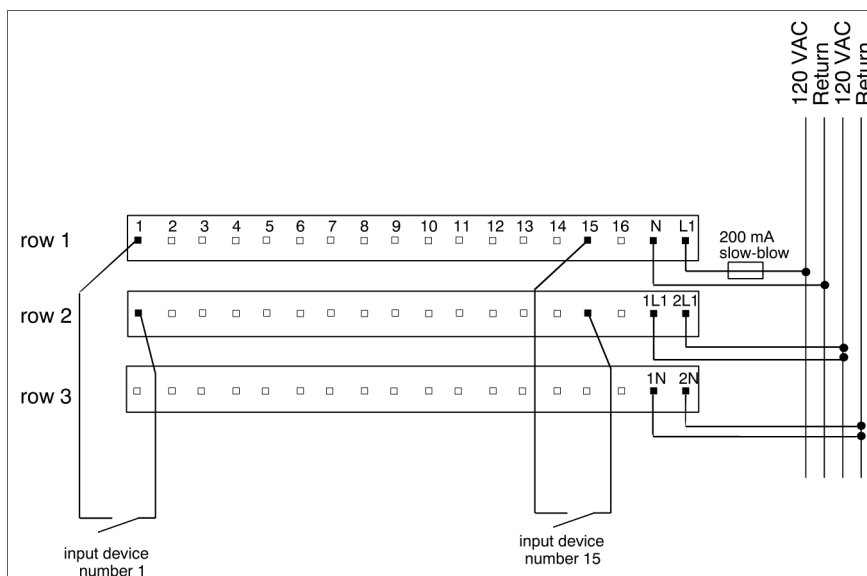
Overview

This section contains diagrams to assist you in wiring the following types of devices:

- Two-wire
- Three-wire

Two-Wire Devices

The diagram below shows an example of wiring for two-wire devices.

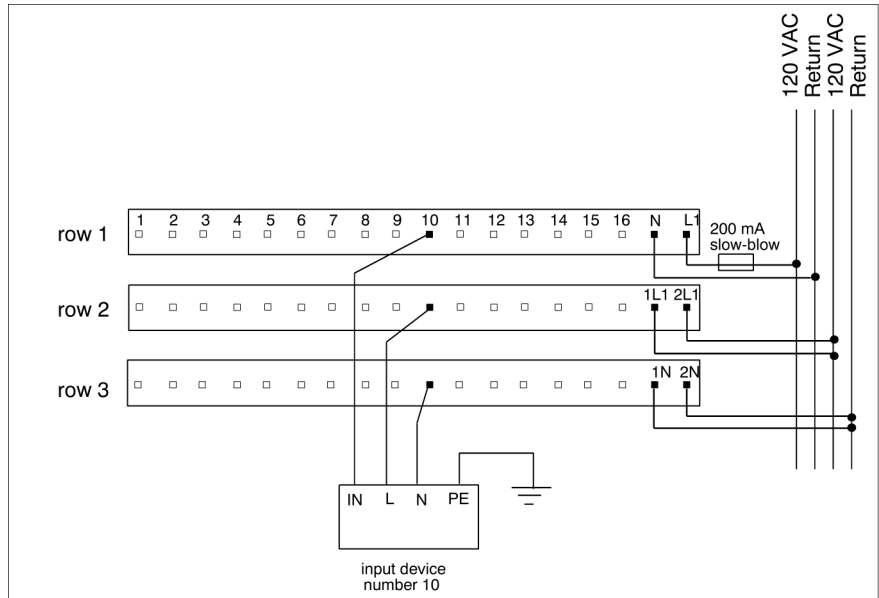


Continued on next page

Wiring Diagrams, Continued

Three-Wire Devices

The diagram below shows an example of wiring for three-wire devices.



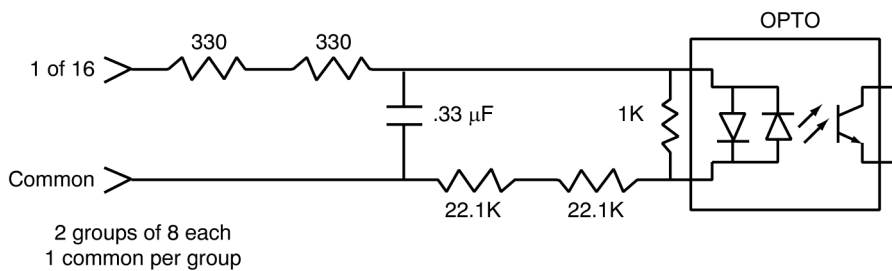
Simplified Schematics

Overview

This section contains a simplified schematic diagram of the field-side input circuitry.

Diagram

The following diagram shows the field-side input circuitry.



Section 13.3

Configuration

Discrete Inputs

Overview This section describes how to map input data from the I/O base to the CPU.

Number of Words Sixteen bits of discrete input data are returned from the base to the processor as one 16-bit word.

IEC vs. Ladder Logic In order to correctly field wire the inputs and map the input data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.

Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.

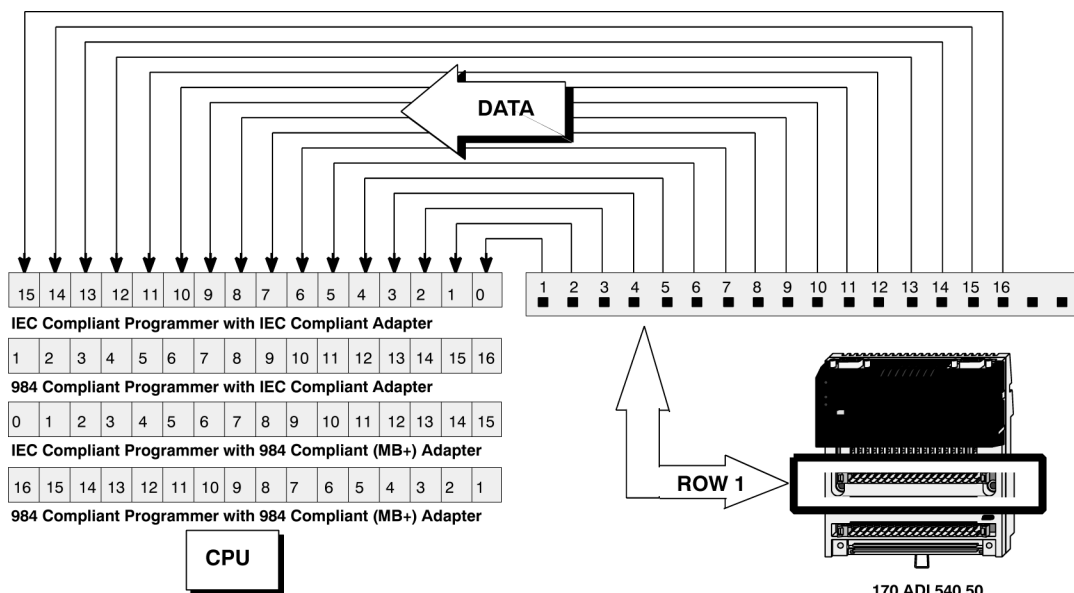
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Inputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADM 350 10

24 VDC - 16 Pt. In / 16 Pt. Out

Module Base

At a Glance

Purpose This chapter describes the 170 ADM 350 10 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	250
Wiring	2	256
Configuration	3	265

Section 14.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 ADM 350 10 TSX Momentum I/O base and provides specifications.

In This Section

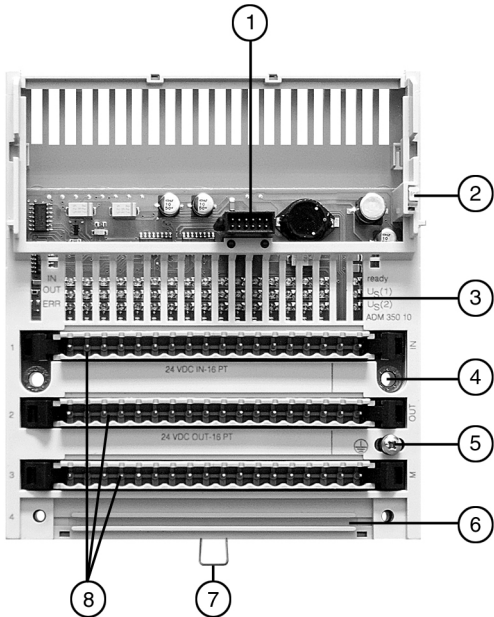
This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	251
Specifications	253

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADM 350 10 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



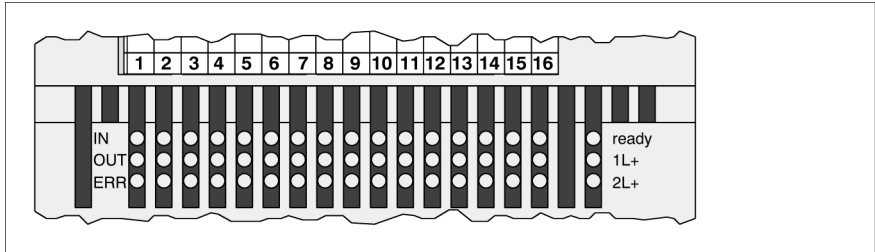
Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Busbar mounting slot
7	Locking tab for DIN rail mount
8	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below

Indicator	Condition	Message
ready	Green	Module is ready to communicate. Operating voltage for internal logic (5 V) is present.
	Off	Module is not ready.
1L+	Green	Output voltage 1L+ of outputs 1 ... 8 (group 1) is present.
	Off	Output voltage of outputs 1 ... 8 (group 1) is not present.
2L+	Green	Output voltage 1L+ of outputs 9 ... 16 (group 2) is present.
	Off	Output voltage of outputs 9 ... 16 (group 2) is not present.
Upper row IN 1 ... 16	Green	Input status (an LED per input). Input point active, ie. input carries a 1 signal (logically ON).
	Off	Input point inactive, ie. input carries a 0 signal (logically OFF).
Middle row OUT 1 ... 16	Green	Output status (an LED per input). Output point active, ie. output carries a 1 signal (logically ON).
	Off	Output point inactive, ie. output carries a 0 signal (logically OFF).
Lower row ERR 1 ... 16	Red	Output overload (an LED per output). Short circuit or overload on the corresponding output.
	Off	Outputs 1 ... 16 operating normally.

Specifications

Overview

This section contains specifications for the 170 ADM 350 10 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	16 discrete inputs in 1 group 16 discrete outputs in 2 groups (8 pts/group)
Supply voltage	24 VDC
Supply voltage range	20...30 VDC
Supply current consumption	max. 250 mA at 24 VDC
Power dissipation	6 W + ((# of input points on x .144 W) + (# of output points on x .25 W))
I/O map	1 input word 1 output word
Potential isolation	
Input to input	None
Output group to output group	None
Input to output group	None
Field to communication interface	Defined by Communication Adapter type
Fuses	
Internal	None
External: operating voltage	315 mA fast-blow (Wickmann 19193-315 mA or 19194-315 mA or equivalent)
External: input voltage	According to the supply of the connected sensors— not to exceed 4A fast-blow
External: output voltage	According to the supply of the connected actuators—not to exceed 4 A fast-blow/ group

Continued on next page

Specifications, Continued

General Specifications, Continued

EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V, 12 Ohm
Emmissions	EN 50081-2
Agency approvals	UL, CUL, CE, FM class 1, div. 2
Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54in)
Length	141.5 mm (5.5in) no or one busbar 159.5 mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	200 g (0.44 lb)

Discrete Inputs

The following table contains specifications for discrete inputs.

Number of points	16
Number of groups	1
Point/group	16
Signal type	True High
IEC 1131 type	1+ (See Appendix on page 607 for definitions of IEC input types.)
ON voltage	+11 ... +30 VDC
OFF voltage	-3 ... +5 VDC
Input current	2.5 mA minimum ON (6 mA at 24VDC) 1.2 mA maximum OFF
Input voltage range	-3 ... +30 VDC
Input resistance	4 kOhm
Response time	2.2 ms OFF to ON 3.3 ms ON to OFF

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

Output type	Solid state switch
Output supply voltage	24 VDC
Output supply voltage range	20 ... 30 VDC
Output voltage	External supply - .5 VDC
Number of points	16
Number of groups	2
Points per group	8
Current capacity	0.5 A/point maximum 4 A/group 8 A/module
Signal type	True High
Leakage current (output out)	< 1 mA @ 24 VDC
Surge (inrush) current	5 A for 1 ms
On state voltage drop	< 0.5 VDC @ 0.5 A
Fault sensing (See Note Below)	Outputs are electronically safeguarded to assist in short circuit and overload protection
Fault reporting	1 red LED/point (row 3) ON when short current/ overload occurs
Error indication	Output overload for at least one out put (I/O-Error) to communication adapter
Response time (resistive load / 0.5 A)	< 0.1 ms OFF to ON < 0.1 ms ON to OFF
Maximum switching cycles	1000/h for 0.5 A inductive load 100/s for 0.5 A resistive load 8/s for 1.2 W Tungsten load



Note: Discrete 24 Vdc outputs incorporate thermal shutdown and overload protection. The output current of a shortened output is limited to a nondestructive value. The short circuit heats the output driver and the output will switch off. The output will switch on again if the driver leaves the overtemperature condition. If the short circuit still exists, the driver will reach the overtemperature condition again and will switch off again.

Section 14.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADM 350 10 TSX Momentum I/O base.

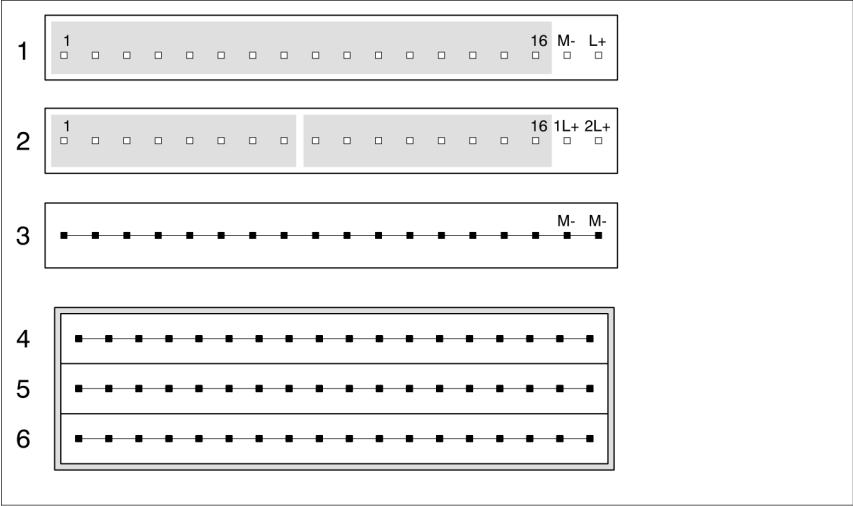
In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	257
Field Wiring Guidelines	258
Wiring Diagrams	260
Simplified Schematics	264

Internal Pin Connections

Overview This section contains a diagram showing the internal connections for terminals on the I/O base and an optional busbar.

Diagram Rows 1 through 3 show the internal connections between terminals on the I/O base. Rows 4 through 6 show the internal connections on the optional busbar.



Field Wiring Guidelines

Overview

The inputs are field wired to row 1 of the base. The outputs are field wired to row 2.

This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-, 2-, or 3-row busbar. The following busbars are available from Schneider Automation.

Type	Number of Rows	Part Number
Screw-in	1-row	170 XTS 006 01
	2-row	170 XTS 005 01
	3-row	170 XTS 004 01
Spring-clip	1-row	170 XTS 007 01
	2-row	170 XTS 008 01
	3-row	170 XTS 003 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbars

The following table shows mapping terminal blocks and optional busbars.

Row	Terminal	Function
1	1 ... 16	Inputs
	17	Return (M-)
	18	+ 24 VDC Operating voltage (L+)
2	1 ... 8	Outputs for group 1
	9 ... 16	Outputs for group 2
	17/18	24 VDC for output group 1 (1L+) and group 2 (2L+)
3	1 ...16	Returns for outputs
	17/18	Return (M-)
4	1...18	Input voltage for I1 ... I16 or PE
5	1...18	Return (M-)
6	1...18	Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Protective Circuit May Be Required

When contacted switches are used on the input lines or when lines to the peripherals are very long, the outputs of inductive loads require protective circuitry with a clamping/suppressor diode. Install the protective circuit parallel to the operating coil.

Wiring Diagrams

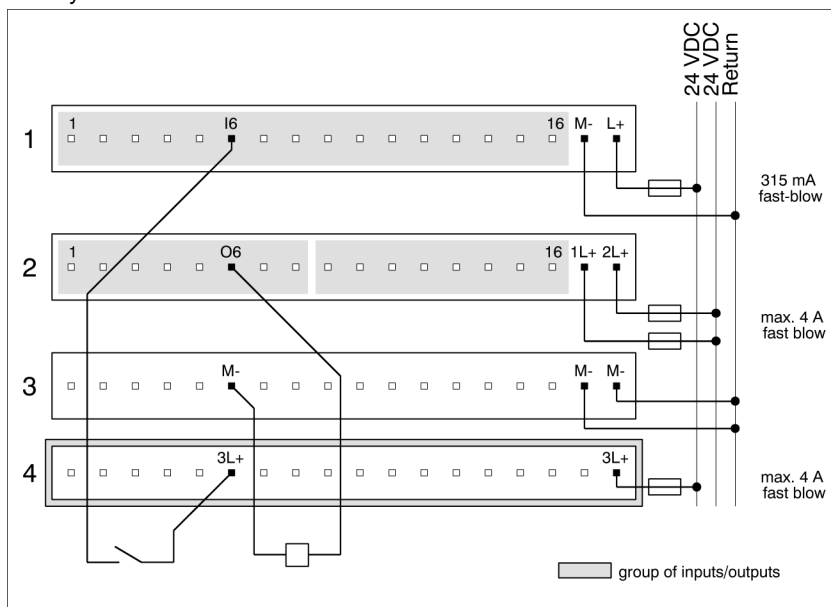
Overview

This section provides diagrams to assist you in wiring the following types of devices:

- Two-wire devices
- Sensor activated by an output
- Four-wire sensor with a two-wire actuator
- Broken wire detection

Two-Wire Devices

The diagram below shows an example of wiring for two-wire devices. Separate connections to pins 17 and 18 are shown on row 3, even though these two pins are internally connected. This is done to halve the load.



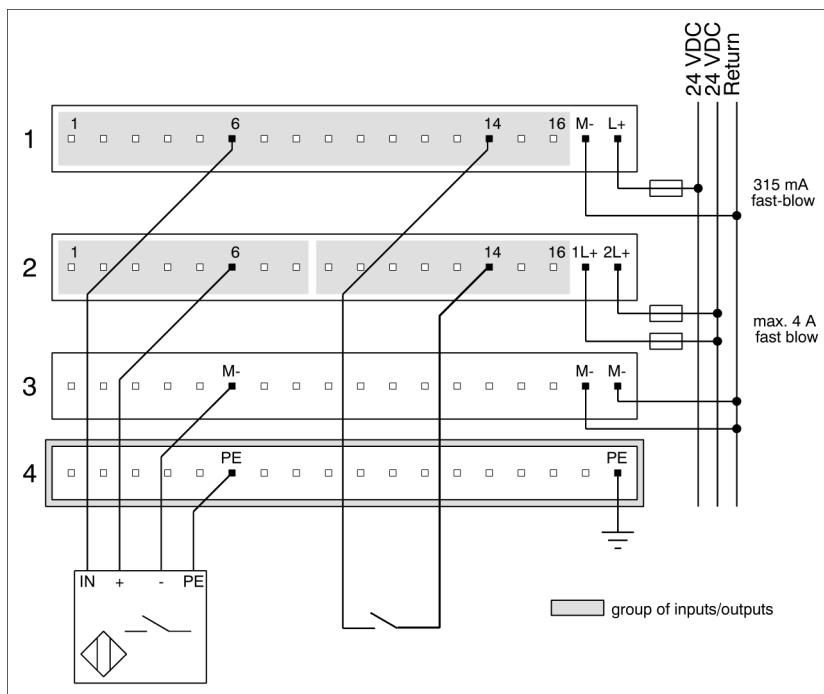
Continued on next page

Wiring Diagrams, Continued

Sensor Activated by Output

The wiring diagram below shows an example of a sensor activated by an output. The diagram shows the sensors being supplied with voltage only when the outputs on pins 6 and 14, row 2, are high. The inputs from pins 6 and 14, row 1, can be high only when one of the associated outputs is high.

Separate connections to pins 17 and 18 are shown on row 3, even though these two pins are internally connected. This is done to halve the load.



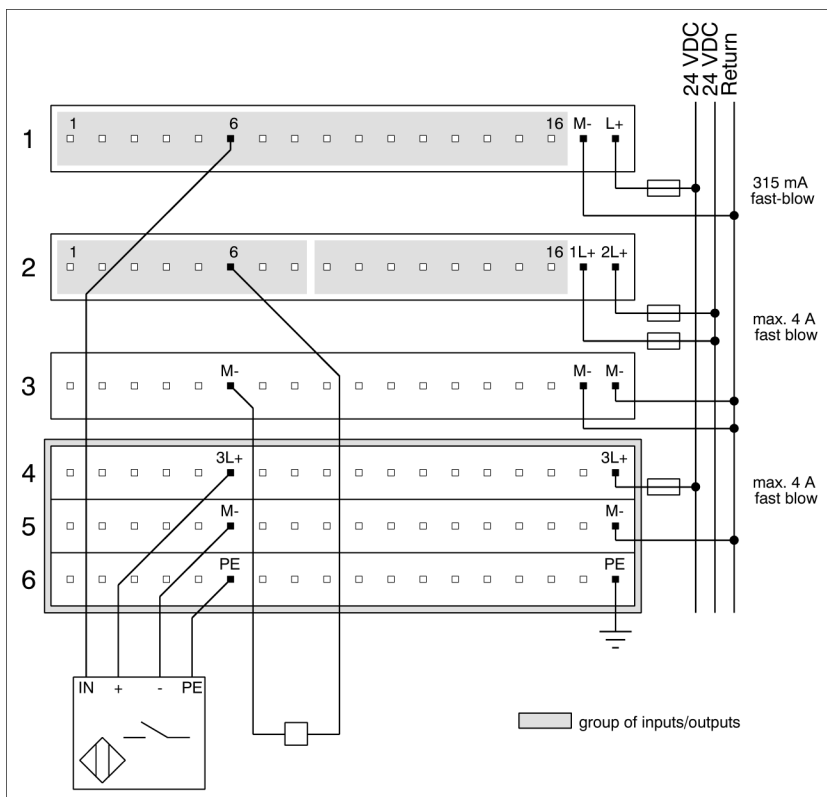
Continued on next page

Wiring Diagrams, Continued

Four-Wire Sensor with a Two-Wire Actuator

The diagram below shows a four-wire sensor with a two-wire actuator. The process of wiring a 3-wire sensor is very similar to the one below. Because 3-wire sensors do not require PE, a 2-row busbar could be used instead of the 3-row busbar shown.

Separate connections to pins 17 and 18 are shown on row 3, even though these two pins are internally connected. This is done to halve the load.



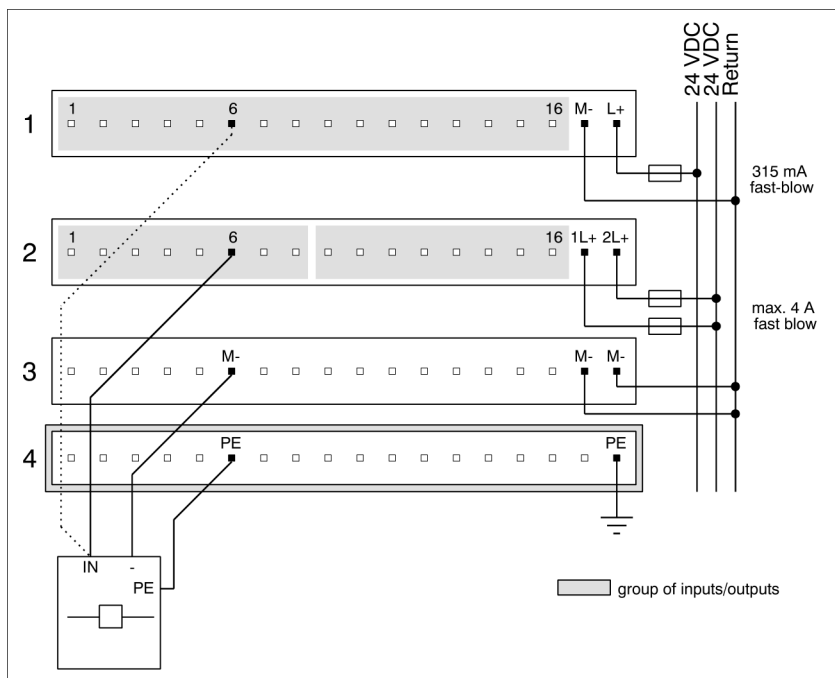
Continued on next page

Wiring Diagrams, Continued

Broken Wire Detection

The diagram below shows a three-wire actuator with an optional wiring scheme for broken wire detection. The dotted line reads back whether or not current has reached the actuator. When the output on pin 6, row 2, is high, the input from pin 6, row 2, must also be high.

Separate connections to pins 17 and 18 are shown on row 3, even though these two pins are internally connected. This is done to halve the load.



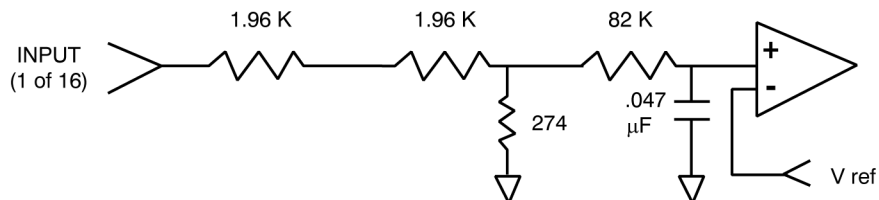
Simplified Schematics

Overview

This section contains simplified schematic diagrams of the field-side input and output circuitry.

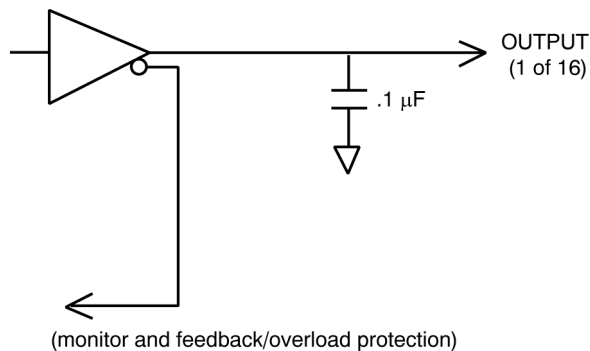
Input Diagram

The following diagram shows the field-side input circuitry.



Output Diagram

The following diagram shows the field-side output circuitry.



Section 14.3

Configuration

Discrete Inputs and Outputs

Overview This section describes how to map data between the I/O base and the CPU.

Number of Words The processor sends 16 bits of discrete output data to the base as one 16-bit word.
The base returns 16 bits of discrete input data to the processor as one 16-bit word.

IEC vs. Ladder Logic In order to correctly field wire the I/O and map the data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.

Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.

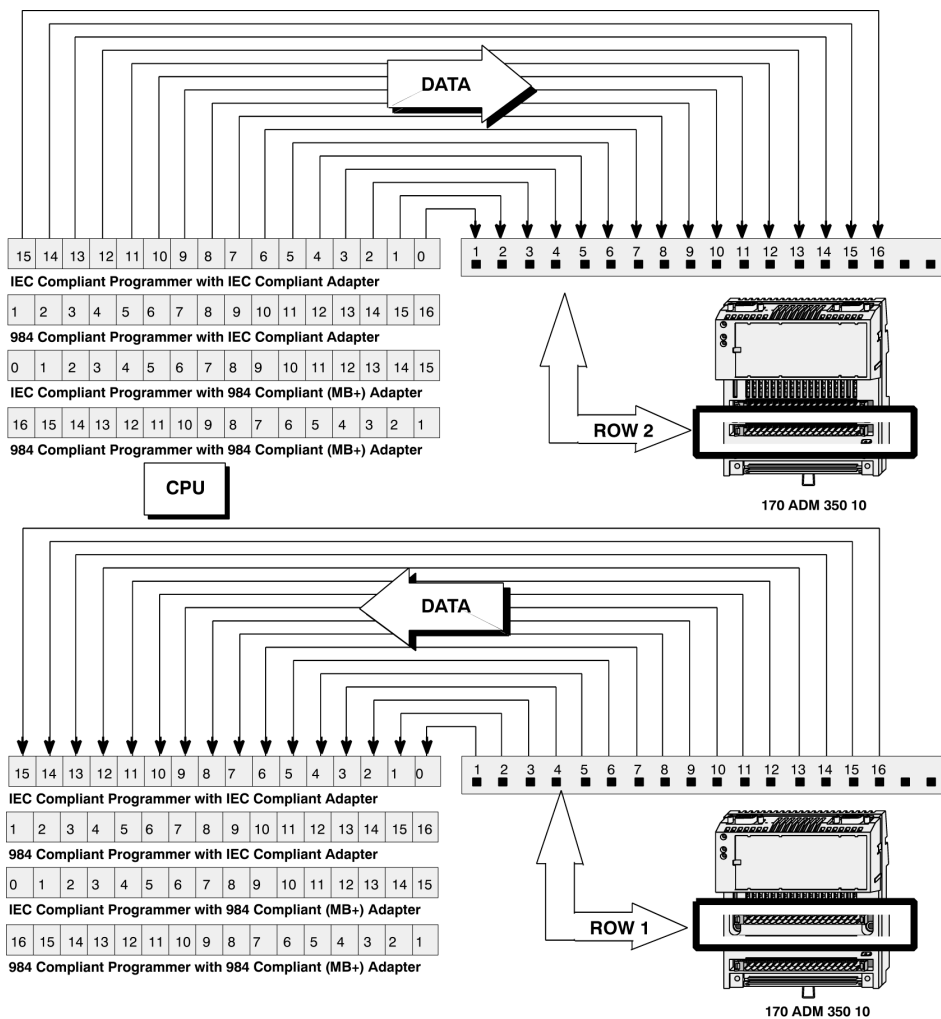
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Inputs and Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADM 350 11

24 VDC - 16 Pt. In / 16 Pt. Out

Module Base

At a Glance

Purpose This chapter describes the 170 ADM 350 11 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	268
Wiring	2	274
Configuration	3	283

Section 15.1

Module Overview

Introduction

Purpose This section describes the front panel components of the 170 ADM 350 11 TSX Momentum I/O base and provides specifications.

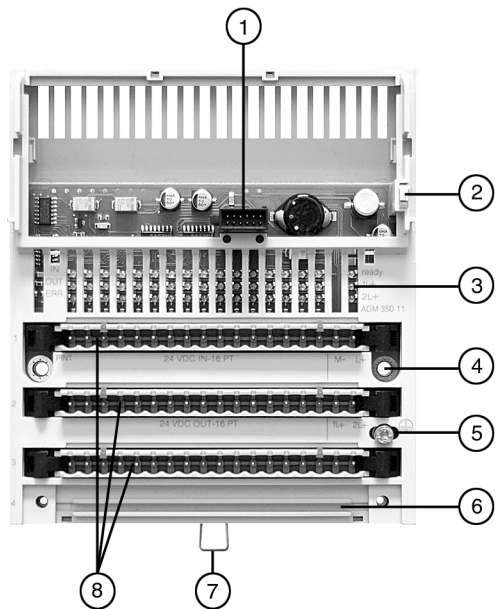
In This Section This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	269
Specifications	271

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADM 350 11 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



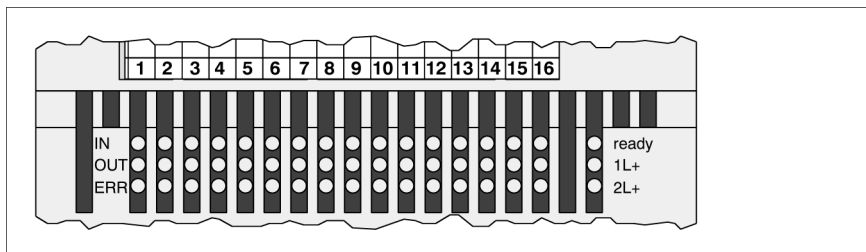
Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Busbar mounting slot
7	Locking tab for DIN rail mount
8	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below

Indicator	Condition	Message
ready	Green	Module is ready to communicate. Operating voltage for internal logic (5 V) is present.
	Off	Module is not ready.
1L+	Green	Output voltage 1L+ of outputes 1 ... 8 (group 1) is present.
	Off	Output voltage of outputs 1 ... 8 (group 1) is not present.
2L+	Green	Output voltage 1L+ of outputs 9 ... 16 (group 2) is present.
	Off	Output voltage of outputs 9 ... 16 (group 2) is not present.
Upper row IN 1 ... 16	Green	Input status (an LED per input). Input point active, ie. input carries a 1 signal (logically ON).
	Off	Input point inactive, ie. input carries a 0 signal (logically OFF).
Middle row OUT 1 ... 16	Green	Output status (an LED per input). Output point active, ie. output carries a 1 signal (logically ON).
	Off	Output point inactive, ie. output carries a 0 signal (logically OFF).
Lower row ERR 1 ... 16	Red	Output overload (an LED per output). Short circuit or overload on the corresponding output.
	Off	Outputs 1 ... 16 operating normally.

Specifications

Overview

This section contains the specifications for the 170 ADM 350 11 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	16 discrete inputs in 1 group 16 discrete outputs in 2 groups (8 pts/group)
Supply voltage	24 VDC
Supply voltage range	20 ... 30 VDC
Supply current consumption	max. 250 mA at 24 VDC
Power dissipation	6 W + ((# of input points on x .144 W) + (# of output points on x .25 W))
I/O map	1 input word 1 output word
Potential isolation	
Input to input	None
Output group to output group	None
Input to output group	None
Field to communication interface	Defined by Communication Adapter type
Fuses	
Internal	None
External: operating voltage	315 mA fast-blow (Wickmann 19193-315 mA or 19194-315 mA or equivalent)
External: input voltage	According to the supply of the connected sensors—not to exceed 4A fast-blow
External: output voltage	According to the supply of the connected actuators—not to exceed 4 A fast-blow/ group

Continued on next page

Specifications, Continued

General Specifications, Continued

EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V, 12 Ohm
Emmissions	EN 50081-2
Agency approvals	UL, CUL, CE, FM class 1, div. 2
Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54in)
Length	141.5 mm (5.5in) no or one busbar 159.5 mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	200 g (0.44 lb)

Discrete Inputs

The following table contains specifications for discrete inputs.

Number of points	16
Number of groups	1
Point/group	16
Signal type	True High
IEC 1131 type	1+ (See Appendix on page 607 for definitions of IEC input types.)
ON voltage	+11 ... +30 VDC
OFF voltage	-3 ... +5 VDC
Input current	2.5 mA minimum ON (6 mA at 24VDC) 1.2 mA maximum OFF
Input voltage range	-3 ... +30 VDC
Input resistance	4 kOhm
Response time	60 microsec OFF to ON 80 microsec ON to OFF

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

Output type	Solid state switch
Output supply voltage	24 VDC
Output supply voltage range	20 ... 30 VDC
Output voltage	External supply - .5 VDC
Number of points	16
Number of groups	2
Points per group	8
Current capacity	0.5 A/point maximum 4 A/group 8 A/module
Signal type	True High
Leakage current (output out)	< 1 mA @ 24 VDC
Surge (inrush) current	5 A for 1 ms
On state voltage drop	< 0.5 VDC @ 0.5 A
Fault sensing (See Note Below)	Outputs are electronically safeguarded to assist in short circuit and overload protection
Fault reporting	1 red LED/point (row 3) ON when short current/overload occurs
Error indication	Output overload for at least one out put (I/O-Error) to communication adapter
Response time (resistive load / 0.5 A)	< 0.1 ms OFF to ON < 0.1 ms ON to OFF
Maximum switching cycles	1000/h for 0.5 A inductive load 100/s for 0.5 A resistive load 8/s for 1.2 W Tungsten load



Note: Discrete 24 Vdc outputs incorporate thermal shutdown and overload protection. The output current of a shortened output is limited to a nondestructive value. The short circuit heats the output driver and the output will switch off. The output will switch on again if the driver leaves the overtemperature condition. If the short circuit still exists, the driver will reach the overtemperature condition again and will switch off again.

Section 15.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADM 350 11 TSX Momentum I/O base.

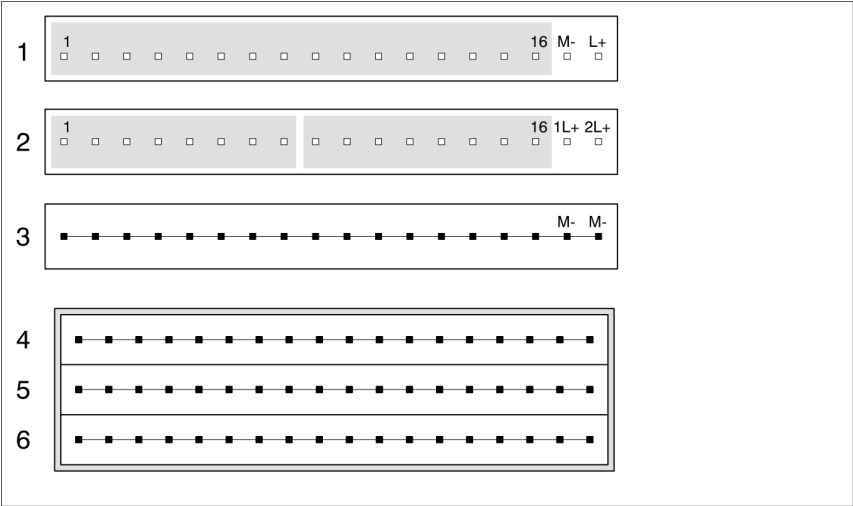
In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	275
Field Wiring Guidelines	276
Wiring Diagrams	278
Simplified Schematics	282

Internal Pin Connections

Overview This section contains a diagram showing the internal connections for terminals on the I/O base and an optional busbar.

Diagram Rows 1 through 3 shows the internal connections between terminals on the base. Rows 4 through 6 show internal connections on the optional busbar.



Field Wiring Guidelines

Overview

The inputs are field wired to row 1 of the base. The outputs are field wired to row 2.

This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-, 2-, or 3-row busbar. The following busbars are available from Schneider Automation.

Type	Number of Rows	Part Number
Screw-in	1-row	170 XTS 006 01
	2-row	170 XTS 005 01
	3-row	170 XTS 004 01
Spring-clip	1-row	170 XTS 007 01
	2-row	170 XTS 008 01
	3-row	170 XTS 003 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbars

The following table shows mapping terminal blocks and optional busbars.

Row	Terminal	Function
1	1 ... 16	Inputs
	17	Return (M-)
	18	+ 24 VDC Operating voltage (L+)
2	1 ... 8	Outputs for group 1
	9 ... 16	Outputs for group 2
	17/18	24 VDC for output group 1 (1L+) and group 2 (2L+)
3	1 ...16	Returns for outputs
	17/18	Return (M-)
4	1...18	Input voltage for I1 ... I16 or PE
5	1...18	Return (M-)
6	1...18	Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Protective Circuit May Be Required

When contacted switches are used on the input lines or when lines to the peripherals are very long, the outputs of inductive loads require protective circuitry with a clamping/suppressor diode. Install the protective circuit parallel to the operating coil.

Wiring Diagrams

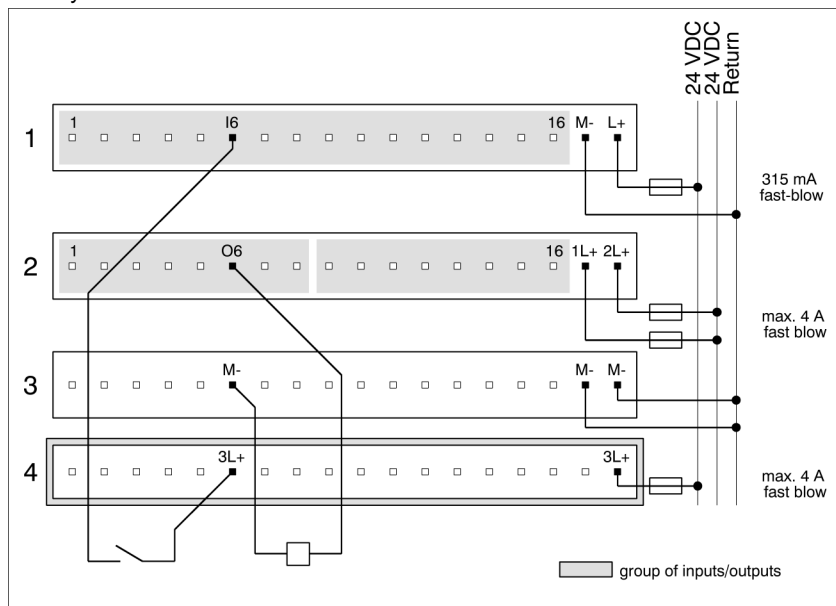
Overview

This section provides diagrams to assist you in wiring the following types of devices:

- Two-wire devices
- Sensor activated by an output
- Four-wire sensor with a two-wire actuator
- Broken wire detection

Two-Wire Devices

The diagram below shows an example of wiring for two-wire devices. Separate connections to pins 17 and 18 are shown on row 3, even though these two pins are internally connected. This is done to halve the load.



Continued on next page

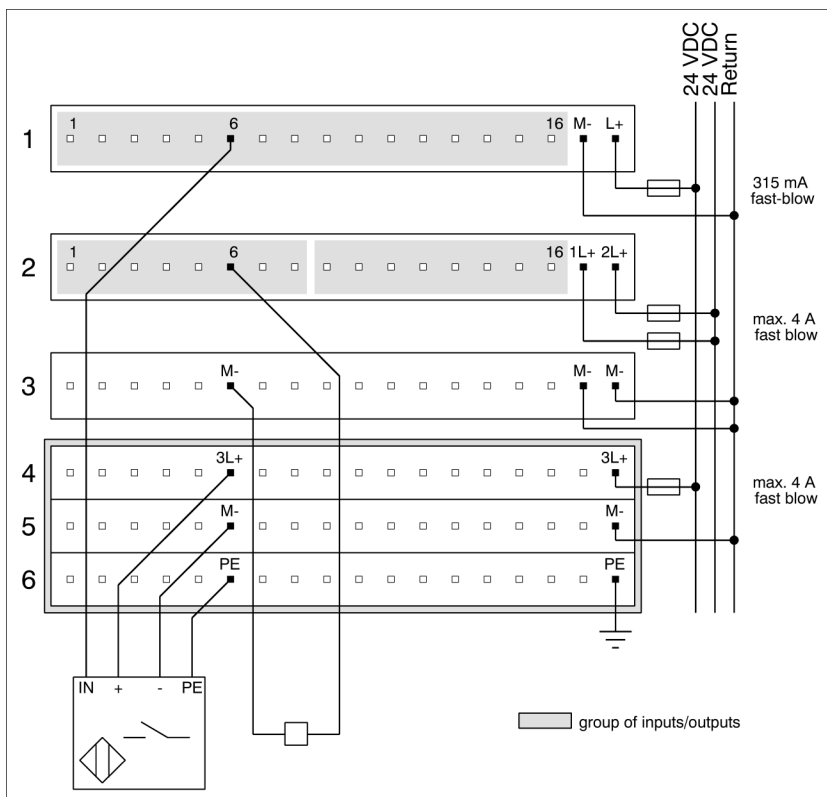
Continued on next page

Wiring Diagrams, Continued

Four-Wire Sensor with a Two-Wire Actuator

The diagram below shows a four-wire sensor with a two-wire actuator. The process of wiring a 3-wire sensor is very similar to the one below. Because 3-wire sensors do not require PE, a 2-row busbar could be used instead of the 3-row busbar shown.

Separate connections to pins 17 and 18 are shown on row 3, even though these two pins are internally connected. This is done to halve the load.



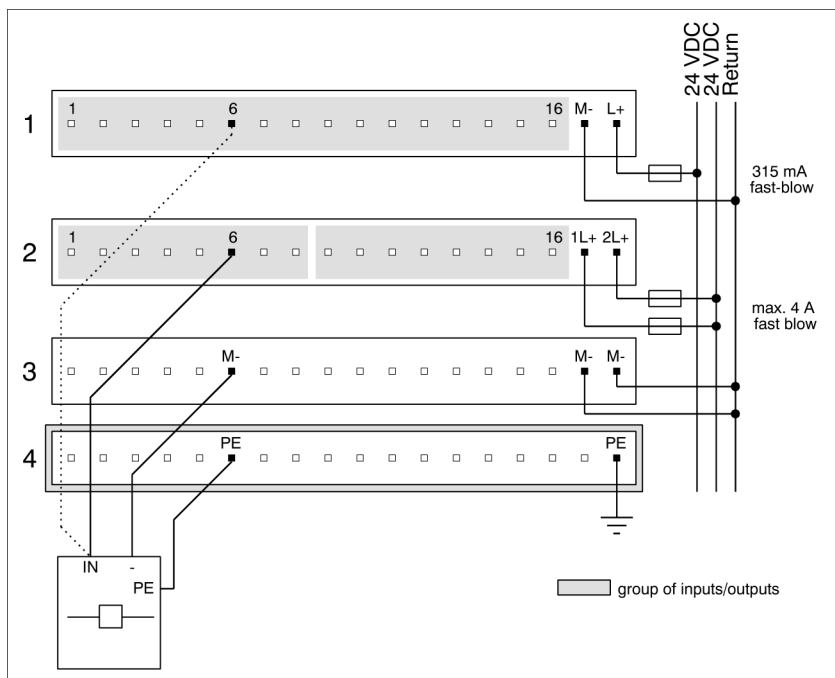
Continued on next page

Wiring Diagrams, Continued

Broken Wire Detection

The diagram below shows a three-wire actuator with an optional wiring scheme for broken wire detection. The dotted line reads back whether or not current has reached the actuator. When the output on pin 6, row 2, is high, the input from pin 6, row 2, must also be high.

Separate connections to pins 17 and 18 are shown on row 3, even though these two pins are internally connected. This is done to halve the load.



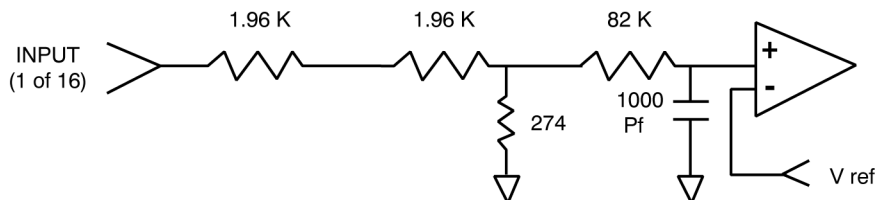
Simplified Schematics

Overview

This section contains simplified schematic diagrams of the field-side input and output circuitry.

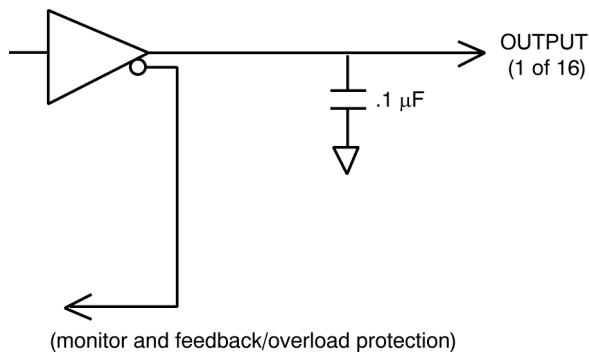
Input Diagram

The following diagram shows the field-side input circuitry.



Output Diagram

The following diagram shows the field-side output circuitry.



Section 15.3

Configuration

Discrete Inputs and Outputs

Overview	This section describes how to map data between the I/O base and the CPU.
Number of Words	<p>The processor sends 16 bits of discrete output data to the base as one 16-bit word.</p> <p>The base returns 16 bits of discrete input data to the processor as one 16-bit word.</p>
IEC vs. Ladder Logic	<p>In order to correctly field wire the inputs and map the input data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.</p> <p>Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.</p>

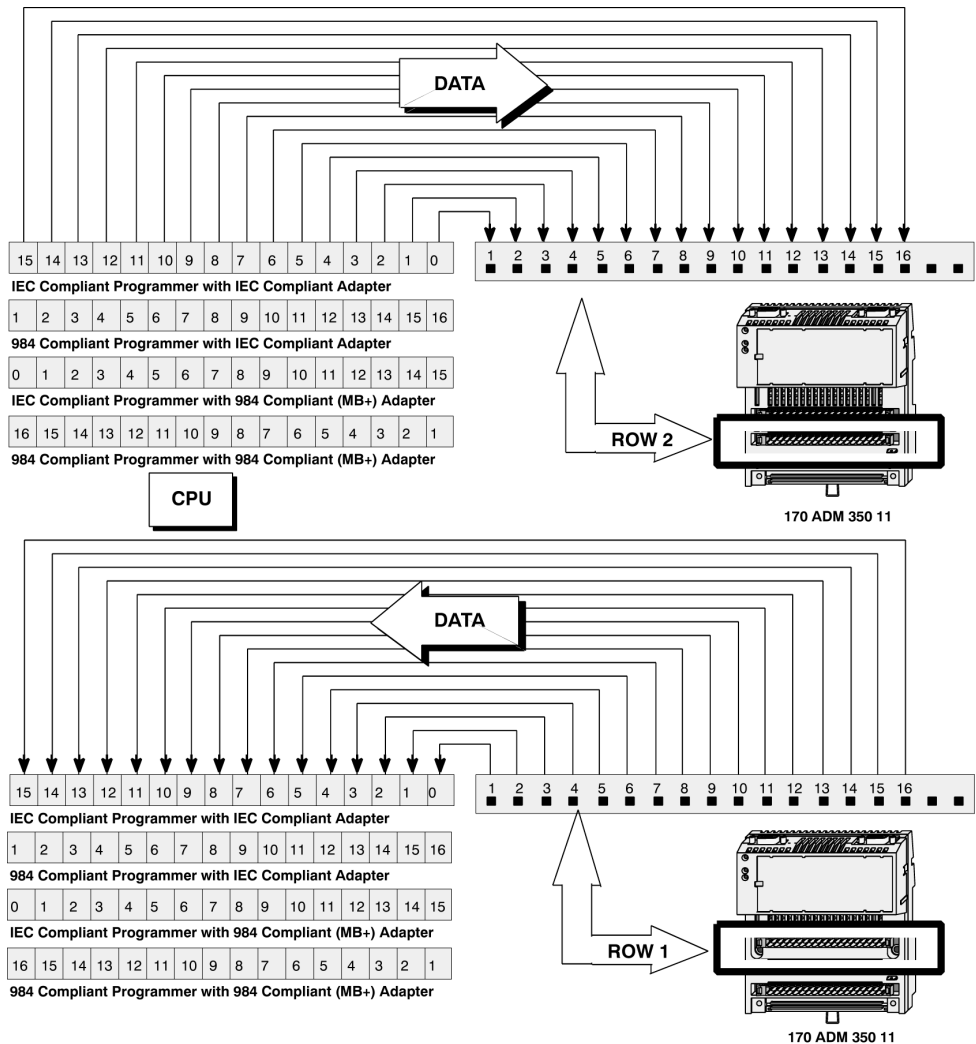
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Inputs and Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADM 370 10
24 VDC - 16 Pt. In / 8 Pt. Out @ 2
Amp. Module Base

16

At a Glance

Purpose This chapter describes the 170 ADM 370 10 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	286
Wiring	2	293
Configuration	3	303

Section 16.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 ADM 370 10 TSX Momentum I/O base and provides specifications.

In This Section

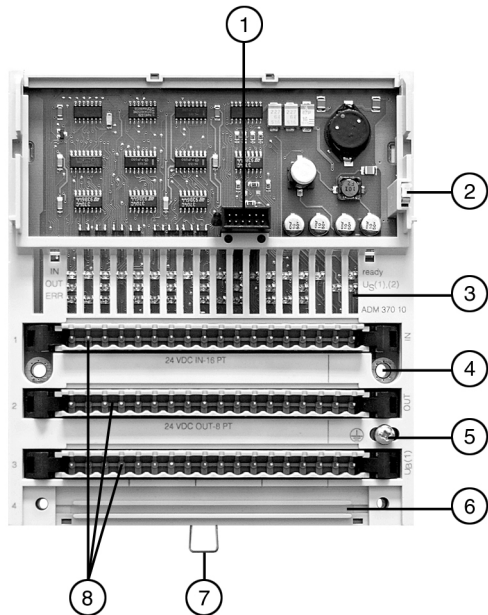
This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	287
Specifications	290

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADM 370 10 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



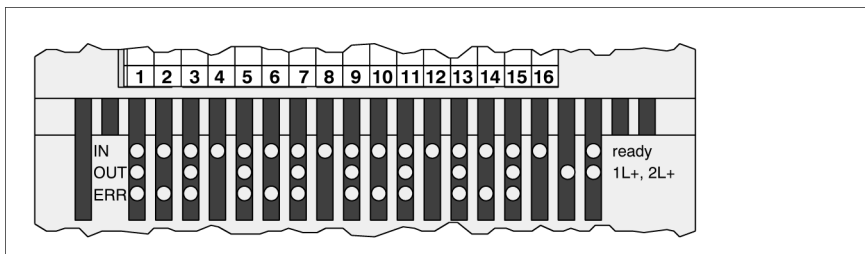
Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Busbar mounting slot
7	Locking tab for DIN rail mount
8	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



Continued on next page

Front Panel Components, Continued

LED Descriptions

The LEDs are described in the table below

Indicator	Condition	Message
ready	Green	Module is ready to communicate. Operating voltage for internal logic (5 V) is present.
	Off	Module is not ready.
1L+	Green	Output voltage 1L+ of outputs 1 ... 4 (group 1) present
	Off	Output voltage of outputs 1 ... 4 (group 1) not present
2L+	Green	Output voltage 2L+ of outputs 5 ... 8 (group 2) present
	Off	Output voltage of outputs 5 ... 8 (group 2) not present
Upper row IN 1 ... 16	Green	Input status (an LED per input); input point active, i.e. input carries a 1 signal (logically ON)
	Off	Input status (an LED per input); input point inactive, i.e. input carries a 0 signal (logically OFF)
Middle row OUT 1, 3, 5, 7, 9, 11, 13, 15	Green	Output status (an LED per output); output point active, i.e. output carries a 1 signal (logically ON)
	Off	Output status (an LED per output); output point inactive, i.e. output carries a 0 signal (logically OFF)
Lower row ERR 1, 3, 5, 7, 9, 11, 13, 15	Red	Output overload (an LED per output); overload on the corresponding output
	Off	Outputs 1 ... 8 operating normally
Lower row ERR 2, 6, 10, 14	Red	Input sensor leads short-circuited or overloaded (one LED per sensor supply line)
	Off	Input sensor current applied

Specifications

Overview

This section contains the specifications for the 170 ADM 370 10 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	16 discrete inputs in 4 groups 8 discrete outputs in 2 groups (4 pts/grp)
Supply voltage	24 VDC
Supply voltage range	20 ... 30 VDC
Supply current consumption	max. 250 mA at 24 VDC
Power dissipation	6 W + ((# of input points on x .144 W) + (# of output points on x 1 W))
I/O map	1 input word 1 output word
Potential isolation	
Input to input	None
Output group to output group	500 VAC
Input to output group	500 VAC
Field inputs to communication interface	Defined by Communication Adapter type
Fuses	
Internal	None
External: operating and input voltage	According to the power distribution to the sensors connected, but not to exceed a max. 4 A fast-blow.
External: output voltage	According to the supply of the connected actuators—not to exceed 8A slow-blow.
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V, 12 Ohm
Emmissions	EN 50081-2
Agency approvals	UL, CUL, CE

Continued on next page

Specifications, Continued

General Specifications, Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54in)
Length	141.5 mm (5.5in) no or one busbar 159.5 mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	220 g (0.49 lb)

Discrete Inputs

The following table contains specifications for discrete inputs.

Number of points	16
Number of groups	4
Point/group	4
Signal type	True High
IEC 1131 type	1+ (See Appendix on page 607 for definitions of IEC input types.)
ON voltage	+11 ... +30 VDC
OFF voltage	-3 ... +5 VDC
Input current	2.5 mA minimum ON (6 mA at 24VDC) 1.2 mA maximum OFF
Input voltage range	-3 ... +30 VDC
Input resistance	4 kOhm
Response time	2.2 ms OFF to ON 3.3 ms ON to OFF

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

Output type	Solid state switch
Output supply voltage	24 VDC
Output supply voltage range	20 ... 30 VDC
Output voltage	External supply - .5 VDC
Number of points	8
Number of groups	2
Points per group	4
Current capacity	2 A/point maximum 8 A/group 16 A/module
Signal type	True High
Leakage current (output out)	< 1 mA @ 24 VDC
Surge (inrush) current	2.8 A for 10 s max.
On state voltage drop	< 0.5 VDC @ 2 A
Fault sensing	Outputs are electronically safeguarded to assist in short circuit and overload protection
Fault reporting outputs	1 red LED/point (row 3) ON when overload occurs
Fault reporting input voltage	1 red LED (row 3) signals the state of 4 inputs belonging to the input power supply group
Error indication	In the event of an overload on at least 1 output, or a short-circuit or overload in one of the 4 encoder supply groups, (I/O-Error) to communication adapter
Response time (resistive load / 2 A)	< 0.1 ms OFF to ON < 0.1 ms ON to OFF
Maximum switching cycles	1000/h for 2 A inductive load (for inductances > 100 mH and switching currents > 1A, a clamping diode must be installed) 100/s for 2 A resistive load 10/s for 10 W Tungsten load (when the startup-current factor ≤ 10 the nominal current)

Section 16.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADM 370 10 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	294
Field Wiring Guidelines	295
Wiring Diagrams	298
Simplified Schematics	302

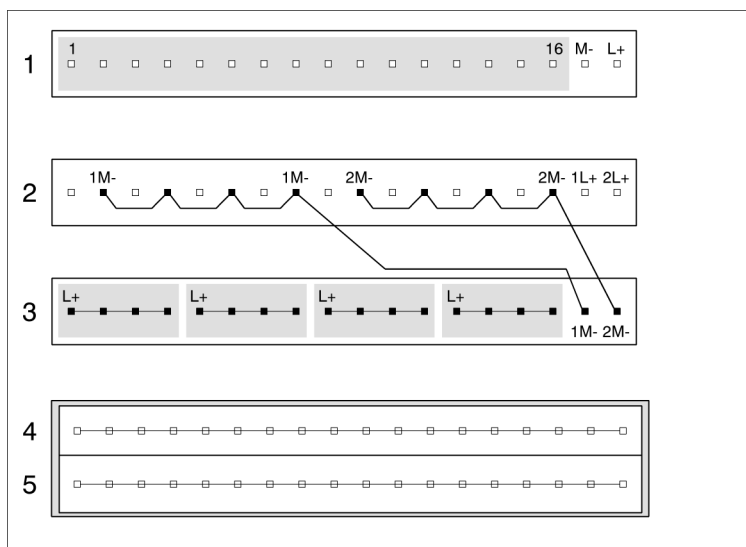
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals on the I/O base and an optional busbar.

Diagram

Rows 1 through 3 show the internal connections between terminals on the base. Rows 4 through 5 show the internal connections on the optional busbar.



Field Wiring Guidelines

Overview

Inputs are field wired to row 1 of the I/O base. Outputs are field wired to row 2 of the base.

This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1- or 2-row busbar. The following busbars are available from Schneider Automation.

Type	Number of Rows	Part Number
Screw-in	1-row	170 XTS 006 01
	2-row	170 XTS 005 01
Spring-clip	1-row	170 XTS 007 01
	2-row	170 XTS 008 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbars

The following table shows mapping terminal blocks and optional busbars.

Row	Terminal	Function
1	1 ... 16	Inputs
	17	Return (M-)
	18	+ 24 VDC Operating voltage (L+)
2	1, 3, 5, 7	Outputs for group 1
	9, 11, 13, 15	Outputs for group 2
	2, 4, 6, 8	Return (1M-) Group 1 outputs
	10, 12, 14, 16	Return (2M-) Group 2 outputs
	17/18	24 VDC for output group 1 (1L+) and group 2 (2L+)
3	1 ... 4	Input voltage for terminal pins 1 ... 4 (L+)
	5 ... 8	Input voltage for terminal pins 5 ... 8 (L+)
	9 ... 12	Input voltage for terminal pins 9 ... 12 (L+)
	13 ... 16	Input voltage for terminal pins 13 ... 16 (L+)
	17/18	Return (1M-, 2M-)
4	1 ... 18	Return (M-) for sensors
5	1 ... 18	Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Continued on next page

Field Wiring Guidelines, Continued

Protective Circuit May Be Required

When contacted switches are used on the input lines or when lines to the peripherals are very long, the outputs of inductive loads require protective circuitry with a clamping/suppressor diode. Install the protective circuit parallel to the operating coil.

Wiring Diagrams

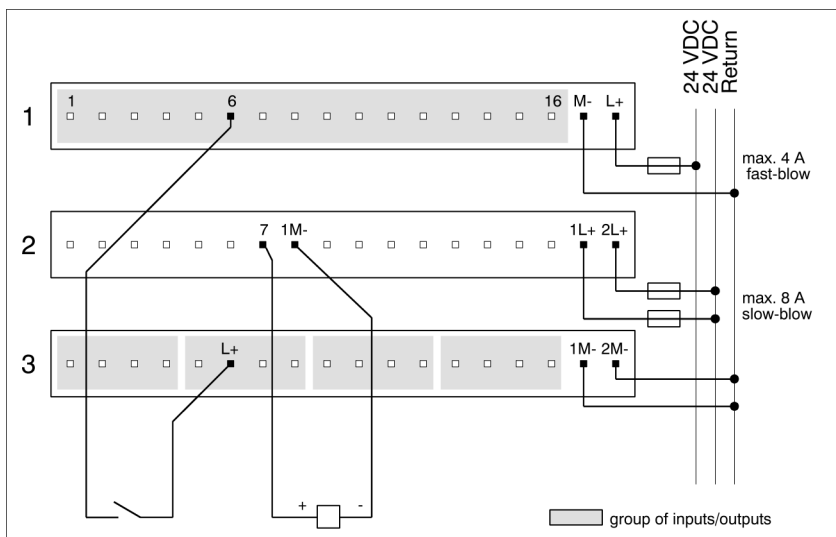
Overview

This section provides diagrams to assist you in wiring the following types of devices:

- Two-wire devices
- Four-wire sensor with a two-wire actuator
- Output enables sensor
- Broken wire detection

Two-Wire Devices

The diagram below shows an example of wiring for two-wire devices.

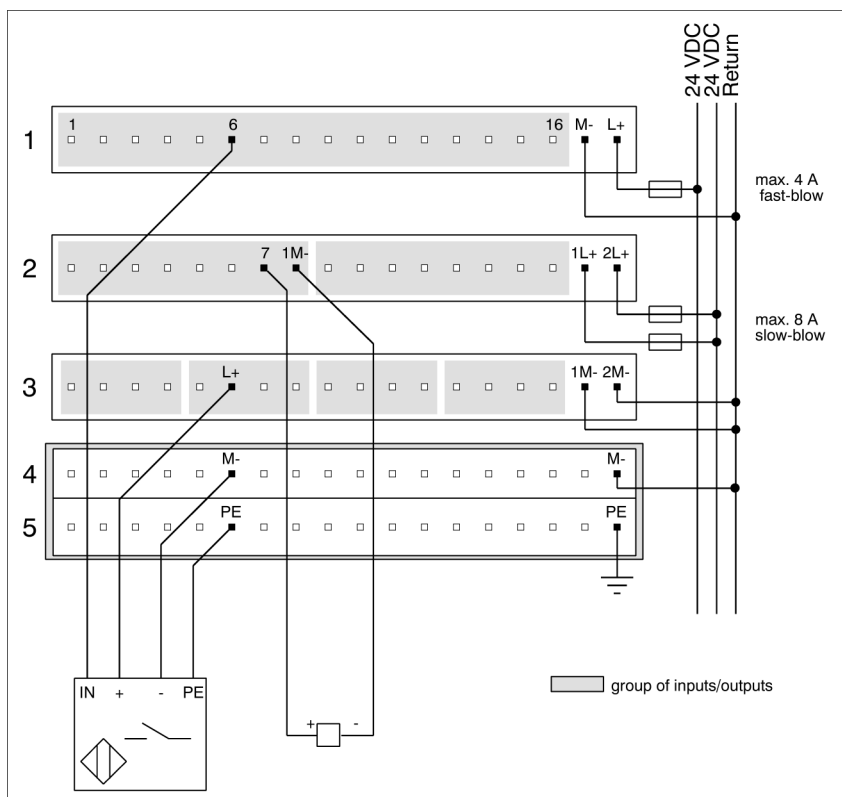


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Wiring Diagrams, Continued

Four-Wire Sensor with a Two-Wire Actuator

The process of wiring a 3-wire sensor is very similar to the example below. Because 3-wire sensors do not require PE, a 1-row busbar could be used instead of the 2-row busbar shown below.

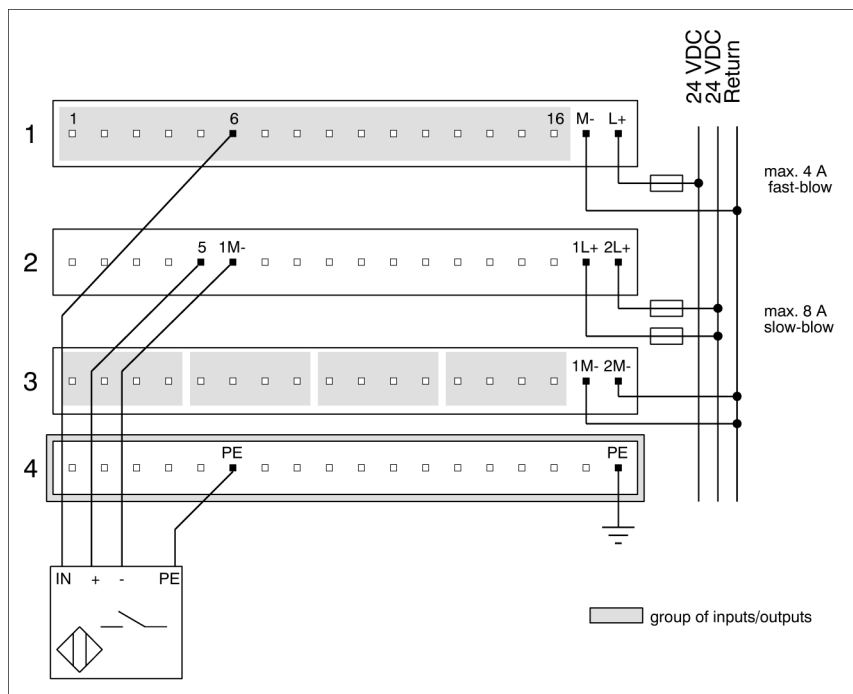


Continued on next page

Wiring Diagrams, Continued

Output Enables Sensor

The figure below shows a sensor enabled by voltage potential only when the corresponding output delivers a high signal. A similar wiring connection scheme can be used with 2- and 3- wire sensors.

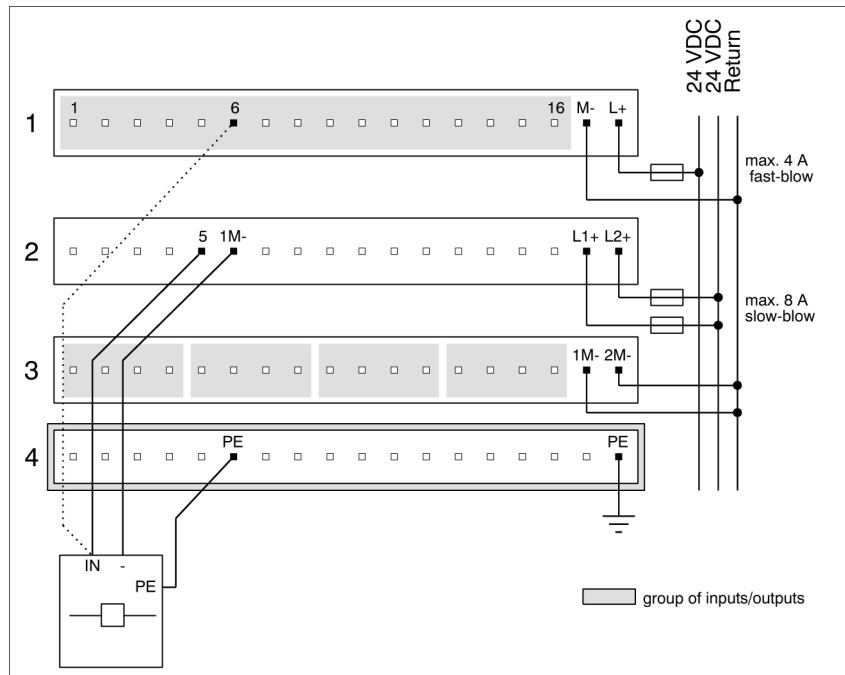


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Wiring Diagrams, Continued

Broken Wire Detection

The diagram below shows a three-wire actuator with an optional wiring scheme for broken wire detection. When output 3 is enabled, the input on pin 6, row 1 receives a high signal. The dotted line in the above wiring diagram permits broken-wire detection. It indicates whether or not current has reached the output from pin 6.



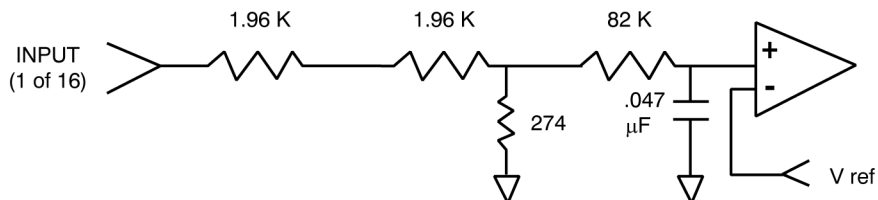
Simplified Schematics

Overview

This section contains simplified schematic diagrams of the field-side input and output circuitry.

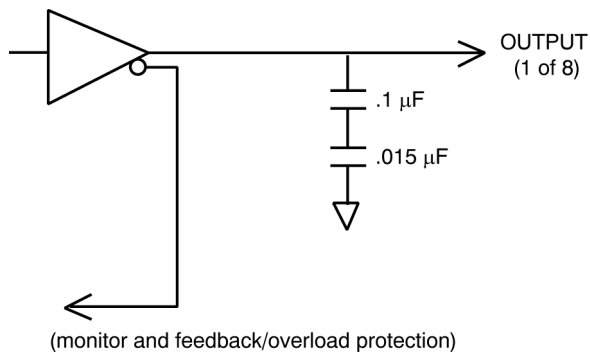
Input Diagram

The following diagram shows the field-side input circuitry.



Output Diagram

The following diagram shows the field-side output circuitry.



Section 16.3

Configuration

Discrete Inputs and Outputs

Overview	This section describes how to map input data between the CPU and the I/O base.
Background	<p>The processor sends eight bits of discrete output data to the base as one 16-bit word.</p> <p>The base returns 16 bits of discrete input data to the processor as one 16-bit word.</p>
IEC vs. Ladder Logic	<p>In order to correctly field wire the inputs and map the input data, you need to understand the type of Momentum Adapter that is mounted on the base and the type of programming software that has been used to configure and program the CPU.</p> <p>Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.</p>

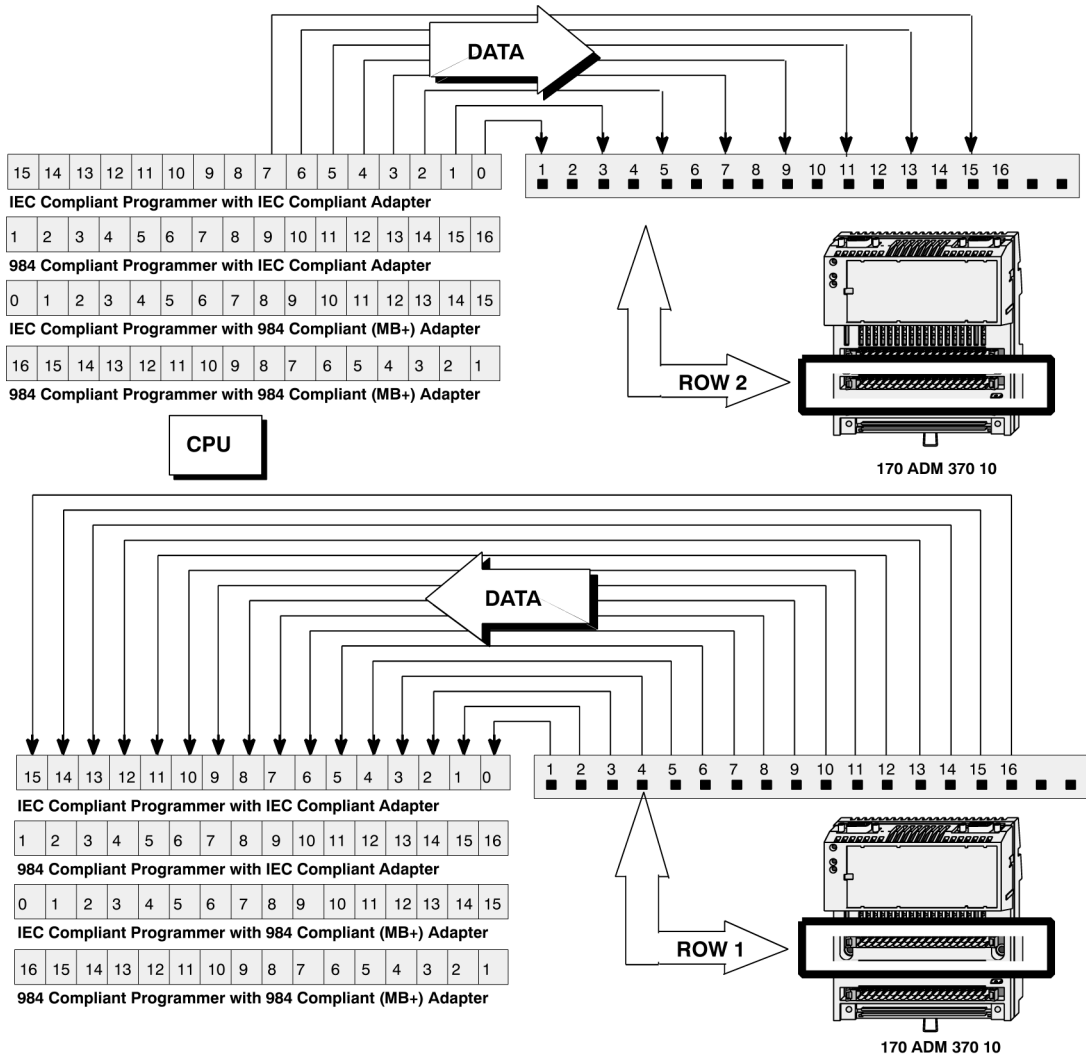
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Inputs and Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADM 390 10

24 VDC - 16 Pt. In / 12 Pt. Out

Monitored Module Base



At a Glance

Purpose This chapter describes the 170 ADM 390 10 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	306
Wiring	2	313
Configuration	3	322

Section 17.1

Module Overview

Introduction

Purpose This section describes the front panel components of the 170 ADM 390 10 TSX Momentum I/O base and provides specifications.

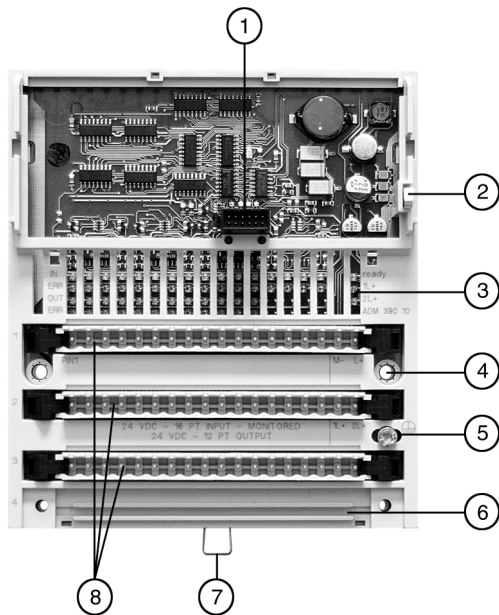
In This Section This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	307
Specifications	309

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADM 390 10 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



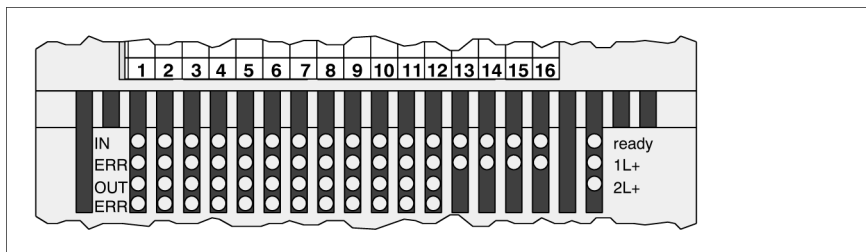
Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Busbar mounting slot
7	Locking tab for DIN rail mount
8	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below.

Indicator	Condition	Message
ready	Green	Module is ready to communicate. Operating voltage L+ for internal logic (5 V) is present.
	Off	Module is not ready.
1L+	Green	Output voltage 1L+ of outputs 1 ... 8 (group 1) present.
	Off	Output voltage of outputs 1 ... 8 (group 1) not present.
2L+	Green	Output voltage 2L+ of outputs 9 ... 12 (group 2) present.
	Off	Output voltage of outputs 9 ... 12 (group 2) not present.
Row 1 IN 1 ... 16	Green	Input status (an LED per input). Input point active, i.e. input carries "1" signal (logically "ON").
	Off	Input status (an LED per input). Input point inactive, i.e. input carries "0" signal (logically "OFF").
Row 2 ERR 1 ... 16	Red	Input detects broken wire (an LED per input).
	Off	Inputs 1 ... 16 operating normally.
Row 3 OUT 1 ... 12	Green	Output status (an LED per output). Output point active, i.e. output carries "1" signal (logically "ON").
	Off	Output status (an LED per output). Output point inactive, i.e. output carries "0" signal (logically "OFF").
Row 4 ERR 1 ... 12	Red	Output overload (an LED per output). Short circuit or overload on the corresponding output.
	Off	Outputs 1 ... 16 operating normally.

Specifications

Overview

This section contains the specifications for the 170 ADM 390 10 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	16 discrete inputs in 1 group 12 discrete outputs in 2 groups (8 pts/grp 1 and 4 pts/grp 2)
Supply voltage	24 VDC
Supply voltage range	20 ... 30 VDC
Supply current consumption	max. 180 mA at 24 VDC
Power dissipation	6 W + ((# of input points on x .125 W) + (# of output points on x .25 W))
I/O map	3 input words 1 output word
Potential isolation	
Input to input	None
Output group to output group	None
Input to output group	None
Field to communication interface	Defined by Communication Adapter type
Fuses	
Internal	None
Operating voltage	250 mA fast-blow (Wickmann 19193-250 mA or equivalent)
Input voltage	According to the supply dimensioning of the connected sensors, but not to exceed 4 A fast-blow/ group.
Output voltage	According to the supply dimensioning of the connected actuators—not to exceed 4 A fast-blow/ group.

Continued on next page

Specifications, Continued

General Specifications, Continued

EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V, 12 Ohm
Emmissions	EN 50081-2
Agency approvals	UL, CUL, CE, FM class 1, div. 2
Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54in)
Length	141.5 mm (5.5in) no or one busbar 159.5 mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	200 g (0.45 lb)

Continued on next page

Specifications, Continued

Discrete Inputs

The following table contains specifications for discrete inputs.

Number of points	16
Number of groups	1
Point/group	16
Signal type	True High
IEC 1131 type	1+ (See Appendix on page 607 for definitions of IEC input types.)
ON voltage	+11 ... +30 VDC
OFF voltage	-3 ... +5 VDC
Input current	2.5 mA minimum ON (5.7 mA at 24VDC) 1.2 mA maximum OFF
Broken wire detection	Input current less than 0.2 mA (0.3 mA required as minimum current for logical zero)
Input resistance	ca. 4 kOhm
Response time	2.2 ms OFF to ON 3.3 ms ON to OFF
Fault reporting	1 red LED/point (row 2) ON when indicating a broken wire
Error indication	Broken wire detection for at least one input (I/O Error) to communication adapter

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

Output type	Solid state switch
Output supply voltage	24 VDC
Output supply voltage range	20 ... 30 VDC
Output voltage	External supply - .5 VDC
Number of points	12
Number of groups	2
Points per group	8 (Group 1) and 4 (Group 2)
Current capacity	.5 A/point maximum 4 A/group 1 2 A/group 2 6 A/module
Signal type	True High
Leakage current (output out)	< 1 mA @ 24 VDC
On state voltage drop	< 0.5 VDC @ 0.5 A
Fault sensing	Outputs are electronically safeguarded to assist in short circuit and overload protection
Fault reporting	1 red LED/point (row 4) ON when overload occurs
Error indication	Output overload for at least one putput (I/O Error) to communication adapter
Response time (resistive load / 0.5 A)	< 0.1 ms OFF to ON < 0.1 ms ON to OFF
Maximum switching cycles	1000/h for 0.5 A inductive load 100/s for 0.5 A resistive load 8/s for 1.2 W bulb load

Section 17.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADM 390 10 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	314
Field Wiring Guidelines	315
Wiring Diagrams	318
Simplified Schematics	320

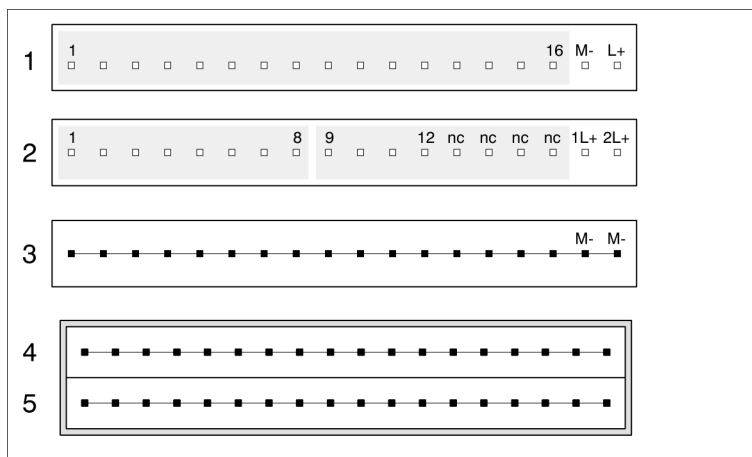
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals on the I/O base and an optional busbar.

Diagram

Rows 1 through 3 show the internal connections between terminals on the base. Rows 4 and 5 show internal connections on the optional busbar.



Field Wiring Guidelines

Overview Inputs are field wired to row 1 of the I/O base. Outputs are field wired to row 2.

 This section contains guidelines and precautions.

Terminal Connector Required To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required Depending on the type of field devices you are using, you may need a 1- or 2-row busbar. The following busbars are available from Schneider Automation.

Type	Number of Rows	Part Number
Screw-in	1-row	170 XTS 006 01
	2-row	170 XTS 005 01
Spring-clip	1-row	170 XTS 007 01
	2-row	170 XTS 008 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbar

The following table shows mapping terminal blocks and an optional busbar.

Row	Terminal	Function
1	1 ... 16	Inputs
	17	- Return (M-)
	18	+ 24 VDC Operating voltage (L+)
2	1 ... 8	Outputs for group 1
	9 ... 12	Outputs for group 2
	13 ... 16	not connected (nc)
	17/18	24 VDC for output groups 1 and 2 (1L+, 2L+)
3	1 ... 18	- Return (M-)
4	1 ... 18	Input voltage for terminal pins 1 ... 16, row 1, or PE
5	1 ... 18	Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Protective Circuit Required

When contacted switches are used on the input lines or when lines to the peripherals are very long, the outputs of inductive loads require protective circuitry with a clamping/suppressor diode. Install the protective circuit parallel to the operating coil.

Continued on next page

Field Wiring Guidelines, Continued

Wiring Inputs to Avoid Error Messages

To avoid I/O Error messages, follow these guidelines when wiring:

- Inputs require a 56 kOhm resistor parallel to the contact. Otherwise the I/O Error signal will be active as long as the input carries 0 signal.
 - Unused inputs have to be wired to the sensor supply or to L+ on row 3 directly (logical 1) or with 56 kOhm (logical 0) to avoid a permanently active I/O Error message.
-

Wiring Diagrams

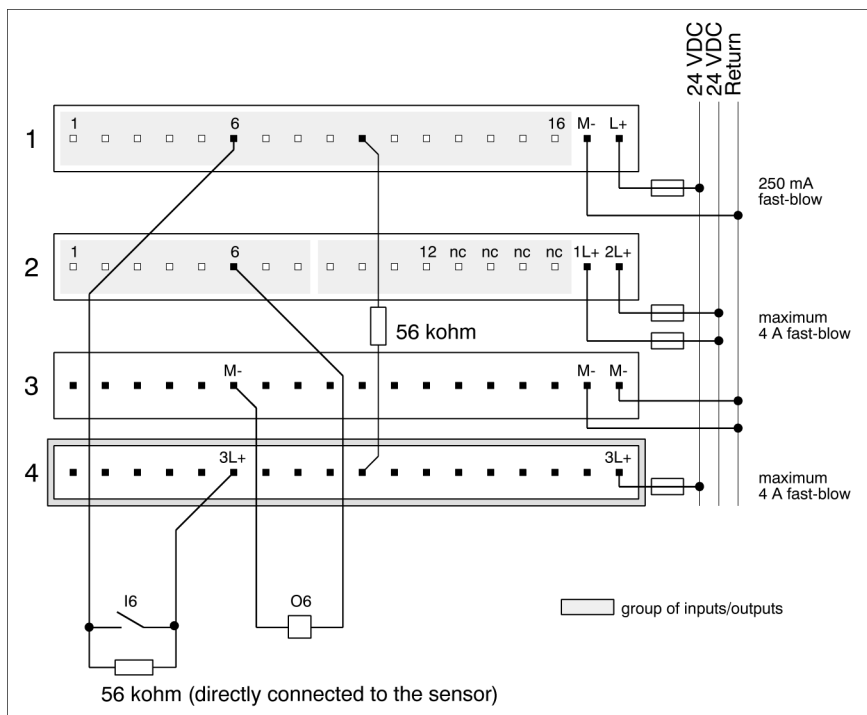
Overview

This section provides a diagram to assist you in wiring the following types of devices:

- Two-wire devices
- Three-wire sensors
- Four-wire sensors

Two-Wire Devices

The diagram below shows an example of wiring for two-wire devices. Use a 1-row busbar for this configuration.

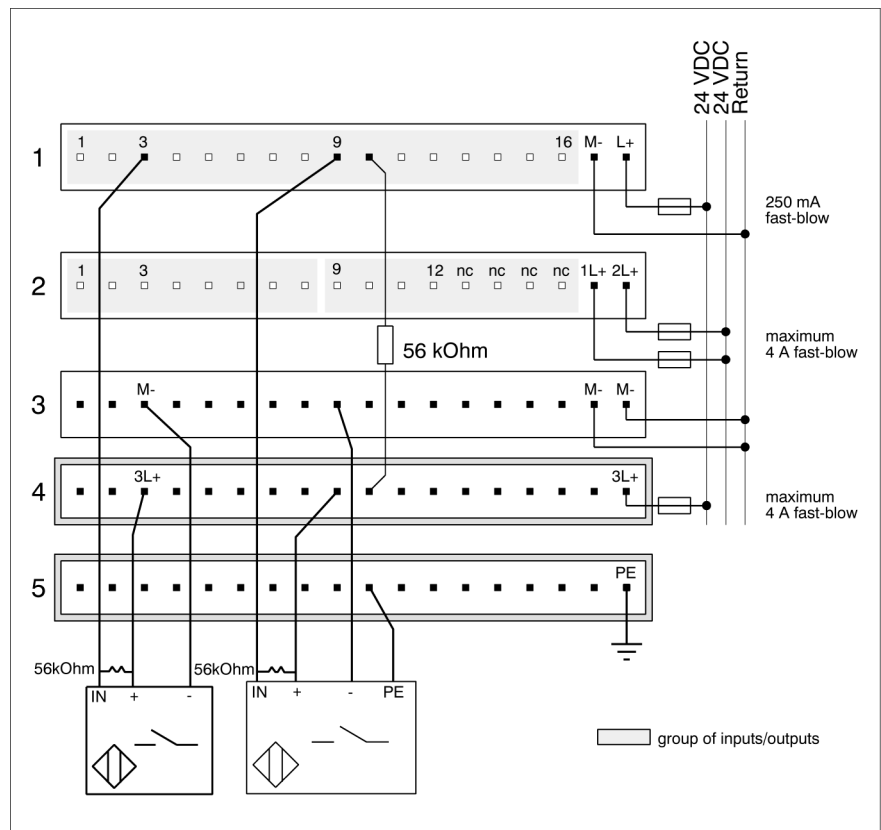


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Wiring Diagrams, Continued

Three and Four-Wire Sensors

To connect a 3- or 4-wire sensor, you need a 2-row busbar.



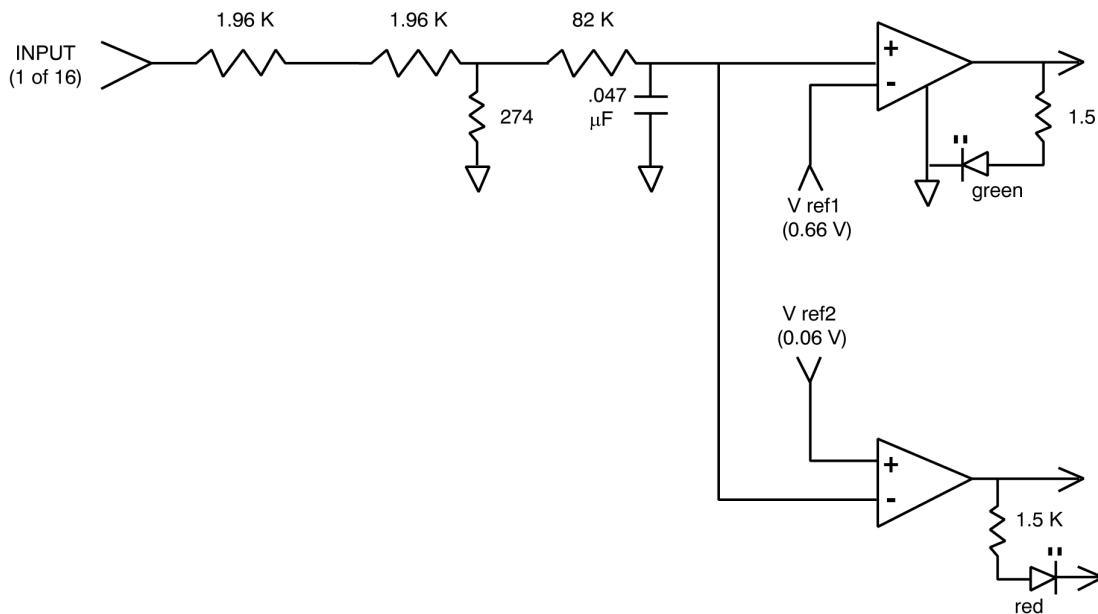
Simplified Schematics

Overview

This section contains simplified schematic diagrams of the field-side input and output circuitry.

Input Diagram

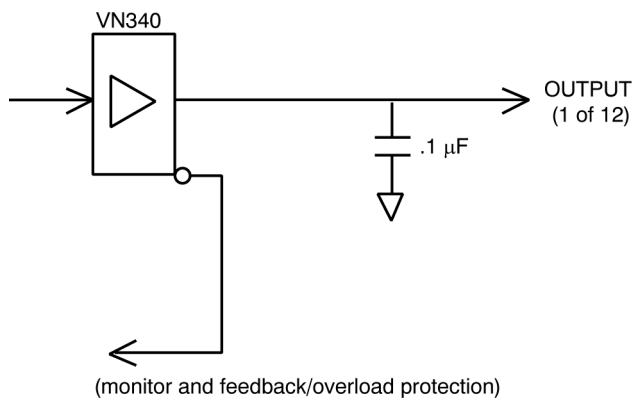
The following diagram shows the field-side input circuitry.



Continued on next page

Simplified Schematics, Continued

Output Diagram The following diagram shows the field-side output circuitry.



Section 17.3

Configuration

Discrete Inputs and Outputs

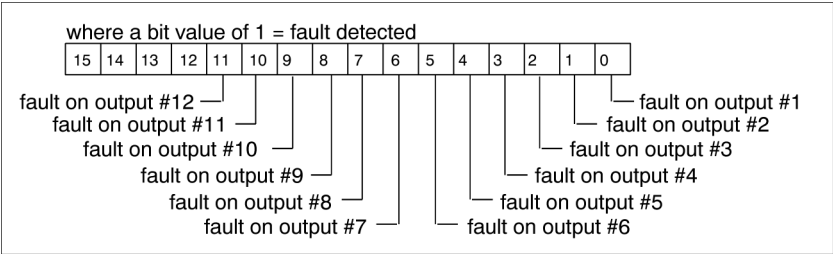
Overview This section describes how to map I/O data between the I/O base and the CPU.

Number of Words The processor sends 12 bits of discrete output data to the base as one 16-bit word.
The base returns three input data words to the processor as three 16-bit words.

Input Words The input words are described in the table below:

This word...	Is used for...
First	Fault detection status on the 12 outputs
Second	Fault detection status on the 16 inputs
Third	Field inputs

Fault Detection for Outputs The following diagram shows how bits are assigned in the first input word:

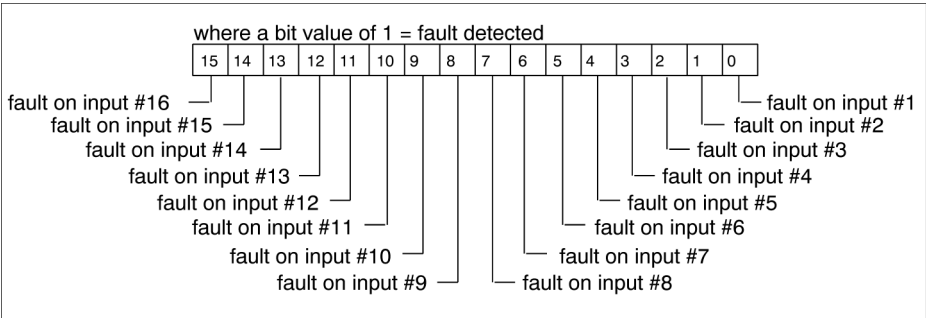


Continued on next page

Discrete Inputs and Outputs, Continued

Fault Detection for Inputs

The following diagram shows how bits are assigned in the second input word:



IEC vs. Ladder Logic

In order to correctly field wire the I/O and map the data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.

Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.

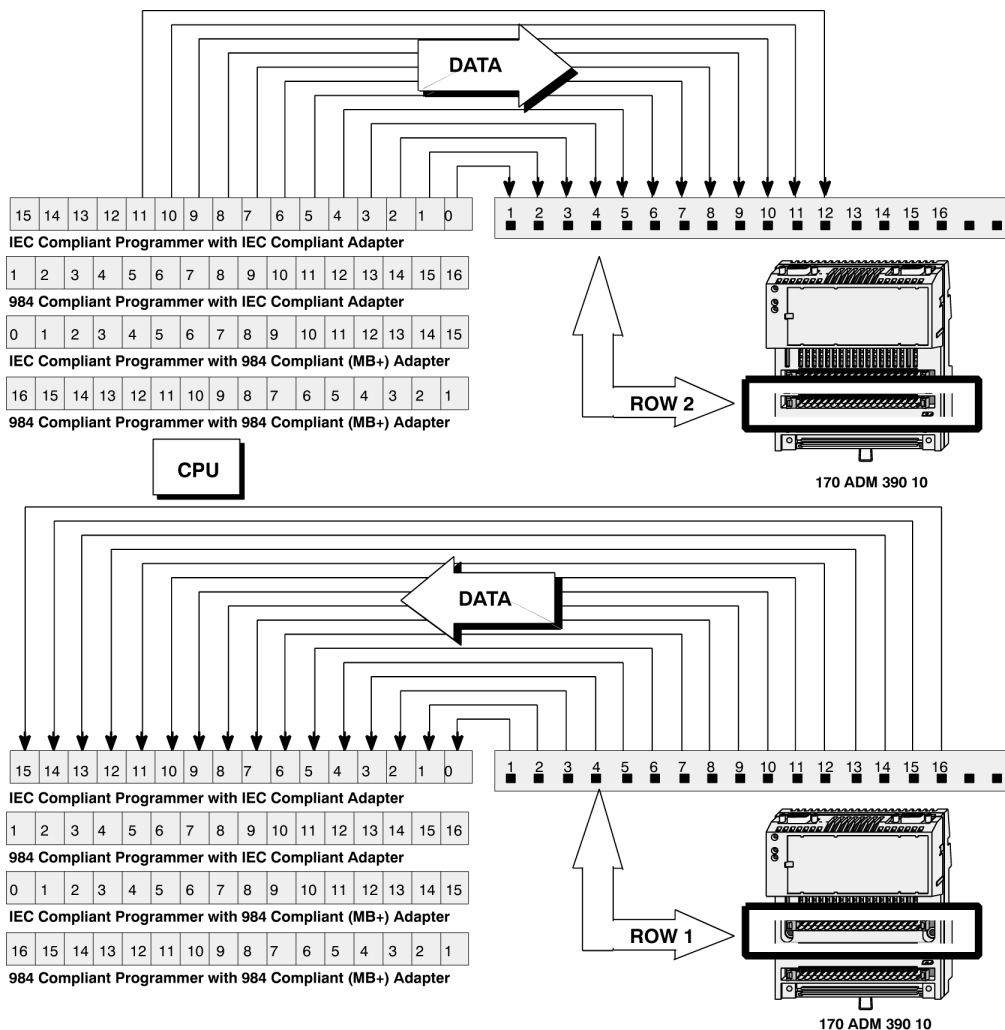
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Inputs and Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADM 390 30 24 VDC - 10 Pt. In / 8 Pt. Relay Out Module Base

At a Glance

Purpose This chapter describes the 170 ADM 390 30 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	326
Wiring	2	333
Configuration	3	341

Section 18.1

Module Overview

Introduction

Purpose This section describes the front panel components of the 170 ADM 390 30 TSX Momentum I/O base and provides specifications.

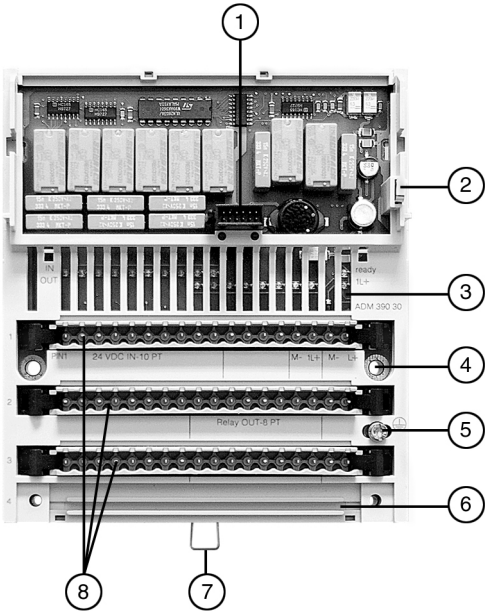
In This Section This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	327
Specifications	329

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADM 390 30 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



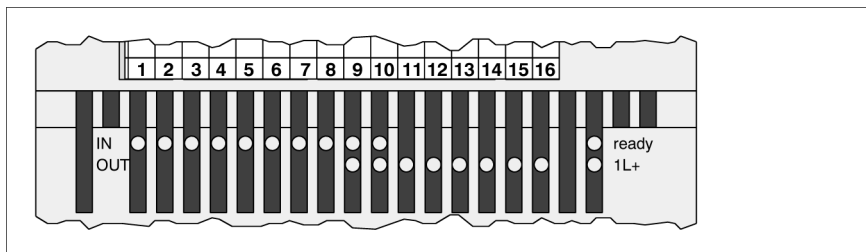
Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Busbar mounting slot
7	Locking tab for DIN rail mount
8	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below.

Indicator	Condition	Message
ready	Green	Module is eady to communicate. Operating voltage for internal logic (5 V) is present
	Off	Module is not ready
1L+	Green	Input voltage of inputs 1 ... 10 present
	Off	Input voltage of inputs 1 ... 10 not present
Upper row IN 1 ... 10	Green	Input status (an LED per input). Input point active, i.e. input carries a 1 signal (logically ON)
	Off	Input status (an LED per input). Input point inactive, i.e. input carries a 0 signal (logically OFF)
Middle row OUT 9 ... 16	Green	Output status (an LED per output). Output point active, i.e. output carries a 1 signal (logically ON)
	Off	Output status (an LED per output). Output point inactive, i.e. output carries a 0 signal (logically OFF)

Specifications

Overview

This section contains the specifications for the 170 ADM 390 30 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	10 discrete inputs in 1 group 8 relay outputs as normally open contacts in 2 groups, 4 pts/group)
Supply voltage	24 VDC
Supply voltage range	20...30 VDC
Supply current consumption	max. 250 mA at 24 VDC
Power dissipation	6 W + (# of input points on x .144 W)
I/O map	1 input word 1 output word
Potential isolation	
Input to input	None
Output group to output group	1 780 VAC RMS
Input to output	1 780 VAC RMS
Output group to communication interface	1 780 VAC RMS
Field to communication interface	Defined by Communication Adapter type
Fuses	
Internal	None
External: operating voltage (L+)	315 mA fast-blow (Wickmann 19193-315 mA or 19194-315 mA or equivalent)
External: input voltage (1L+)	max. 4 A fast-blow (Wickmann 19193-4A or equivalent)
External: output voltage (1L1, 2L1)	According to the supply of the connected actuators—not to exceed 8 A slow-blow/ group.

Continued on next page

Specifications, Continued

General Specifications, Continued

EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply AC 2 KV to PE, 1 KV to differential Surge on auxiliary power supply DC 0.5 KV, 12 Ohm
Emmissions	EN 50081-2
Agency approvals	UL, CUL, CE
Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54in)
Length	141.5 mm (5.5in) no or one busbar 159.5 mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	260 g (0.57 lb)

Continued on next page

Specifications, Continued

Discrete Inputs

The following table contains specifications for discrete inputs.

Number of points	10
Number of groups	1
Signal type	True High
IEC 1131 type	1+ (See Appendix on page 607 for definitions of IEC input types.)
ON voltage	+11 ... +30 VDC
OFF voltage	-3 ... +5 VDC
Input current	2.5 mA minimum ON (6 mA at 24VDC) 1.2 mA maximum OFF
Input voltage range	-3 ... +30 VDC
Input resistance	4 kOhm
Response time	2.2 ms OFF to ON 3.3 ms ON to OFF

Continued on next page

Specifications, Continued

Relay Outputs

The following table contains specifications for relay outputs.

Output type		Relay normally open output
Number of points		8
Number of groups		2
Points per group		4
Current capacity	20 VDC	> 5 mA (but only for new contacts) max 2 A (switching current ≤ 5 A) ohmic load max 1 A (L/R ≤ 40 ms) inductive load
	115 VDC	max. 0.5 A (switching current ≤ 1.5 A) ohmic load max. 0.15 A (L/R ≤ 40 ms) inductive load
	24 VAC	max. 2A (switching current ≤ 5 A) $\cos\phi = 1$ max. 1 A $\cos\phi = 0.5$
	230 VAC	max. 2A (switching current ≤ 5 A) $\cos\phi = 1$ max. 1 A $\cos\phi = 0.5$
Relay type		Normally Open
Leakage current (output out)		< 1.2 mA @ 230 VAC
Fault sensing		These contacts have an internal suppressor circuit.
Fault reporting		None
Error indication		None
Response time (resistive load / 0.5 A)		10 ms @ 60 Hz OFF to ON 10 ms @ 60 Hz ON to OFF
Maximum switching cycles		> 30×10^6 (mechanical) > 1×10^5 (inductive load with external protective circuitry)

Section 18.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADM 390 30 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	334
Field Wiring Guidelines	335
Wiring Diagrams	338
Simplified Schematics	340

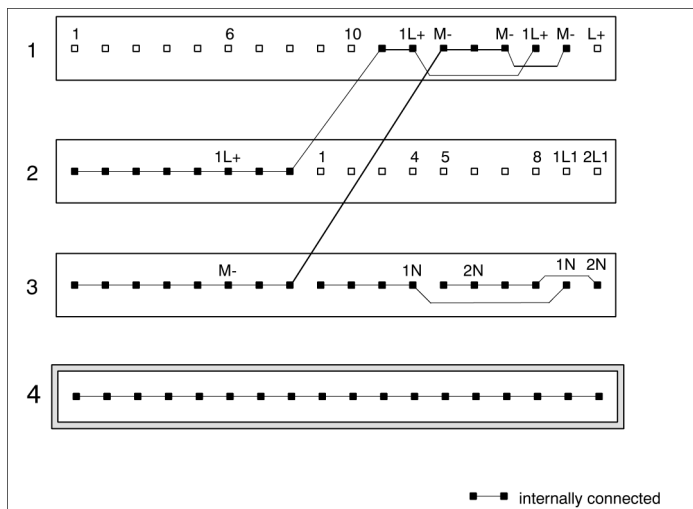
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals on the I/O base and an optional busbar.

Diagram

Rows 1 through 3 show the internal connections between terminals on the base. Row 4 shows internal connections on the optional busbar.



Field Wiring Guidelines

Overview

Inputs are field wired to row 1 of the I/O base. Outputs are field wired to row 2.

This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-row busbar. The following busbars are available from Schneider Automation.

Type	Part Number
Screw-in	170 XTS 006 01
Spring-clip	170 XTS 007 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbar

The following table shows mapping terminal blocks and an optional 1-row busbar.

Row	Terminal	Function
1	1 ... 10	Inputs
	11, 12, 16	Input voltage for terminal pins 1...10 (1L+)
	13, 14, 15	Return (M-) for the inputs
	17	Return (M-) for the module
	18	+ 24 VDC Operating voltage (L+)
2	1 ... 8	Input voltage for pins 1 ... 8 (1L+)
	9 ... 12	Outputs for group 1
	13 ... 16	Outputs for group 2
	17	Output Voltage for relays 1 ... 4 (1L1, 20 ... 115VDC or 24... 230 VAC)
	18	Output Voltage for relays 5 ... 8 (2L1, 20 ... 115VDC or 24...230 VAC)
3	1 ... 8	Return (M-) for the inputs
	9, 10, 11, 12	Return (1N) for relays 1 ... 4
	13, 14, 15, 16	Return (2N) for relays 5 ... 8
	17/18	Return/Neutral for relay outputs
4	1 ... 18	Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Continued on next page

Field Wiring Guidelines, Continued

Protective Circuit Required

When contacted switches are used on the input lines or when lines to the peripherals are very long, the outputs of inductive loads require protective circuitry with a clamping/suppressor diode. Install the protective circuit parallel to the operating coil.

Wiring Inputs to Avoid Error Messages

To avoid I/O Error messages, follow these guidelines when wiring:

- Inputs required a 56 kOhm resistor parallel to the contact. Otherwise the I/O Error signal will be active as long as the input carries 0 signal.
 - Unused inputs have to be wired to the sensor supply or to L+ on row 3 directly (logical 1) or with 56 kOhm (logical 0) to avoid a permanently active I/O Error message.
-

Wiring Diagrams

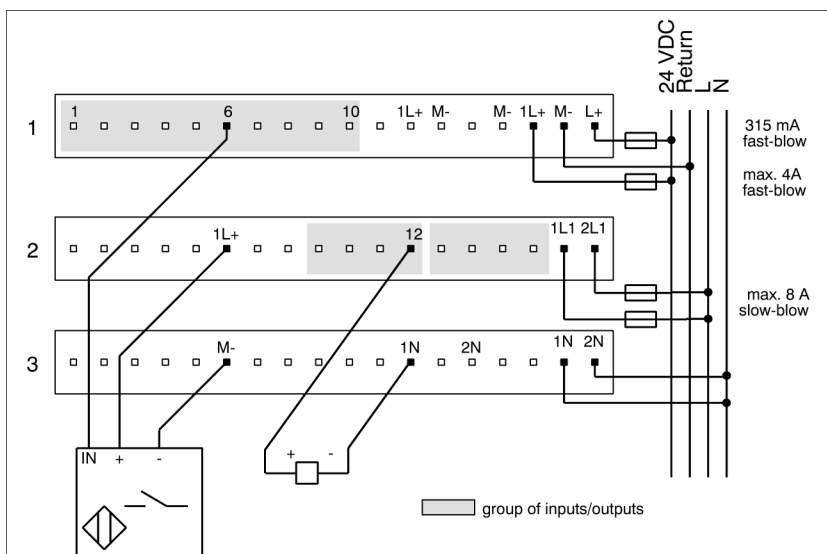
Overview

This section provides diagrams to assist you in wiring the following types of devices:

- Three-wire sensor with a two-wire actuator
- Four-wire sensor with a three-wire actuator

3-Wire Sensor with a 2-Wire Actuator

The diagram below shows field wiring for a 3-wire (24 VDC) sensor and a 2-wire (230 VAC) actuator.

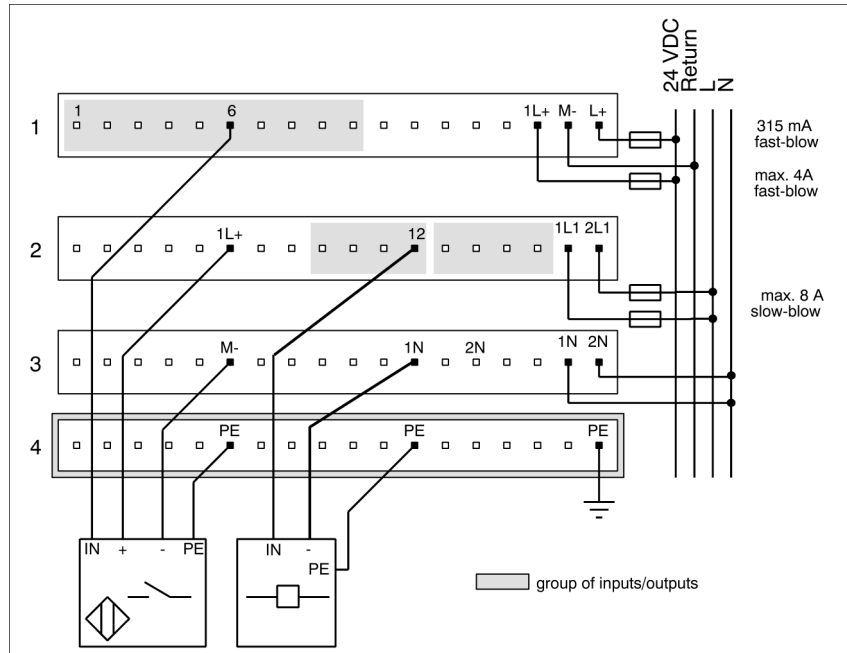


Continued on next page

Wiring Diagrams, Continued

4-Wire Sensor with a 3-Wire Actuator

The diagram below shows field wiring for a 4-wire (24 VDC) sensor and a 3-wire (230 VAC) actuator.



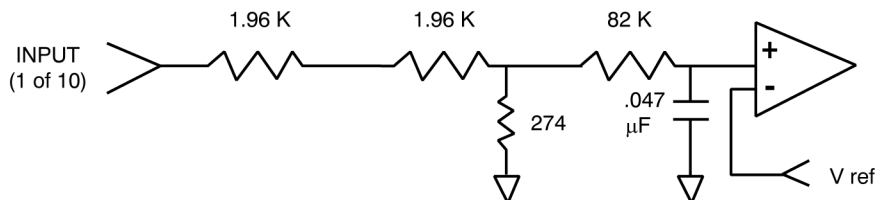
Simplified Schematics

Overview

This section contains simplified schematic diagrams of the field-side input and output circuitry.

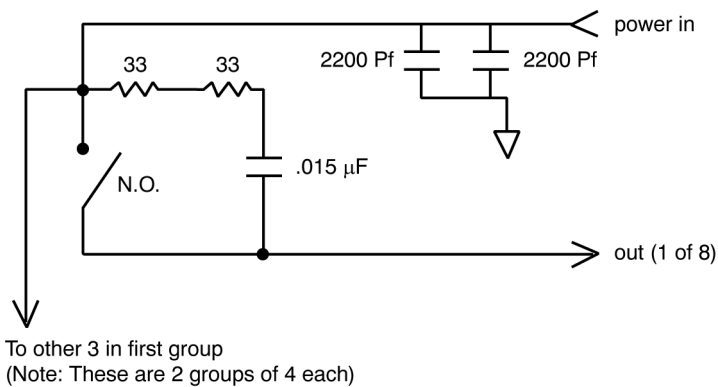
Input Diagram

The following diagram shows the field-side input circuitry.



Output Diagram

The following diagram shows the field-side output circuitry.



Section 18.3

Configuration

Discrete Inputs and Relay Outputs

Overview This section describes how to map I/O data between the I/O base and the CPU.

Number of Words The processor sends eight output data bits in one 16-bit word to the I/O base.
The base returns 10 input data bits in one 16-bit word to the processor.

IEC vs. Ladder Logic In order to correctly field wire the I/O and map the data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.

Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.

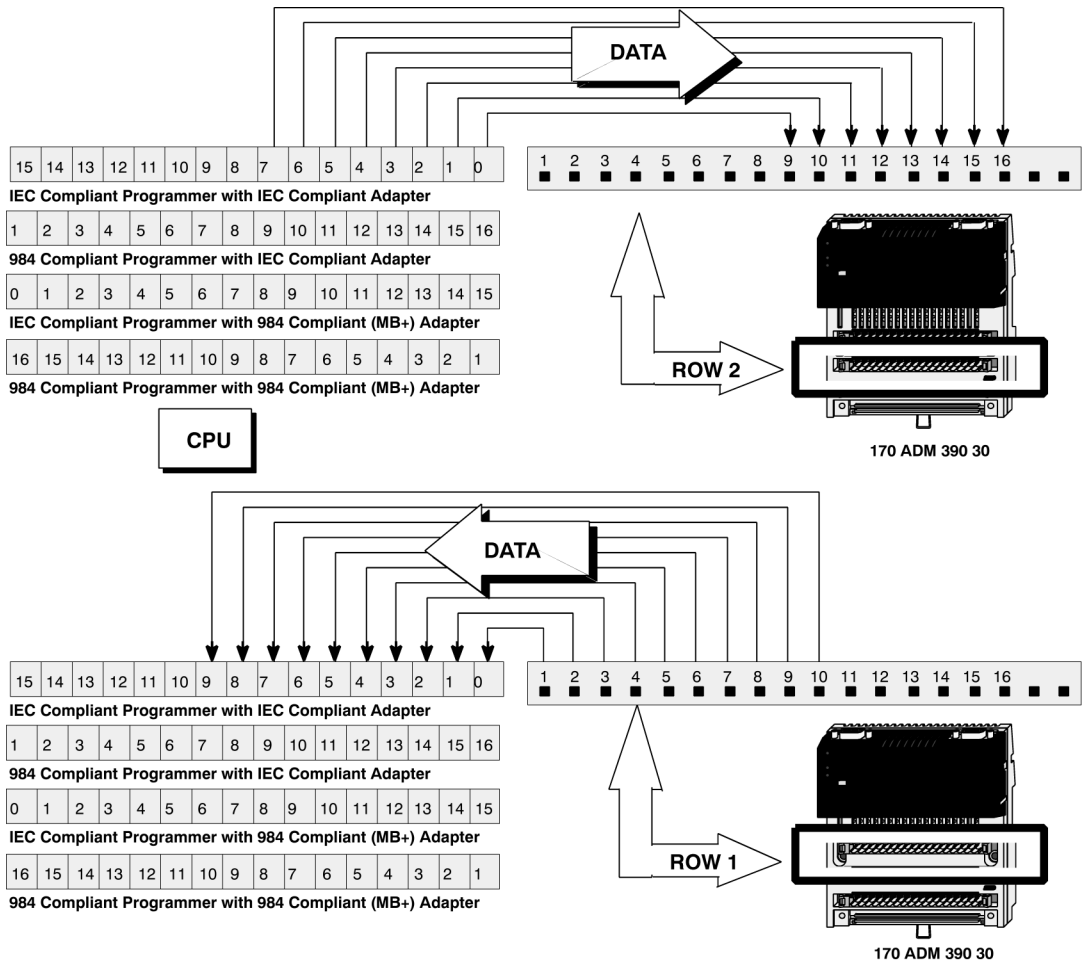
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Inputs and Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADM 540 80

120 VAC - 6 Pt. In / 3 Pt. Out

Discrete MCC Module Base

At a Glance

Purpose

This chapter describes the 170 ADM 540 80 TSX Momentum I/O base.

Module Description

This module has 6 discrete inputs and 3 discrete outputs with a Modbus communication port featuring standard Modbus protocol or generic read and writes capable of transferring blocks of data over Modbus RS485 to other Modbus slave devices such as Motor logic plus, and Power Meters.

Module Type	6 discrete inputs/ 3 discrete outputs
Operating and Output Voltages	85 ... 132 Vac
Max. Load Current/Output	0.5 A
Inrush Capacity	5 amps rms/point for 2 cycles 7.5 amps rms/point for 1cycles 15 amps rms/group for 2 cycles 22.5 amps rms/group for 1 cycle

In This Chapter

This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	344
Wiring	2	351
Configuration	3	357

Section 19.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 ADM 540 80 TSX Momentum I/O base and provides specifications.



CAUTION

Electrical voltages are present when the I/O base is under power. Be sure that the power is OFF whenever the I/O base has not been fully assembled with a communications adapter.

To be sure that power is not present, do not insert the wiring terminal connectors onto the I/O base until after the adapter has been mounted.

If you intend to remove an adapter from the base, disconnect all the terminal connectors from the I/O base before removing the adapter.

Failure to observe this precaution can result in injury or equipment damage.



Note: This module requires Modsoft 2.6.1 or greater for full functionality.

In This Section

This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	345
Specifications	347

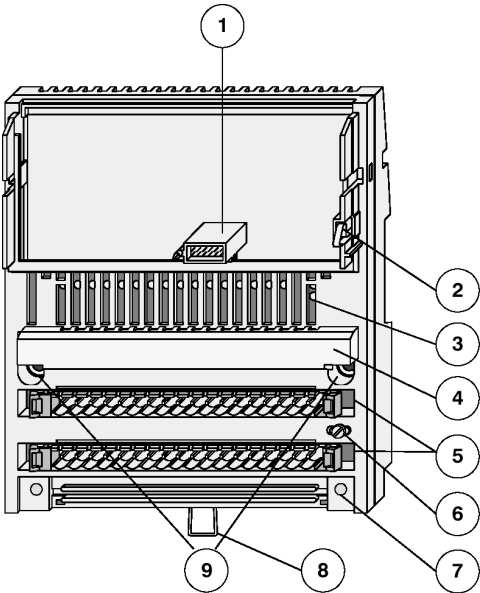
Front Panel Components

Overview

This section contains an illustration of the front panel of the 170 ADM 540 80 discrete I/O base and a description of the LEDs.

Front Panel Diagram

The front panel of the I/O base is shown in the diagram below:



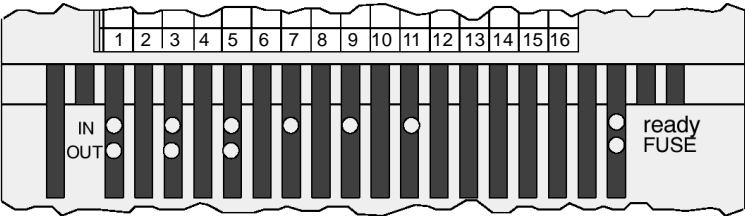
Label	Description
1	Internal interface (ATI) connector
2	Locking and ground contact for the adapter
3	LED status display
4	Protective cover
5	Sockets for the terminal connectors
6	Grounding screw
7	Busbar mounting slot
8	Locking tab for DIN rail mount
9	Mounting holes for panel mount

Continued on next page

Front Panel Components, Continued

LED Diagram

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below

LED	Status	Function
Ready	Green	Module has power
	Off	Module has no power. Check the L1 voltage source.
FUSE	Green	Output voltage present and fuse 1 (group output) and field power is OK.
	Off	Output voltage not present or fuse 1 or field power not OK.
IN	Green	Input status (an LED per input); input point active.
1 ... 6	Off	Input status (an LED per input); input point inactive.
OUT	Green	Output status (an LED per output); output point active.
1 ... 3	Off	Output status (an LED per output); output point inactive.

Specifications

Overview

This section contains specifications for the 170 ADM 540 80 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

External Power Supply Requirements	Operating Voltage	120 Vac
	Range	85 ... 132 Vac @ 47 ... 63 Hz
	Current	125 mA
Potential Isolation	Point to Point	None
	I.O points to communication adapter	1250V RMS for one minute
	Module field power to communication adapter	1250V RMS for one minute
	Module power to I.O field power	1250V RMS for one minute
	Field input to field input	1250V RMS for one minute
	Modbus Port RS485 to communication adapter	Not isolated
Fusing	Internal (replaceable)	2.5 A slow-blow (Wickmann 19195-2.5A or equivalent)
	Internal (non-replaceable)	200 mA slow-blow
	External (field power)	2 A slow-blow (Wickmann 19195-2.0A or equivalent)
	External (module power)	200 mA slow-blow (Wickmann 19195-200.mA or equivalent)
Physical Dimensions	Width	125 mm (4.9 in)
	Depth (with no adapter)	52 mm (2.05 in)
	Length	141.1 mm (5.6 in) no or one busbar 159.5 mm (6.3 in) two busbars 171.5 mm (6.75 in) three busbars
	Weight	284 g (10 oz)

Continued on next page

Specifications, Continued

General Specifications, Continued

EMC for Industrial Environment	Immunity	IEC 1131
	Emissions	EN 55011 group 1, class A
	Agency Approvals	UL, CSA, CE FM class 1, div. 2 pending

Discrete Inputs

The following table contains specifications for discrete inputs.

Discrete Inputs	Number of Points	6
	Number of Groups	1, Non-isolated
	Points per Group	6
	47 ... 53 Hz	85Vac
	ON Voltage	20Vac
	Off Voltage	5.5ma rms
	ON current	1.9ma rms
	OFF current	
	57 ... 63 Hz	79Vac
	ON Voltage	20Vac
	Off Voltage	5.5ma rms
	ON current	1.9ma rms
	OFF current	
	Absolute Maximum Input	132Vac rms continuous
	Input Response	1 line cycle maximum ON to OFF, 1 line cycle maximum OFF to ON
	Internal Impedance	12 k Ω (nominal) @ 60Hz, predominantly capacitive
	Input Protection	Resistor limited

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

Discrete Outputs	Number of Points	3
	Number of Groups	1 fuse group
	Points per Group	3
	Output Voltage	85 ... 120 ... 132 Vac @ 47 ... 63 Hz
	Surge Voltage	150 Vac for 10 sec 200 Vac for 1 cycle
	On State Voltage Drop	1.5 Vac max @ 0.5 A
	Output (Load) Current	0.5 A / point, 1.5 A / module
	Minimum Output Current	30 mA
	Maximum Surge Current (rms)	7.5 A per point, one cycle 5 A per point, two cycles
	Output Protection	RC snubber suppression, varistor
	Leakage Current	1.9 mA @ 120 Vac
	Applied dV / dT	400 V / microseconds
	Response Time	0.5 of one line cycle max OFF to ON 0.5 of one line cycle max ON to OFF

Modbus Port The following table contains specifications for the Modbus port.

Modbus Port	Baud	9600, 19200
	Parity	Even, odd or none
	Mode/data bits	8 bit RTU, 7 bit ASCII
	Stop bit	1 or 2
	Modbus Address	0 ... 247
	RS485	2 or 4 wire
Timeout	150ms (after transmission, waiting for reception)	

Continued on next page

Specifications, Continued

Modbus Port Test

Test	Spec Reference	Conditions/Levels
Radiated	EN61000-4-3	80 ... 1000Mhz, 10V/M
Fast transients	EN61000-4-4	1kV, CM, cap clamp
Surge withstand (transients)	EN61000-4-5	1kV, CM, 42 Ω source Z
Electrostatic discharge	EN61000-4-2	8kV, air discharge, 4kV, contact
Conducted RF	ENV61000-4-6	0.15 ... 80Mhz 10 VRMS
Pulsed modulated field	ENV 50140	10V/M

Section 19.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides a wiring diagram for the 170 ADM 540 80 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	352
Field Wiring Guidelines	353
Wiring Diagram	356
Configuration	357

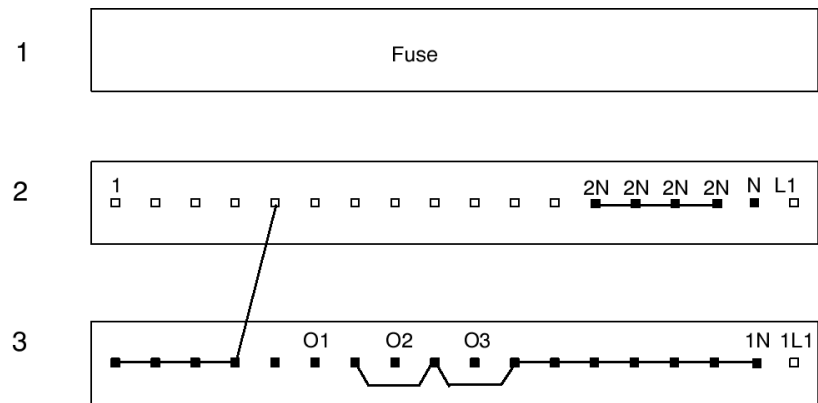
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals on the I/O base and an optional one-row busbar.

Diagram

Rows 1 through 3 show the internal connections between terminals on the I/O base. Row 4 shows the internal connections on the optional busbar.



Field Wiring Guidelines

Overview The inputs are field wired to row 2 of the base. The outputs are field wired to row 3.

 This section contains guidelines and precautions.

Terminal Connector Required To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required Depending on the type of field devices you are using, you may need a 1-row busbar. The following busbars are available from Schneider Automation.

Type	Part Number
Screw-in	170 XTS 006 01
Spring-clip	170 XTS 007 00

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbars

The following table shows mapping terminal blocks and optional busbars.

Row	Terminal	Connection	
2	1	RxHi	Modbus Master RS485
	2	RxLo	Modbus Master RS485
	3	TxHi	Modbus Master RS485
	4	TxLo	Modbus Master RS485
	5	PE	Earth Ground
	6		Not Used
	7 ... 12	I1 ... I6	Inputs 1 ... 6
	13 ... 16	2N	Voltage for input field devices, Neutral
	17	N	Module operating voltage, Neutral
	18	L1	Module operating voltage, Line
3	1 ... 4	PE	Earth Ground
	5		Not Used
	6, 8, 10	O1 ... O3	Outputs 1 ... 3
	7, 9, 11 ... 16	1N	Voltage for output field devices, Neutral
	17	1N	Voltage for output field devices, Neutral
	18	1L1	Voltage for field devices, Line
4	18	PE	Earth Ground



Note: Rows 4, 5, 6 may be added by mounting a separate terminal block to the I/O base at the grounding busbar slot. See Modicon TSX Momentum I/O Bases User Manual, 870 USE 002 00, Version 2.0.

Continued on next page

Field Wiring Guidelines, Continued



CAUTION

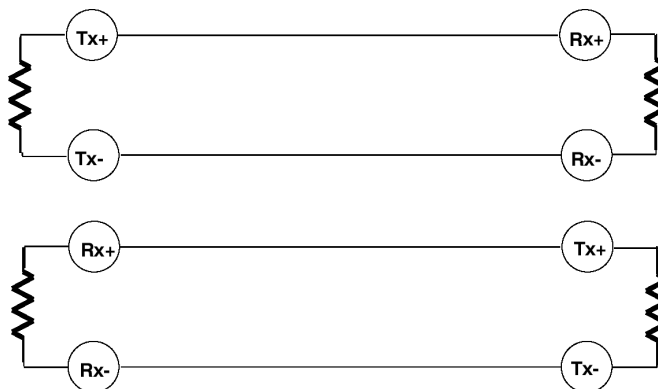
VOLTAGE SPIKE MAY BE SUFFICIENT TO DAMAGE OR DESTROY MODULE

If an external switch is wired to control an inductive load in parallel with the module output, then an external varistor (Harris V390ZA05 or equivalent) must be wired in parallel with the switch.

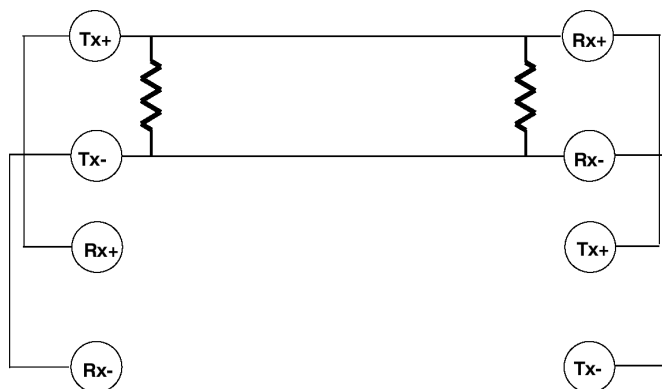
Failure to observe this precaution can result in injury or equipment damage.

Module RS-485 Termination

The illustration below shows how to properly terminate the module's RS-485 connector. Y-wire terminals with 120 Ω only at each end of the network.



OR: 2 wire the terminals with 120 Ω only at each end of the network.



Continued on next page

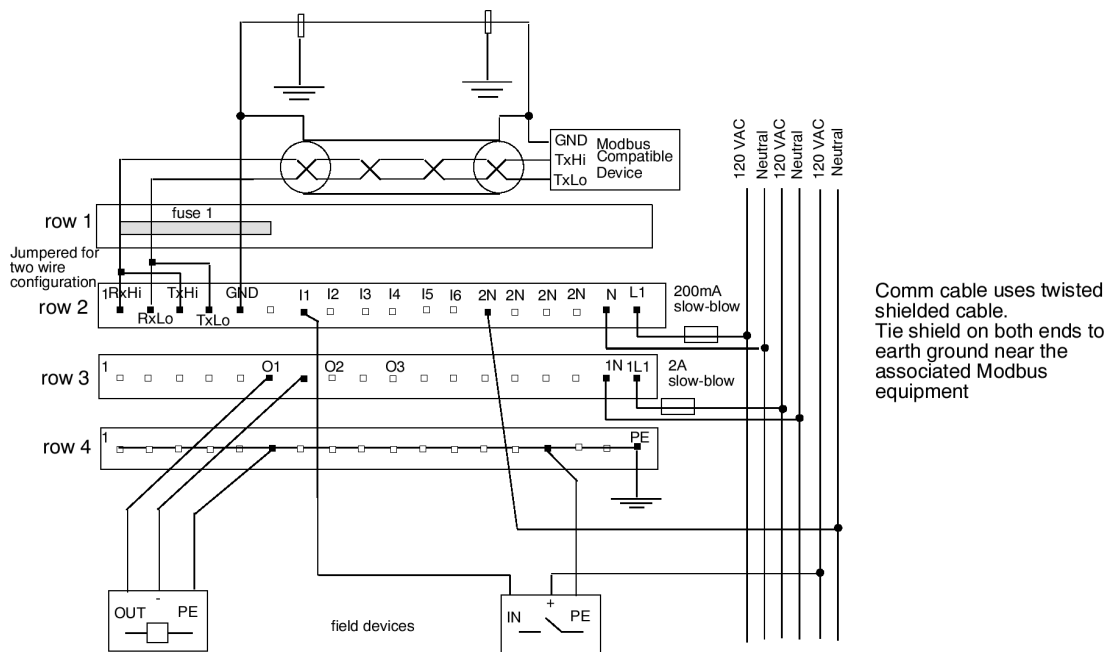
Wiring Diagram

Overview

This section contains a diagram to assist you in wiring 2-wire field devices.

Two-Wire Devices

The diagram below shows an example of wiring for two-wire devices.



Section 19.3

Configuration

Introduction

Purpose This section describes the discrete inputs and outputs.

Discrete Inputs and Outputs

Overview This section describes how to map data between the I/O base and the CPU.

Number of Words The processor sends 3 bits of discrete output data to the base as a single low byte (8 bits).

The base returns 6 bits of discrete input data to the processor as a single low byte (8 bits).

IEC vs. Ladder Logic In order to correctly field wire the I/O, you need to understand the type of Momentum Adapter that is mounted on the base and the type of programming software that has been used to configure and program the CPU. Programmers and Adapters may be either IEC compliant or 984 Ladder Logic compliant. The figure on page 359 is an example of the various data mapping possibilities.

Continued on next page

Discrete Inputs and Outputs continued

Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.

	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Mapping I/O Data from the CPU to the Base

This module is I/O mapped as 16 contiguous input words and 16 contiguous output words. The Processor sends 3 bits of discrete output data to the 170 ADM 540 80 base as a single low byte (8-bits), and the base returns 6 input data bits in a single low byte (8-bits) to the processor. The inputs are field wired to row 2, and the outputs are field wired to row 3 of the base.

Continued on next page

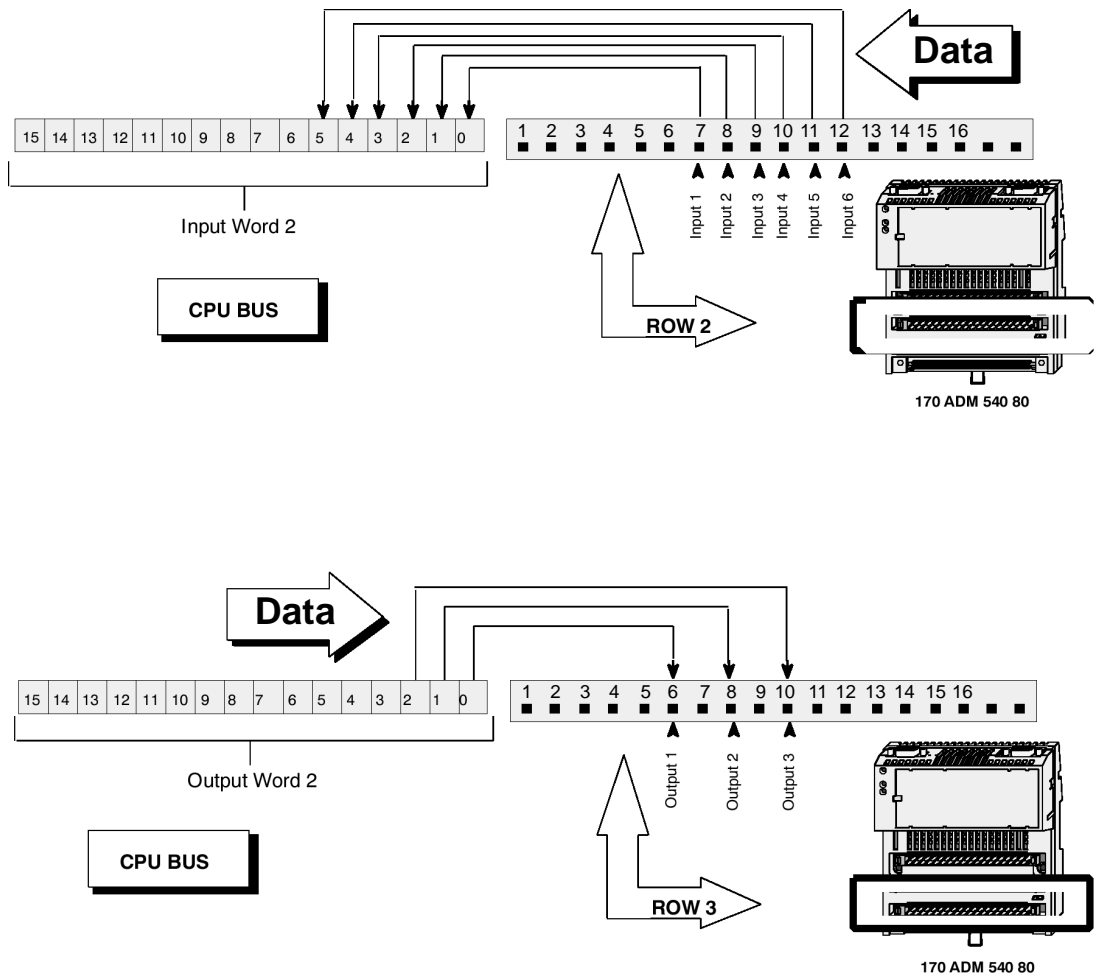
Discrete Inputs and Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



Note: 984 and IEC processor adapters operate the same with no bit swapping when mapped as registers or words



Continued on next page

General Modbus Message Rules

Introduction

Purpose	The following rules state what is expected of the user and what the expected response is.
Sequence Number	A change in the sequence number starts any and all Modbus transactions. The I/O module contains the last sequence number written and starts with 0 at power-up. The sequence number is echoed to the input buffer after the Modbus message is complete. Continuous read data can be obtained after the first initial read, by incrementing the sequence number only every scan.
Command and Response	See <i>Output Words Control Modes</i> on page 368 and <i>Input Words Control Modes</i> on page 377. No more than 4 commands can be requested at any one time (Control Modes 4 ... 8). The response for the requests are returned in the response registers.
Block Read Response	All read commands are contiguous, incrementing up from the starting address to the numbers specified by length. The first read command with a length of zero or a length that is larger than the allocated response buffer will end further Modbus processing and the remainder of the input data field will be zeroed. The first read command starts at the end of the buffer, (words 15 and 16). The first word of the response data is placed in word 5 of the input buffer. After word 5 all read data values fill in consecutively as executed.
Block write Response	All block write commands (Control Modes 2 and 3) are contiguous, incrementing up from the starting address to the numbers specified by length. Block write commands with a length of zero or a length that is larger than the allocated command buffer will not be executed. However, the read in control mode 3 will be executed regardless of the write command.

Continued on next page

General Modbus Message Rules, Continued

Single write Response	All single write commands (Control Modes 4 ... 8) will be executed. Zero is a legal start address and a legal data value.
Read / Write Commands	All Write commands precede the read response.
Modbus Message Time out	The Modbus message time out is fixed in the firmware at 200 msec and cannot be altered.
Start Address	Start address of 0 = Modbus register 400001. For example: A Modbus start address of 0 is actually Modbus register 400001. A value of 9 is actually 400010.
Modbus Protocol	For a better understanding of Modbus protocol, refer to PI-MBus-300, Modbus Protocol Reference Guide.

Continued on next page

General Modbus Message Rules, Continued

General Modbus Response The table below lists the possible Modbus response codes.

Response	Code
Illegal function	01 Hex
Illegal data address	02 Hex
Illegal data value	03 Hex
Device failure	04 Hex
Acknowledge	05 Hex
Busy, message rejected	06 Hex
Bad Modbus state Rcv_int	1C Hex
Bad comm state trn_asc	1F Hex
Bad comm state trn_rtu	1D Hex
Bad comm state rcv_asc	20 Hex
Command buffer full error	21 Hex
Bad comm state rcv_rtu	22 Hex
Bad frame type put_chr	23 Hex
Bad transmit comm state	25 Hex
Bad receive comm state	26 Hex
Bad Modbus state tmr0_evt	27 Hex
3 char timeout ASCII mode	28 Hex
No message requested	29 Hex
Bad data length	2A Hex
CRC error	2B Hex
Illegal control mode (> 8)	2C Hex
Control mode 0 failed	30 Hex
Control mode 1 failed	31 Hex
Control mode 2 failed	32 Hex
Control mode 3 failed	33 Hex
Control mode 4 failed	34 Hex
Control mode 5 failed	35 Hex
Control mode 6 failed	36 Hex
Control mode 7 failed	37 Hex
Control mode 8 failed	38 Hex
Message Mismatch	50 Hex
Message accepted	55 Hex

I / O Map Registers

Introduction

Purpose This section describes the I/O map registers.

In This Section This section contains the following topics:

For This Topic...	See Page...
Output Words 4x ... 4x + 15	364
Output Word 1	364
Output Word 2	365
Output Word 3	366
Output Word 4	367

Continued on next page

I / O Map Registers, Continued

Output Words 4x ... 4x + 15

16 words of output data are used for 3 120Vac output points and commands for the Modbus master device.

Output Words		
Word 1	Sequence #	
Word 2	Output configuration	AC output
Word 3	Control mode	
Word 4	Port configuration	Slave Node
Word 5 ... 16	Message data field	

Output Word 1

- Valid settings are 1 ... FFFF
- The module defaults to zero at power-up (module shut down)
- Whenever the module is set to zero, it goes to the module shut down state.
- When the value in the first output word is not equal to the first input word then a Modbus message will be sent. When they are equal, there will be no message activity.
- A change in the sequence word value starts the Modbus command execution. It is your responsibility to change the output data for the Modbus message. The sequence number must be the last word of information written in order to ensure Modbus messages are correctly handled.

Depending on how the application is written, moving a block of data to the registers which includes a change in the sequence number is acceptable.



CAUTION

Zero is an illegal sequence number.

A zero value in word one will cause an output shut down state and no inputs are updated.

Failure to observe this precaution can result in injury or equipment damage.

Continued on next page

I / O Map Registers, Continued

Module Shut Down is defined as:



- Hold last value, OR
- User defined, OR
- Minimum output (OFF)

Note: When the sequence number is 1 ... FFFF, the 120 Vac output and input data are collected every scan and are not affected by the sequence number. When a sequence number is zero, this causes shut down status and no input update. Discrete input and output points are processed every scan and are independent of the module's communication activity.

Output Word 2

Output word 2 contains 3 bits of 120 Vac discrete output data, 3 bits of user defined output data shut down values and 2 bits for user shut down state.

Word 2 High Byte (Shut down states)	
Bit 15	0= Shut down state minimum output 1= Check bit 14 for shut down state
Bit 14	0= Hold last value (shut down state) 1= User defined (shut down state)
Bit 13 ... 11	Not used
Bit 10	User defined value for output 3 (shut down)
Bit 9	User defined value for output 2 (shut down)
Bit 8	User defined value for output 1 (shut down)
Word 2 Low Byte (120 Vac output data)	
Bit 7 ... 3	Not used
Bit 2	Output 3
Bit 1	Output 2
Bit 0	Output 1

Continued on next page

I/O Map Registers, Continued

Output Word 3 See *Output Words Control Modes* on page 368. Output word 3 contains the Modbus message control mode.

Word 3 Control Modes			
Mode	Value	Function	Description
Mode 0	0	Idle	No Modbus activity. Input buffer to zero
Mode 1	1	Modbus message	The I/O module executes the data field from a user-defined Modbus message
Mode 2	2	Block write	The I/O module performs a block write command (Modbus function code 16)
Mode 3	3	Block write and Block read	The I/O module performs mode 2 plus a block read command
Mode 4	4	4 single writes	The I/O module performs 4 Modbus function code 06 commands (single writes)
Mode 5	5	3 single writes and 1 block read	The I/O module performs 3 Modbus function code 06 commands (single writes) and Modbus function code 03 (1 block read command)
Mode 6	6	2 single writes and 2 block reads	The I/O module performs 2 Modbus function code 06 commands (single writes) and Modbus function code 03 (2 block read commands)
Mode 7	7	1 single writes and 3 block reads	The I/O module performs 1 Modbus function code 06 commands (single writes) and Modbus function code 03 (3 block read commands)
Mode 8	8	4 block reads	The I/O module performs Modbus function code 03 (4 block read commands)
Others	-	Illegal command	Response = illegal control mode

Continued on next page

I/O Map Registers, Continued

Output Word 4 Output word 4 contains the port configuration parameters (High byte) and the Modbus slave address (Low byte).

Word 4 - Port Configuration	
High Byte	
Bit 15	0= 1 stop bit 1= 2 stop bits
Bit 14	0= 7 data bits 1= 8 data bits
Bit 13	0= no parity 1= parity enabled
Bit 12	0= odd parity 1= even parity
Bits 11 ... 8	0010= 19.2 baud others= 9600 baud
Low Byte	
Bits 7 ... 1	Modbus slave node address

Output Words Control Modes

Introduction

Purpose This section describes output words 5 ... 16 control modes.

In This Section This section contains the following topics:

For This Topic...	See Page...
Control Mode 0	369
Control Mode 1	369
Control Mode 2	369
Control Mode 3	370
Control Mode 4	370
Control Mode 5	371
Control Mode 6	372
Control Mode 7	373
Control Mode 8	374

Output words 5 ... 16 Output words 5 ... 16 are used as data for specific control modes.



Note: Be sure you read *General Modbus Message Rules* on page 360

Continued on next page

Control Modes

Output Words Mode Memory Allocation

Output word modes are used for message data. The table below describes the specific memory allocation for each control mode.

Control Mode 0

Control Mode 0 - Idle, Clear Response Buffer		
Word 1	Sequence #	
Word 2	Output Configuration	Output
Word 3	Control Mode 0	
Word 4	Port Configuration	Slave node address
Words 5 ... 16	Not used	

Control Mode 1

Control Mode 1 - Modbus Message		
Word 1	Sequence #	
Word 2	Output Configuration	Output
Word 3	Control Mode 1	
Word 4	Port Configuration	Message length
Words 5 ... 16	12 words of message output data	

Control Mode 2

Control Mode 2 - Block Write		
Word 1	Sequence #	
Word 2	Output Configuration	Output
Word 3	Control Mode 2	
Word 4	Port Configuration	Slave node address
Word 5	Start address - value of 0 = 400001	
Word 6	Number of data words, 1 ... 10 are valid	
Words 7 ... 16	10 words of message output data	

Continued on next page

Control Modes, Continued

Control Mode 3

Control Mode 3 - 1 Block Write And 1 Block Read Command		
Word 1	Sequence #	
Word 2	Output Configuration	Output
Word 3	Control Mode 3	
Word 4	Port Configuration	Slave node address
Word 5	First write command address - value of 0 = 400001	
Word 6	Number of data words, 1 ... 8 are valid	
Words 7 ... 14	8 words of message output data	
Word 15	First read command address	
Word 16	Number of data words to read, 1 ... 12 are valid	

Control Mode 4

Control Mode 4 - 4 Single Write Commands		
Word 1	Sequence #	
Word 2	Output Configuration	Output
Word 3	Control Mode 4	
Word 4	Port Configuration	Slave node address
Word 5	First single write command address - value of 0 = 400001	
Word 6	1 word of message output data	
Word 7	Second single write command address - value of 0 = 400001	
Word 8	1 word of message output data	
Word 9	Third single write command address - value of 0 = 400001	
Word 10	1 word of message output data	
Word 11	Fourth single write command address - value of 0 = 400001	
Word 12	1 word of message output data	
Words 13 ... 16	Not used	

Continued on next page

Control Modes, Continued

Control Mode 5

Control Mode 5 - 3 Single Writes And 1 Block Read Command		
Word 1	Sequence #	
Word 2	Output Configuration	Output
Word 3	Control Mode 5	
Word 4	Port Configuration	Slave node address
Word 5	First single write command address - value of 0 = 400001	
Word 6	1 word of message output data	
Word 7	Second single write command address - value of 0 = 400001	
Word 8	1 word of message output data	
Word 9	Third single write command address - value of 0 = 400001	
Word 10	1 word of message output data	
Words 11 ... 14	Not used	
Word 15	First block read command address	
Word 16	Number of data words to read, 1 ... 12 are valid	

Continued on next page

Control Modes, Continued



Note: With control mode 6, words 14 and 16 combined length must be 1 ... 12.

Control Mode 6

Control Mode 6 - 2 Single Writes And 2 Block Read Commands		
Word 1	Sequence #	
Word 2	Output Configuration	Output
Word 3	Control Mode 6	
Word 4	Port Configuration	Slave node address
Word 5	First single write command address - value of 0 = 400001	
Word 6	1 word of message output data	
Word 7	Second single write command address - value of 0 = 400001	
Word 8	1 word of message output data	
Words 9 ... 12	Not used	
Word 13	Second block read command address	
Word 14	Number of data words to read	
Word 15	First block read command address	
Word 16	Number of data words to read	

Continued on next page

Control Modes, Continued



Note: With control mode 7, words 14 and 16 combined length must be 1 ... 12.

Control Mode 7

Control Mode 7 - 1 Write And 3 Block Read Commands		
Word 1	Sequence #	
Word 2	Output Configuration	Output
Word 3	Control Mode 7	
Word 4	Port Configuration	Slave node address
Word 5	First single write command address - value of 0 = 400001	
Word 6	1 word of message output data	
Word 7 ... 10	Not used	
Word 11	Third block read command address	
Word 12	Number of data words to read	
Word 13	Second block read command address	
Word 14	Number of data words to read	
Word 15	First block read command address	
Word 16	Number of data words to read	

Continued on next page

Control Modes, Continued



Note: With control mode 8; words 10, 14 and 16 combined length must be 1 ... 12.

Control Mode 8

Control Mode 8 - 4 Block Read Commands		
Word 1	Sequence #	
Word 2	Output Configuration	Output
Word 3	Control Mode 8 - 4 block read commands	
Word 4	Port Configuration	Slave node address
Words 5 ... 8	Not used	
Word 9	Fourth block read command address	
Word 10	Number of data words to read	
Word 11	Third block read command address	
Word 12	Number of data words to read	
Word 13	Second block read command address	
Word 14	Number of data words to read	
Word 15	First block read command address	
Word 16	Number of data words to read	

Input Words

Introduction

Purpose This section describes input words.

Input Words
3x ... 3x + 15

16 words of input data are used for 6 120Vac input points and the Modbus master response buffer.

Input Words Control Mode 1		
Word 1	Sequence #	
Word 2	Status	AC input
Word 3 ... 16	Messsage response data field	

Input Words Control Modes 2 ... 8		
Word 1	Sequence #	
Word 2	Status	AC input
Word 3	Message 1 response	Message 2 response
Word 4	Message 3 response	Message 4 response
Word 5 ... 16	Message response data field	

Input Word 1 Input word 1 contains an echo of the sequence number.

- Valid settings are 1 ... FFFF
- Whenever the module is set to zero, it goes to the module shut down state.

Continued on next page

Input Words, Continued

- When the value in the first input word is not equal to the output word then a Modbus message will be sent. If not, when they are equal, there will be no message activity.
 - A change in the sequence word value starts the Modbus command execution. It is your responsibility to change the output data for the Modbus message. The sequence number must be the last word of information written in order to ensure Modbus messages are correctly handled.
-

Input Word 2

Input word 2 contains 6 bits of 120 Vac input data and 8 bits for module status.

Input Word 1 High Byte (Status)	
Bit 15 MSB	0= message processing done 1= message in process
Bit 14	Copy of output 3
Bit 13	copy of output 2
Bit 12	copy of output 1
Bit 11	Not used
Bit 9	1= fuse ok 0= fuse blown
Bit 8	1= module healthy 0= module not healthy

Input Word 1 Low Byte (Input Data Values)	
Bit 7 ... 6	Not used
Bit 5	Input 6
Bit 4	Input 5
Bit 3	Input 4
Bit 2	Input 3
Bit 1	Input 2
Bit 0 LSB	Input 1

Continued on next page

Input Words Control Modes

Introduction

Purpose This section describes input words.

In This Section This section contains the following topics:

For This Topic...	See Page...
Control Mode 0	378
Control Mode 1	378
Control Mode 2 and 4	379
Control Mode 3 and 5	379
Control Mode 6	379
Control Mode 7	380
Control Mode 8	380

Input Words 3 ... 4



Note: In control mode 0, input words 3 and 4 are zeroed.



Note: The message response code is contained in the Modbus message itself, so control mode 1, input buffer words 3 ... 16 are used as the actual message.

Continued on next page

Control Modes, Continued



Note: For control modes 2 ... 8, all four response fields are present whether used or not. The table below shows the input message responses to words 3 and 4.

Control Modes 2 ... 8	
Input Word 3 High Byte	Input Word 3 Low Byte
Message 1 response	Message 2 response
Input Word 4 High Byte	Input Word 4 Low Byte
Message 3 response	Message 4 response

Input Words 5 ... 16

Input words 5 ... 16 contain Modbus message response data.



Note: Refer to *General Modbus Message Rules* on page 360

Input Words Mode Memory Allocation

The tables below describe the specific memory allocation for each control mode.

Control Mode 0

Control Mode 0 - Idle, Clear Response Buffer		
Word 1	Sequence #	
Word 2	Status	6 120Vac inputs
Word 3 ... 16	Message data field = (00) hex	

Control Mode 1

Control Mode 1 - Modbus Message		
Word	Used for ...	Description
Word 1	Sequence #	
Word 2	Status	6 120Vac inputs
Word 3 ... 16	Modbus Message data response	

Continued on next page

Control Modes, Continued

Control Mode 2 and 4

Control Mode 2 and 4 - Write Commands		
Word 1	Sequence #	
Word 2	Status	6 120Vac inputs
Word 3	Message 1 response	Message 2 response
Word 4	Message 3 response	Message 4 response
Word 5 ... 16	Not used. Input data values are 0	

Control Mode 3 and 5

Control Mode 3 and 5 - 1 Write Command and 1 Block Read Command		
Word 1	Sequence #	
Word 2	Status	6 120Vac inputs
Word 3	Message 1 response	Message 2 response
Word 4	Message 3 response	Message 4 response
Words 5 ... 16	12 words of message input data	

Control Mode 6

Control Mode 6 - 2 Single Write Commands and 2 Block Read Commands		
Word 1	Sequence #	
Word 2	Status	6 120Vac inputs
Word 3	Message 1 response	Message 2 response
Word 4	Message 3 response	Message 4 response
Words 5 ... 16	12 words shared between 2 input responses	

Continued on next page

Control Modes, Continued

Control Mode 7

Control Mode 7 - 1 Write Command and 3 Block Read Commands		
Word 1	Sequence #	
Word 2	Status	6 120Vac inputs
Word 3	Message 1 response	Message 2 response
Word 4	Message 3 response	Message 4 response
Words 5 ... 16	12 words shared between 3 input responses	

Control Mode 8

Control Mode 8 - 4 Block Read Commands		
Word 1	Sequence #	
Word 2	Status	6 120Vac inputs
Word 3	Message 1 response	Message 2 response
Word 4	Message 3 response	Message 4 response
Words 5 ... 16	12 words shared between 4 input responses	

**170 ADM 690 50,
170 ADM 690 51
120 VAC - 10 Pt. In / 8 Pt. Out
Module Bases**

20

At a Glance

Purpose This chapter describes the 170 ADM 690 50 and 170 ADM 690 51 TSX Momentum I/O bases.



Note: These bases are identical except that the field input neutral is isolated from the module neutral on the 170 ADM 690 51.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	382
Wiring for the 170 ADM 690 50	2	388
Wiring for the 170 ADM 690 51	3	396
Configuration	4	404

Section 20.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 ADM 690 50 and 170 ADM 690 51 TSX Momentum I/O base and provides specifications.

In This Section

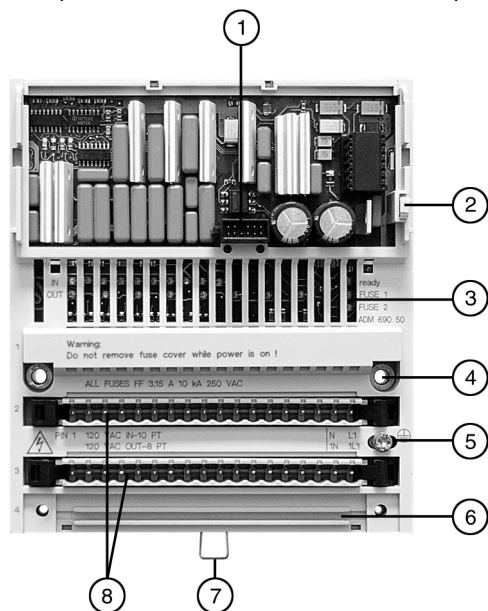
This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	383
Specifications	385

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADM 690 50 and 170 ADM 690 51 discrete I/O bases and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



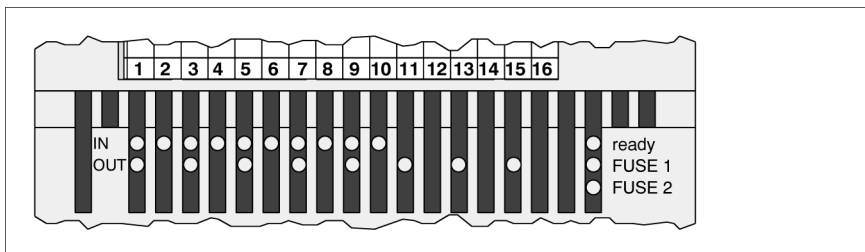
Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Busbar mounting slot
7	Locking tab for DIN rail mount
8	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below.

Indicator	Condition	Message
ready	Green	Module is ready to communicate. Operating voltage for internal logic (5 V) is present
	Off	Module is not ready
FUSE 1	Green	Output voltage of outputs 1 ... 4 (one common output voltage for group 1) present and FUSE 1 is ok
	Off	Output voltage of outputs 1 ... 4 (one common output voltage for group 1) is not present and/or FUSE 1 is defective
FUSE 2	Green	Output voltage of outputs 5 ... 8 (one common output voltage for group 2) present and FUSE 2 is ok
	Off	Output voltage of outputs 5 ... 8 (one common output voltage for group 2) is not present and/or FUSE 2 is defective
Upper row IN 1 ... 10	Green	Input status (an LED per input). Input point active, i.e. input carries a 1 signal (logically ON)
	Off	Input status (an LED per input). Input point inactive, i.e. input carries a 0 signal (logically OFF)
Middle row OUT 1, 3, 5, 7, 9, 11, 13, 15	Green	Output status (an LED per output). Output point active, i.e. output carries a 1 signal (logically ON)
	Off	Output status (an LED per output). Output point inactive, i.e. output carries a 0 signal (logically OFF)

Specifications

Overview

This section contains the specifications for both I/O bases.

General Specifications

The following table contains general specifications for both I/O bases.

Module type	10 discrete inputs in 1 group 8 triac outputs in 1 group (in 2 fuse groups)
Supply voltage	120 VAC
Supply voltage range	100 ... 132 VAC @ 47...63Hz
Supply current consumption	max. 160 mA at 120 VAC
Power dissipation	6 W + ((# of input points on x .144 W) + (# of output points on x .75 W))
I/O map	1 input word 1 output word
Potential isolation	
Input to input	None
Output group to output group	None
Input to output group	125 VAC, tested with 1780 VAC
Field to communication interface	125 VAC, tested with 1780 VAC
Fuses	
Internal	Wickman 19195-2.5 A Note If you replace this fuse, you must use a Ferraz type W 020547 (UL listed).
External: operating voltage (L1)	315 mA fast-blow, 250 V
External: input voltage (2L1)	max. 4 A fast-blow, 250 V
External: output voltage (1L1)	According to the supply of the connected actuators—not to exceed 8 A slow-blow
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 2 KV to PE, 1 KV to differential
Emmissions	EN 50081-2
Agency approvals	UL, CUL, CE

Continued on next page

Specifications, Continued

General Specifications, Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54in)
Length	141.5 mm (5.5in) no or one busbar 159.5 mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	220 g (0.49 lb)

Discrete Inputs

The following table contains specifications for discrete inputs.

Number of points	10
Number of groups	1
Signal type	120 VAC
IEC 1131 type	2 (See Appendix on page 607 for definitions of IEC input types.)
ON voltage	74 VAC
OFF voltage	20 VAC
Input current	6 mA minimum ON 2.6 mA maximum OFF
Input voltage range	74 ... 132 VAC
Input resistance	4 kOhm
Response time	max. 1/2 x 1/f ms OFF to ON max. 1/2 x 1/f ms ON to OFF

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

Output type	Triac
Output supply voltage	120 VAC
Output supply voltage range	100 ... 132 VAC
Output voltage	External supply - 1.5 VAC
Number of points	8
Number of groups	1
Points per group	8, but 2 fuses
Current capacity	0.5 A/point max., 30 mA/point min. 2 A/group 4 A/module
Signal type	True High
Leakage current (output out)	< 1.3 mA @ 120 VAC
On state voltage drop	< 1.5 VAC @ 0.5 A
Fault sensing	One common voltage supply for output 1 .. 4 and output 5 ... 8, each is protected by an internal fuse against short-circuits (but not against overload). Each output is provided with an RC network (normal mode noise voltage rejection) and a Varistor (surge protection).
Fault reporting	None
Error indication	None
Response time	max. 1/2 x 1/f ms OFF to ON max. 1/2 x 1/f ms ON to OFF
Maximum switching cycles	3000/h for 0.5 A inductive load

Section 20.2

Wiring for the 170 ADM 690 50

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADM 690 50 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	389
Field Wiring Guidelines	390
Wiring Diagrams	392
Simplified Schematics	394

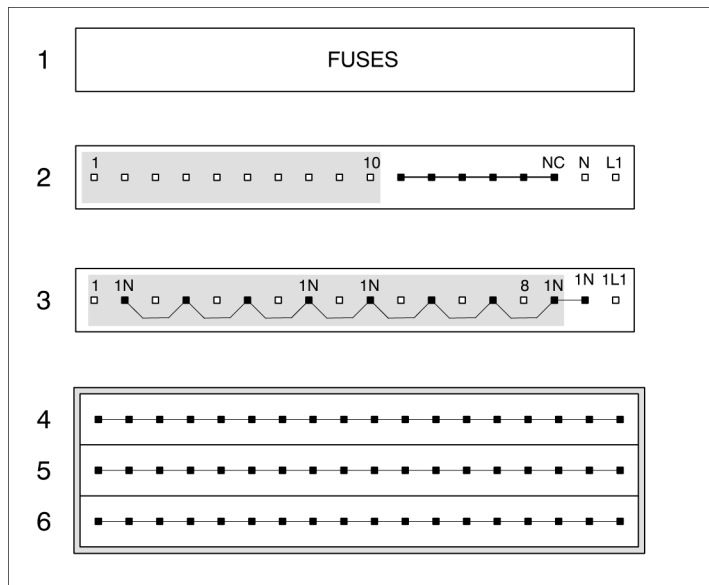
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals and an optional busbar for the 170 ADM 690 50 TSX Momentum I/O base.

Diagram

Rows 1 through 3 show the internal connections between terminals on the base. Rows 4 through 6 show internal connections on the optional busbar.



Field Wiring Guidelines

Overview

Inputs are field wired to row 2 of the I/O base. Outputs are field wired to row 3.

This section contains guidelines and precautions for wiring the 170 ADM 690 50 TSX Momentum I/O base.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-, 2-, or 3-row busbar. The following busbars are available from Schneider Automation.

Type	Number of Rows	Part Number
Screw-in	1-row	170 XTS 006 01
	2-row	170 XTS 005 01
	3-row	170 XTS 004 01
Spring-clip	1-row	170 XTS 007 01
	2-row	170 XTS 008 01
	3-row	170 XTS 003 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbars

The following table shows mapping terminal blocks and optional busbars for the 170 ADM 690 50 TSX Momentum I/O base.

Row	Terminal	Function
1	FUSE 1, FUSE 2	Internal fuses for output voltages
2	1 ... 10	Inputs
	11 ... 16	Connected internally within the row, for general purpose use
	17	Return (N)
	18	120 VAC Operating voltage (L1)
3	1, 3, 5, 7, 9, 11, 13, 15	Outputs
	2, 4, 6, 8, 10, 12, 14, 16	Return (1N) for the actuators
	17	Return for the output voltage
	18	20 ... 132 VAC Output voltage for terminal pins 1 ... 8 (1L1)
4	1 ... 18	120 VAC Input voltage (2L1)
5	1 ... 18	Return (2N) for sensors
6	1 ... 18	Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Wiring Diagrams

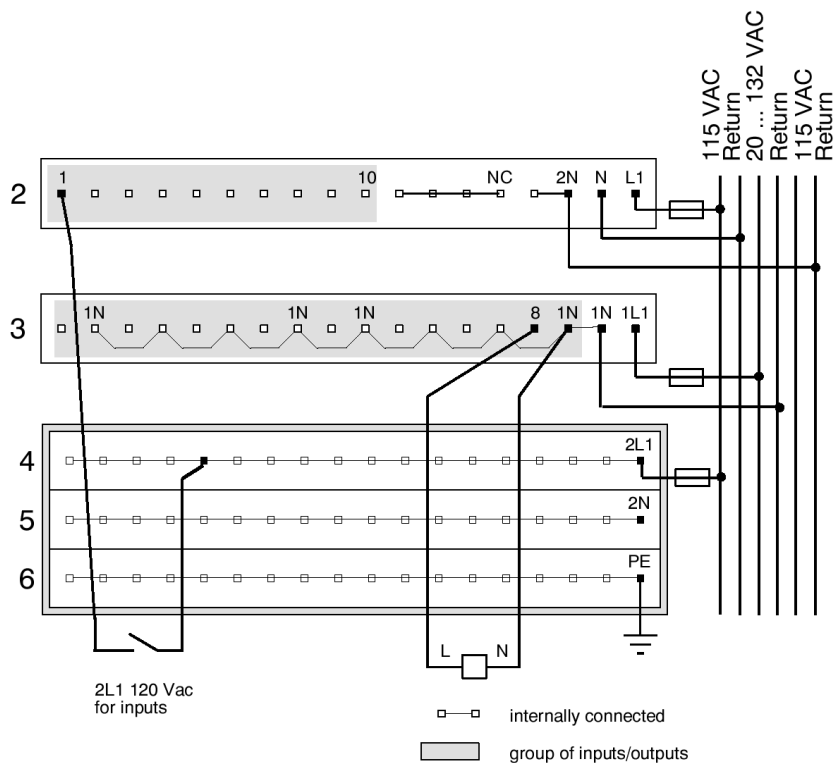
Overview

This section provides diagrams for the 170 ADM 690 50 TSX Momentum I/O base to assist you in wiring the following types of devices:

- Two-wire sensor with a two-wire actuator
- Four-wire sensor with a three-wire actuator

2-Wire Sensor with a 2-Wire Actuator

The diagram below shows field wiring for a 2-wire sensor and a 2-wire actuator.



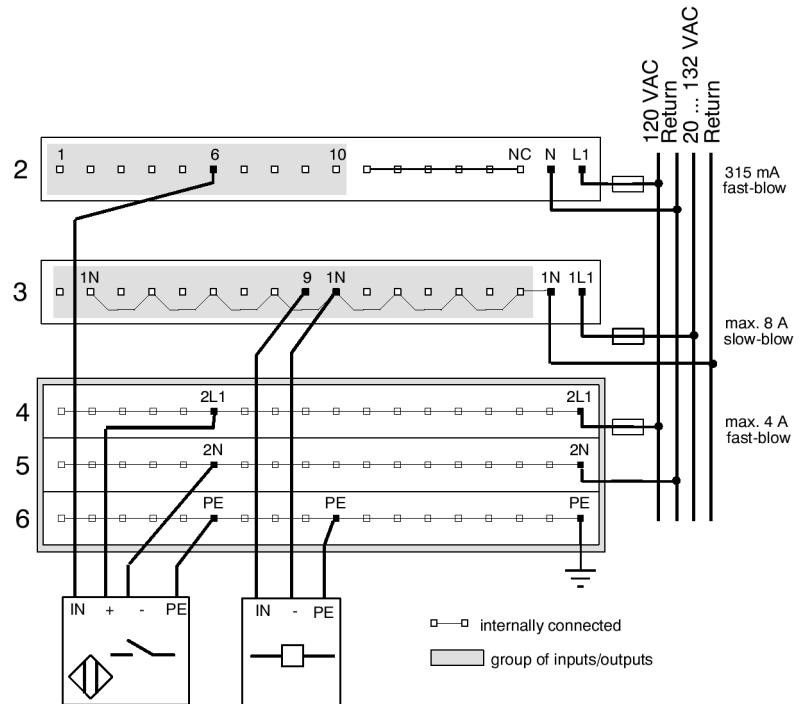
Continued on next page

Wiring Diagrams, Continued

4-Wire Sensor with a 3-Wire Actuator

The diagram below shows field wiring for a 4-wire sensor and a 3-wire actuator.

When using three-phase current for supply L1, 1L1 and 2L1 must come from one phase.



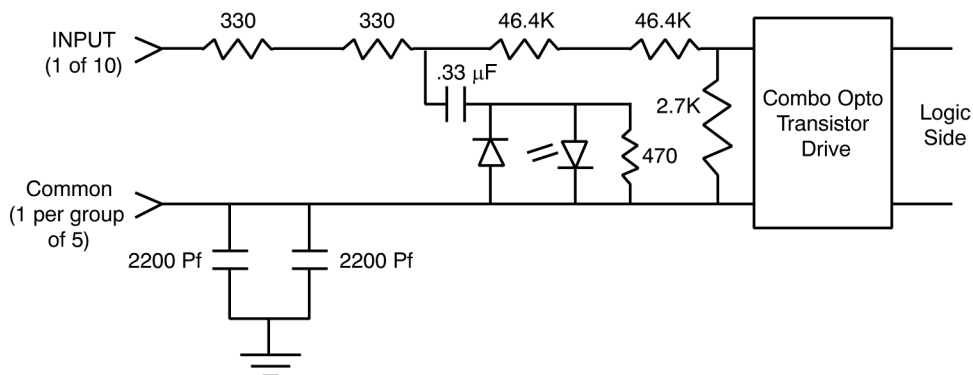
Simplified Schematics

Overview

This section contains a simplified schematic diagram of the field-side input and output circuitry for the 170 ADM 690 50 TSX Momentum I/O base.

Input Diagram

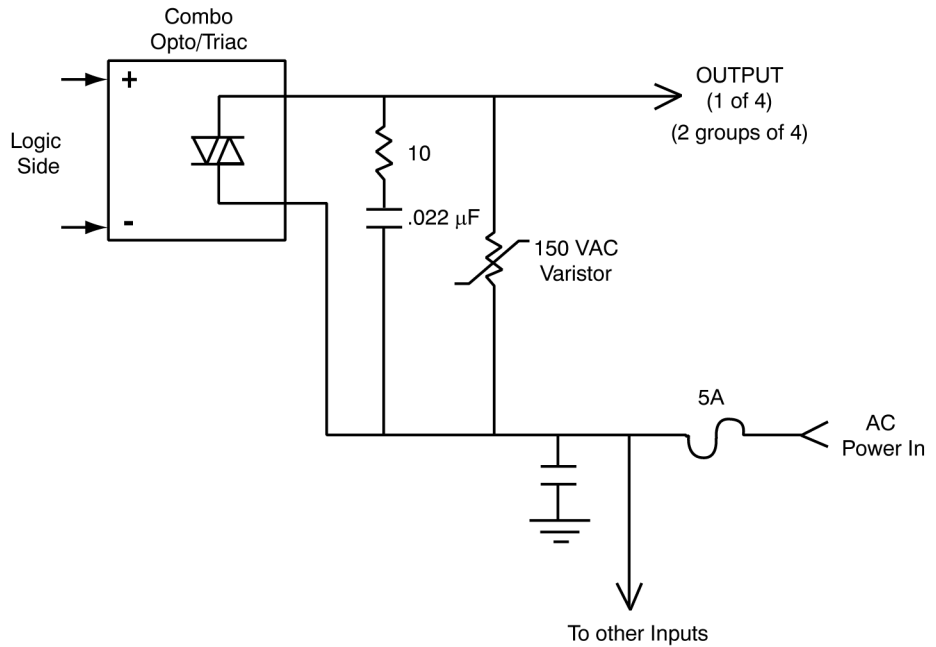
The following diagram shows the field-side input circuitry.



Continued on next page

Simplified Schematics, Continued

Output Diagram The following diagram shows the field-side output circuitry.



Section 20.3

Wiring for the 170 ADM 690 51

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADM 690 51 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	397
Field Wiring Guidelines	398
Wiring Diagrams	400
Simplified Schematics	402

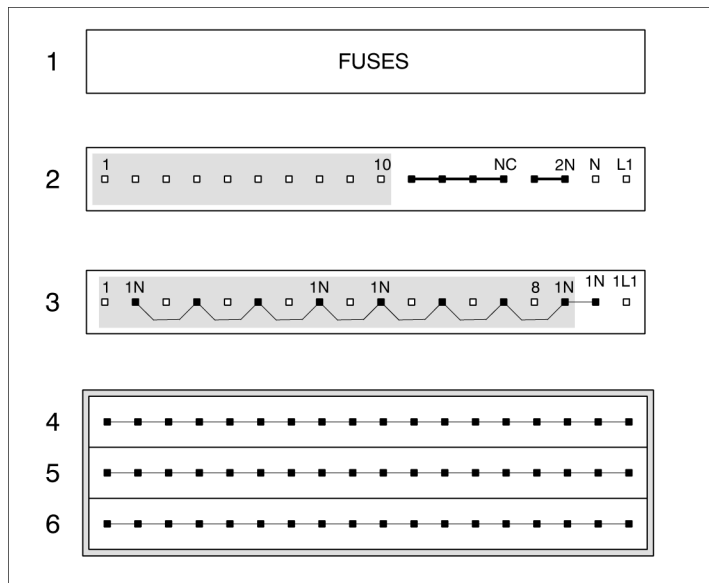
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals and an optional busbar for the 170 ADM 690 51 TSX Momentum I/O base.

Diagram

Rows 1 through 3 show the internal connections between terminals on the base.
Rows 4 through 6 show internal connections on the optional busbar.



Field Wiring Guidelines

Overview

Inputs are field wired to row 2 of the I/O base. Outputs are field wired to row 3.

This section contains guidelines and precautions for wiring the 170 ADM 690 51 TSX Momentum I/O base.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-, 2-, or 3-row busbar. The following busbars are available from Schneider Automation.

Type	Number of Rows	Part Number
Screw-in	1-row	170 XTS 006 01
	2-row	170 XTS 005 01
	3-row	170 XTS 004 01
Spring-clip	1-row	170 XTS 007 01
	2-row	170 XTS 008 01
	3-row	170 XTS 003 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping of Terminal Blocks and Busbars

The following table shows mapping of terminal blocks and optional busbars for the 170 ADM 690 51 TSX Momentum I/O base.

Row	Terminal	Function
1	FUSE 1, FUSE 2	Internal fuses for output voltages
2	1 ... 10	Inputs
	11 ... 14	Connected internally within the row, for general purpose use
	15 ... 16	2N return for sensors
	17	Return (N)
	18	120 VAC Operating voltage (L1)
3	1, 3, 5, 7, 9, 11, 13, 15	Outputs
	2, 4, 6, 8, 10, 12, 14, 16	Return (1N) for the actuators
	17	Return for the output voltage
	18	20 ... 132 VAC Output voltage for terminal pins 1 ... 8 (1L1)
4	1 ... 18	120 VAC Input voltage (2L1)
5	1 ... 18	Return (2N) for sensors
6	1 ... 18	Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Wiring Diagrams

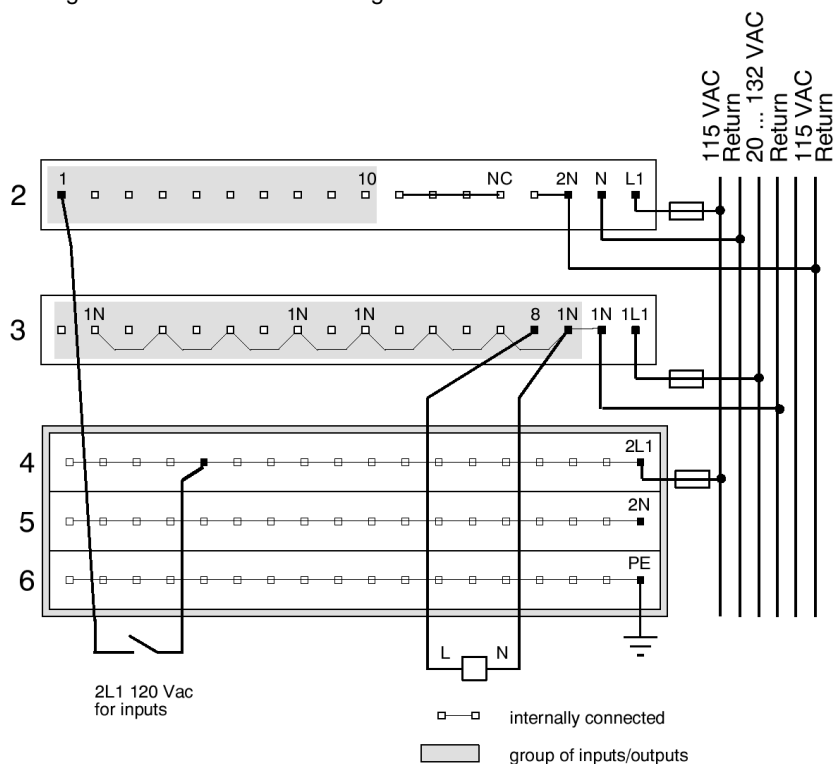
Overview

This section provides diagrams for the 170 ADM 690 51 TSX Momentum I/O base to assist you in wiring the following types of devices:

- Two-wire sensor with a two-wire actuator
- Four-wire sensor with a three-wire actuator

2-Wire Sensor with a 2-Wire Actuator

The diagram below shows field wiring for a 2-wire sensor and a 2-wire actuator.



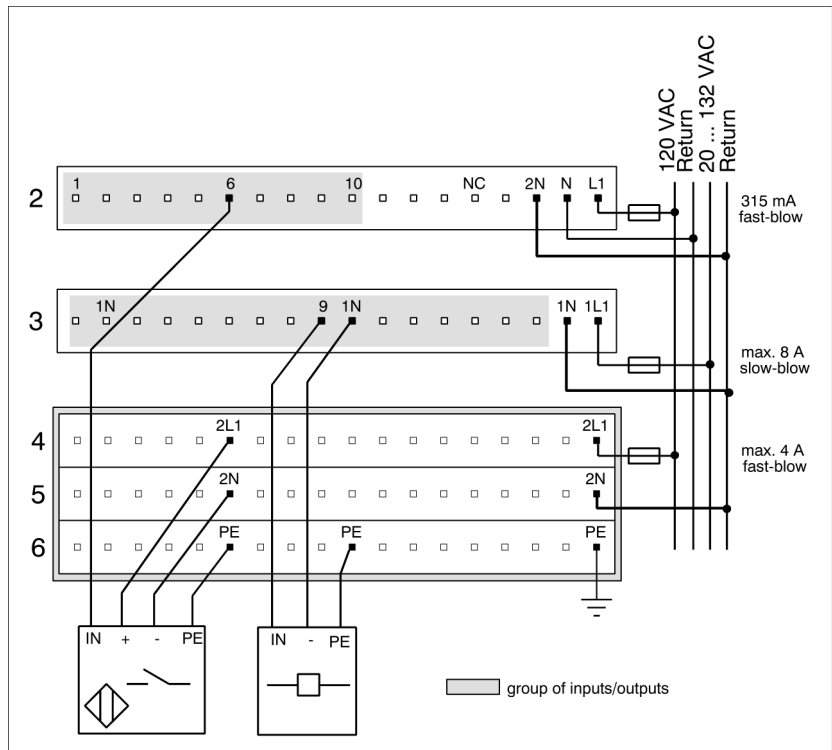
Continued on next page

Wiring Diagrams, Continued

4-Wire Sensor with a 3-Wire Actuator

The diagram below shows field wiring for a 4-wire sensor and a 3-wire actuator.

When using three-phase current for supply L1, 1L1 and 2L1 must come from one phase.



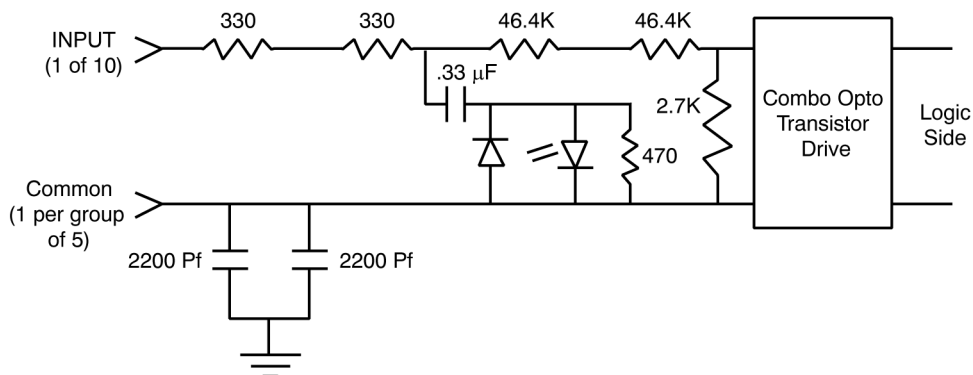
Simplified Schematics

Overview

This section contains simplified schematic diagrams of the field-side input and output circuitry for the 170 ADM 690 51 TSX Momentum I/O base.

Input Diagram

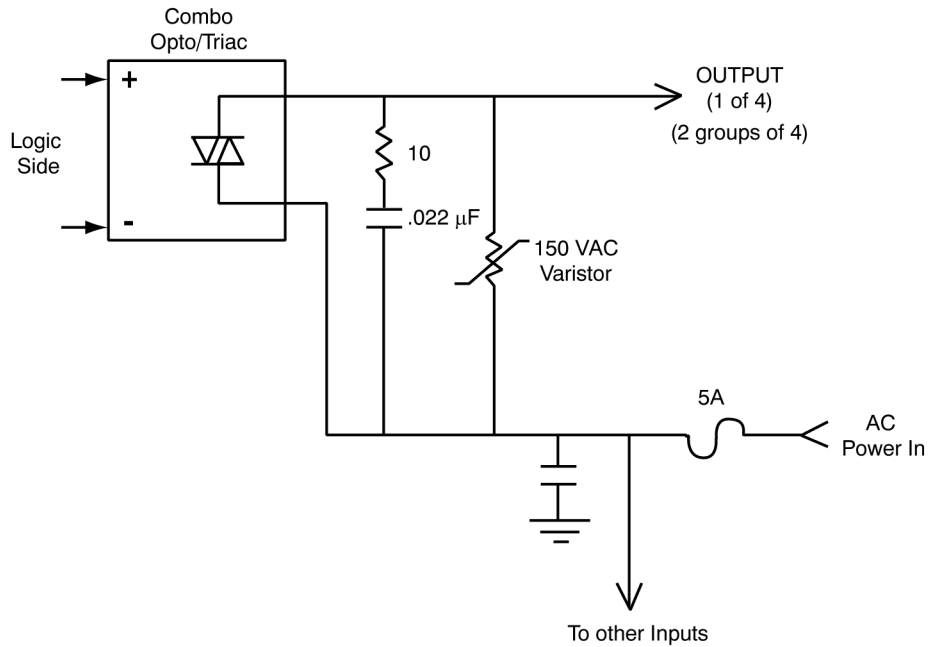
The following diagram shows the field-side input circuitry.



Continued on next page

Simplified Schematics, Continued

Output Diagram The following diagram shows the field-side output circuitry.



Section 20.4

Configuration

Discrete Inputs and Triac Outputs

Overview

This section describes how to map I/O data between the I/O base and the CPU. This information is valid for both the 170 ADM 690 50 and 170 ADM 690 51 TSX Momentum I/O bases.

Number of Words

The processor sends eight output data bits in one 16-bit word to the I/O base.

The base returns 10 input data bits in one 16-bit word to the processor.

IEC vs. Ladder Logic

In order to correctly field wire the I/O and map the data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.

Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.

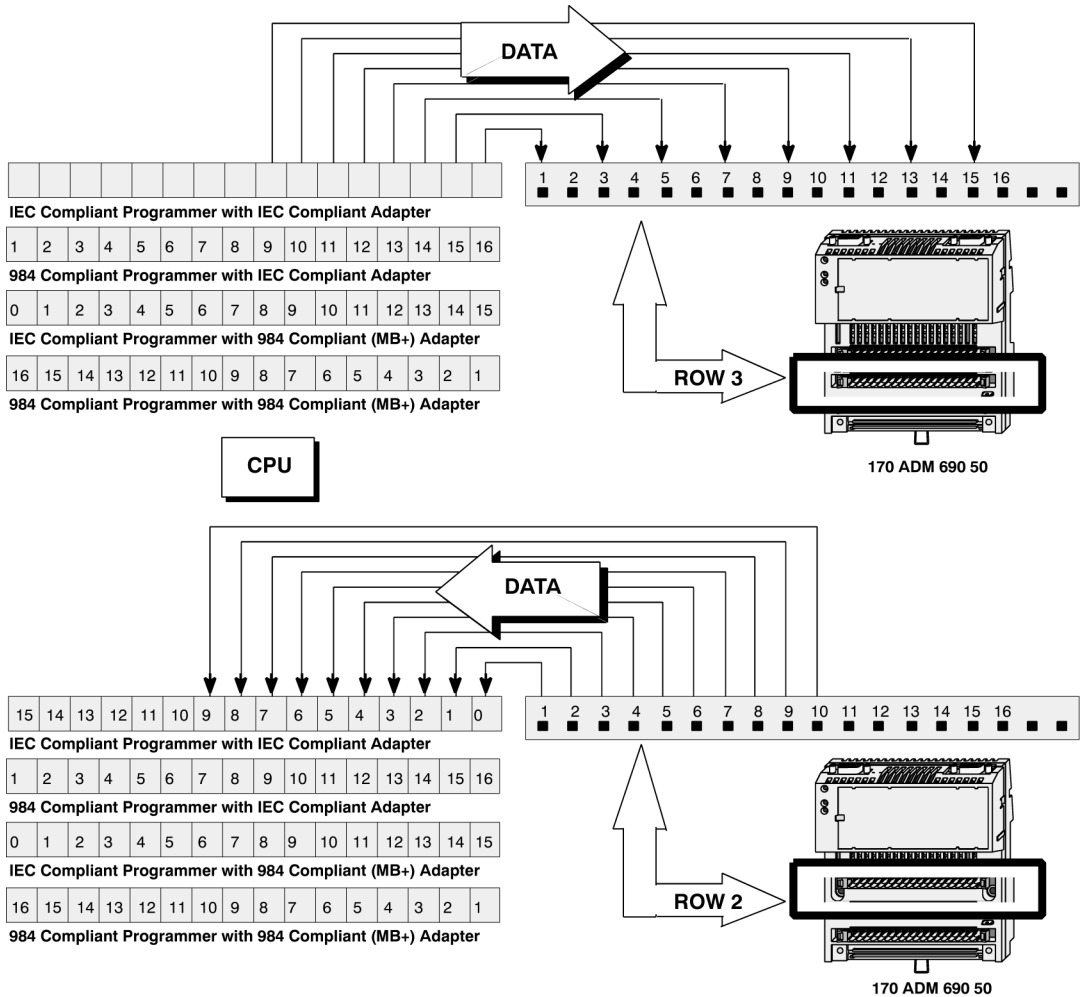
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Inputs and Triac Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADO 340 00
24 VDC - 16 Pt. Discrete Output
Module Base

21

At a Glance

Purpose This chapter describes the 170 ADO 340 00 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	408
Wiring	2	414
Configuration	3	421

Section 21.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 ADO 340 00 TSX Momentum I/O base and provides specifications.

In This Section

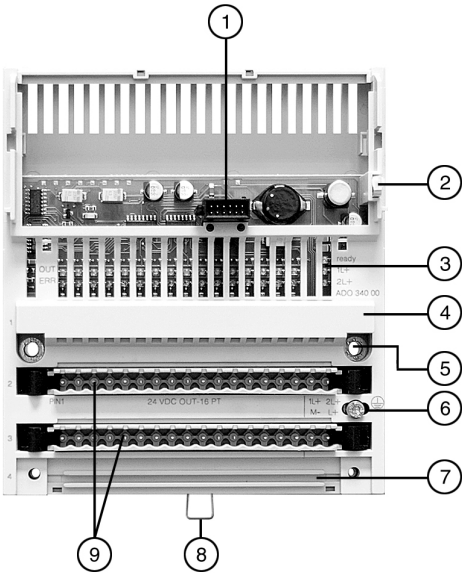
This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	409
Specifications	411

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADO 340 00 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



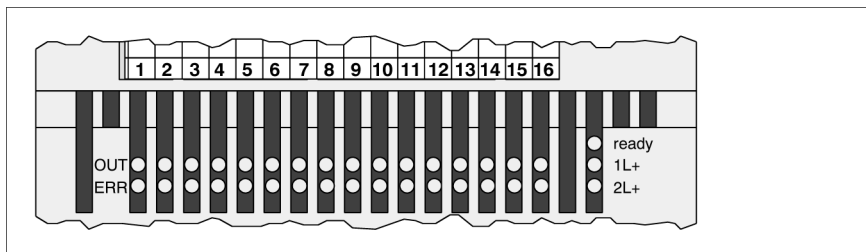
Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Protective cover
5	Mounting holes for panel mount
6	Grounding screw
7	Grounding busbar mounting slot
8	Locking tab for DIN rail mount
9	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below

Indicator	Condition	Message
ready	Green	Module is ready to communicate. Operating voltage for internal logic (5 V) is present.
	Off	Module is not ready.
1L+	Green	Output voltage 1L+ of outputs 1 ... 8 (group 1) present
	Off	Output voltage of outputs 1 ... 8 (group 1) not present
2L+	Green	Output voltage 2L+ of outputs 9 ... 16 (group 2) present
	Off	Output voltage of outputs 9 ... 16 (group 2) not present
Middle row OUT 1 ... 16	Green	Output status (an LED per output). Output point active, i.e. output carries a 1 signal (logically ON)
	Off	Output status (an LED per output) Output point inactive, i.e. output carries a 0 signal (logically OFF)
Lower row ERR 1 ... 16	Red	Output overload (an LED per output). Short circuit or overload on the corresponding output
	Off	Outputs 1 ... 16 operating normally

Specifications

Overview

This section contains the specifications for the 170 ADO 340 00 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	16 discrete outputs in 2 groups (8 pts/grp)
Supply voltage	24 VDC
Supply voltage range	20 ... 30 VDC
Supply current consumption	max. 250 mA at 24 VDC
Power dissipation	6 W + (# of output points on x .25 W)
I/O map	1 output word
Potential isolation	
Output group to output group	None
Field to communication interface	Defined by Communication Adapter type
Fuses	
Internal	None
External: operating voltage	315 mA fast-blow (Wickmann 19193 - 315 mA or 19194 - 315 mA or equivalent)
External: output voltage	According to the supply of the connected actuators— not to exceed 4 A fast-blow/ group
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V, 12 Ohm
Emmissions	EN 50081-2
Agency approvals	UL, CUL, CE

Continued on next page

Specifications, Continued

General Specifications, Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54in)
Length	141.5 mm (5.5in) no or one busbar 159.5 mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	210 g (0.46 lb)

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

Output type	Solid state switch
Output supply voltage	24 VDC
Output supply voltage range	20 ... 30 VDC
Output voltage	External supply - .5 VDC
Number of points	16
Number of groups	2
Points per group	8
Current capacity	0.5 A/point maximum 4 A/group 8 A/module
Signal type	True High
Leakage current (output out)	< 1 mA @ 24 VDC
Surge (Inrush) current	5 A for 1 ms
On state voltage drop	< 0.5 VDC @ 0.5 A
Fault sensing	Outputs are electronically safeguarded to assist in short circuit and overload protection
Fault reporting	1 red LED/point (row 3) ON when short current/ overload occurs
Error indication	Output overload for at least one out put (I/O-Error) to communication adapter
Response time (resistive load / 0.5 A)	< 0.1 ms OFF to ON < 0.1 ms ON to OFF
Maximum switching cycles	1000/h for 0.5 A inductive load 100/s for 0.5 A resistive load 8/s for 1.2 W Tungsten load

Section 21.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADO 340 00 TSX Momentum I/O base.

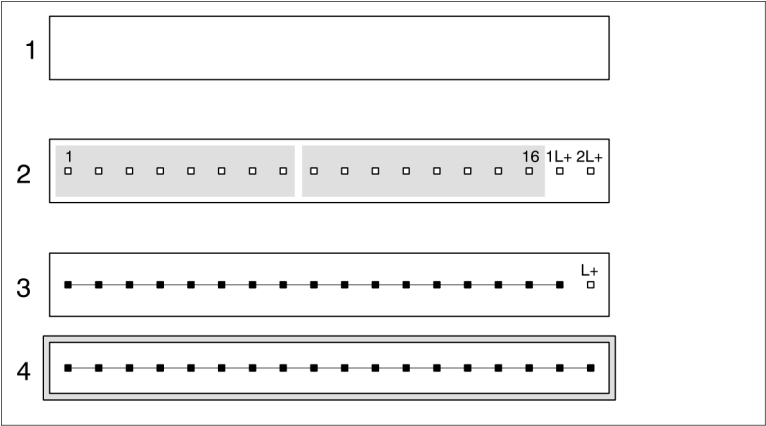
In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	415
Field Wiring Guidelines	416
Wiring Diagrams	418
Simplified Schematics	420

Internal Pin Connections

Overview This section contains a diagram showing the internal connections for terminals on the I/O base and an optional 1-row busbar.

Diagram Rows 1 through 3 show the internal connections between terminals on the base. Row 4 shows internal connections on the optional busbar.



Field Wiring Guidelines

Overview

The outputs are field wired to row 2 of the base. This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-row busbar. The following busbars are available from Schneider Automation.

Type	Part Number
Screw-in	170 XTS 006 01
Spring-clip	170 XTS 007 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbar

The following table shows mapping terminal blocks and an optional busbar.

Row	Terminal	Function
1	Not used	
2	1 ... 8	Outputs for group 1
	9 ... 16	Outputs for group 2
	17/18	24 VDC for output groups 1 and 2 (1L+, 2L+)
3	1 ... 16	Return (M-) for outputs
	17	Return (M-) for module and outputs
	18	+ 24 VDC Operating voltage (L+)
4	1 ... 18	Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Protective Circuit May Be Required

When contacted switches are used on the input lines or when lines to the peripherals are very long, the outputs of inductive loads require protective circuitry with a clamping/suppressor diode. Install the protective circuit parallel to the operating coil.

Wiring Diagrams

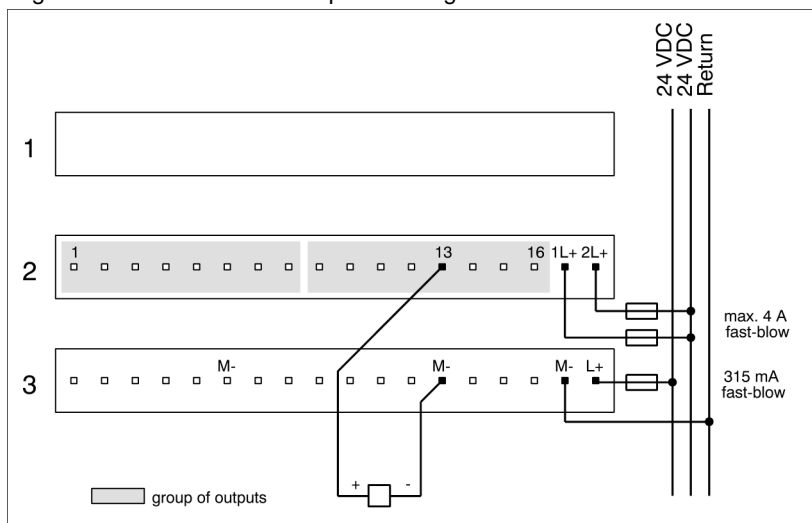
Overview

This section provides diagrams to assist you in wiring the following types of devices:

- Two-wire actuators
- Three-wire actuators

Two-Wire Actuator

The diagram below shows an example of wiring for a two-wire actuator.

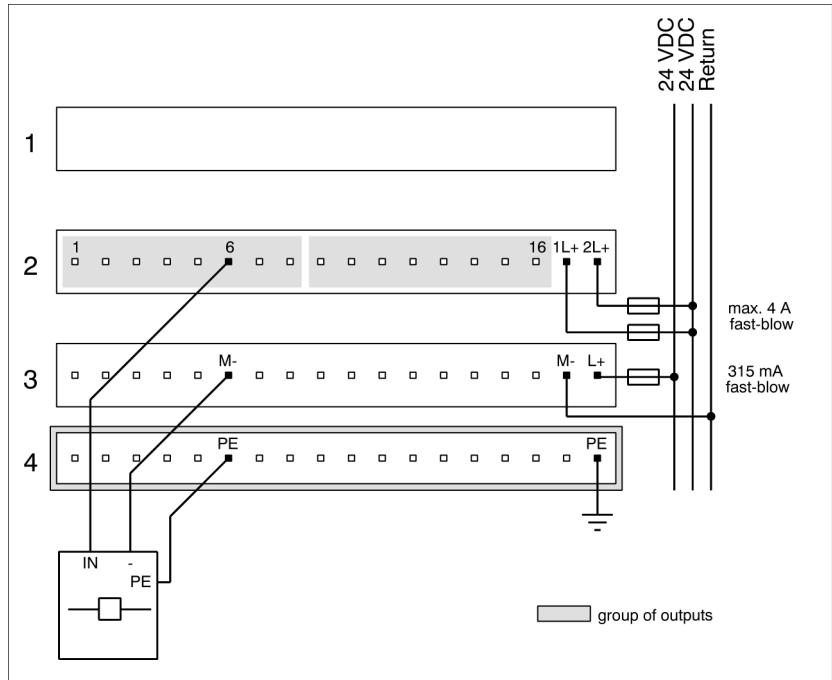


Continued on next page

Wiring Diagrams, Continued

Three-Wire Actuator

The diagram below shows an example of wiring for a three-wire actuator.



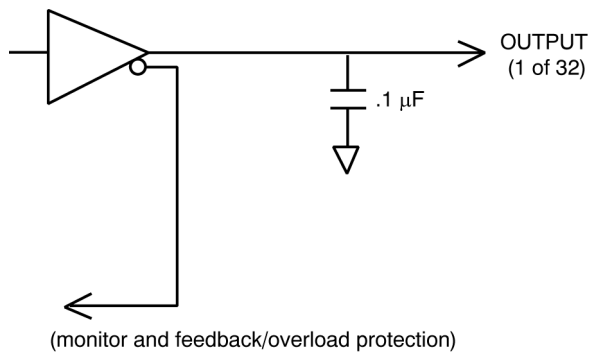
Simplified Schematics

Overview

This section contains a simplified schematic diagram of the field-side output circuitry.

Diagram

The following diagram shows the field-side output circuitry.



Section 21.3

Configuration

Discrete Outputs

Overview	This section describes how to map output data from the CPU to the I/O base.
Number of Words	The processor sends 16 bits of discrete output data to the base as one 16-bit word.
IEC vs. Ladder Logic	<p>In order to correctly field wire the outputs and map the output data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.</p> <p>Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.</p>

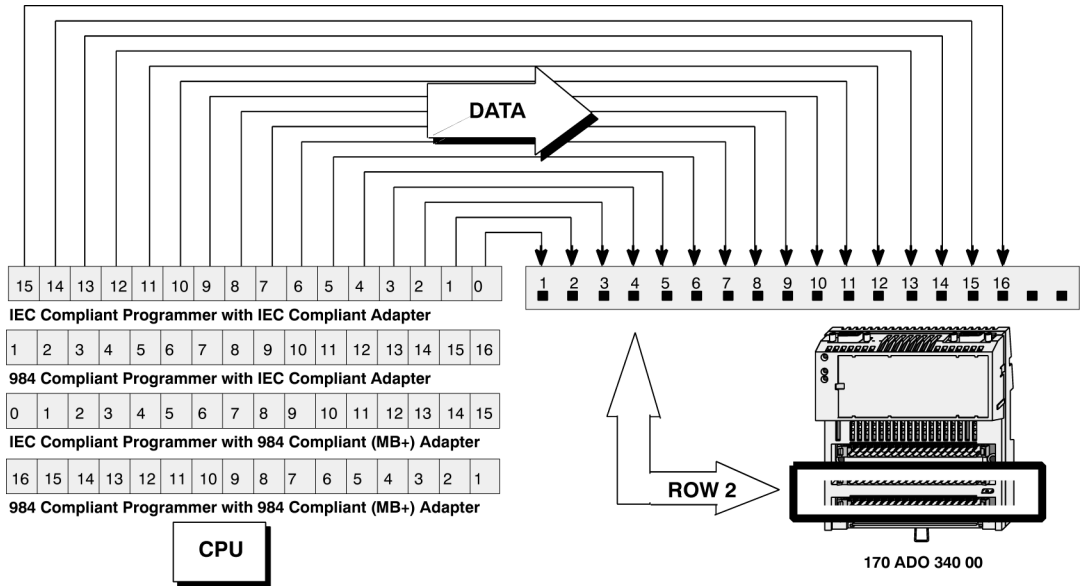
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADO 350 00
24 VDC - 32 Pt. Discrete Output
Module Base

22

At a Glance

Purpose This chapter describes the 170 ADO 350 00 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	424
Wiring	2	431
Configuration	3	438

Section 22.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 ADO 350 00 TSX Momentum I/O base and provides specifications.

In This Section

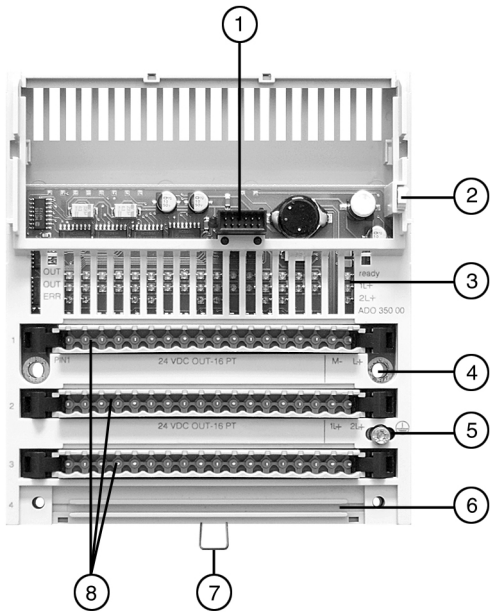
This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	425
Specifications	428

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADO 350 00 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



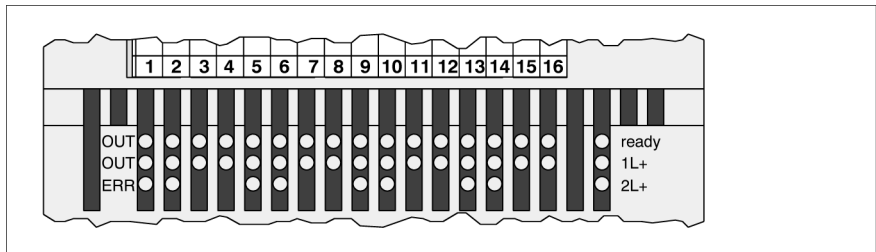
Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Mounting holes for panel mount
5	Grounding screw
6	Grounding busbar mounting slot
7	Locking tab for DIN rail mount
8	Sockets for the terminal connector

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



Continued on next page

Front Panel Components, Continued

LED Descriptions

The LEDs are described in the table below

Indicator	Condition	Message
ready	Green	Module is ready to communicate. Operating voltage for internal logic (5 V) is present.
	Off	Module is not ready.
1L+	Green	Output voltage 1L+ of outputs 1 ... 8 (group 1) present
	Off	Output voltage of outputs 1 ... 8 (group 1) not present
2L+	Green	Output voltage 2L+ of outputs 9 ... 16 (group 2) present
	Off	Output voltage of outputs 9 ... 16 (group 2) not present
Upper row OUT 1 ... 16	Green	Status of outputs 1 ... 16 (an LED per output). Output point active, i.e. output carries a 1 signal (logically ON)
	Off	Status of outputs 1 ... 16 (an LED per output). Output point inactive, i.e. output carries a 0 signal (logically OFF)
Middle row OUT 1 ... 16	Green	Status of outputs 17 ... 32 (an LED per output). Output point active, i.e. output carries a 1 signal (logically ON)
	Off	Status of outputs 17 ... 32 (an LED per output). Output point inactive, i.e. output carries a 0 signal (logically OFF)
Lower row ERR 1, 5, 9, 13	Red	Output overload in group 1 (one LED for every 4 outputs). Short circuit or overload on the corresponding output
	Off	Outputs 1 ... 16 operating normally
Lower row ERR 2, 6, 10, 14	Red	Output overload in group 2 (one LED for every 4 outputs). Short circuit or overload on the corresponding output
	Off	Outputs 17 ... 32 operating normally

Specifications

Overview

This section contains the specifications for the 170 ADO 350 00 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	32 discrete outputs in 2 groups (16 points/group)
Supply voltage	24 VDC
Supply voltage range	20 ... 30 VDC
Supply current consumption	max. 250 mA at 24 VDC
Power dissipation	6 W + (# of output points on x .25 W)
I/O map	2 output words
Potential isolation	
Output group to output group	None
Field to communication interface	Defined by Communication Adapter type
Fuses	
Internal	None
External: operating voltage	315 mA fast-blow (Wickmann 19193 - 315 mA or 19194 - 315 mA or equivalent)
External: output voltage	According to the supply of the connected actuators— not to exceed 8 A slow-blow/ group
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V, 12 Ohm
Emmissions	EN 50081-2
Agency approvals	UL, CUL, CE

Continued on next page

Specifications, Continued

General
Specifications,
Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54in)
Length	141.5 mm (5.5in) no or one busbar 159.5 mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	210 g (0.46 lb)

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

Output type	Solid state switch
Output supply voltage	24 VDC
Output supply voltage range	20 ... 30 VDC
Output voltage	External supply - .5 VDC
Number of points	32
Number of groups	2
Points per group	16
Current capacity	0.5 A/point maximum 8 A/group 16 A/module
Signal type	True High
Leakage current (output out)	< 1 mA @ 24 VDC
Surge (Inrush) current	5 A for 1 ms
On state voltage drop	< 0.5 VDC @ 0.5 A
Fault sensing	Outputs are electronically safeguarded to assist in short circuit and overload protection
Fault reporting	1 red LED/ 4 points (row 3) ON when short current/ overload occurs
Error indication	Output overload for at least one out put (I/O-Error) to communication adapter
Response time (resistive load / 0.5 A)	< 0.1 ms OFF to ON < 0.1 ms ON to OFF
Maximum switching cycles	1000/h for 0.5 A inductive load 100/s for 0.5 A resistive load 8/s for 1.2 W Tungsten load

Section 22.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADO 350 00 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	432
Field Wiring Guidelines	433
Wiring Diagrams	435
Simplified Schematics	437

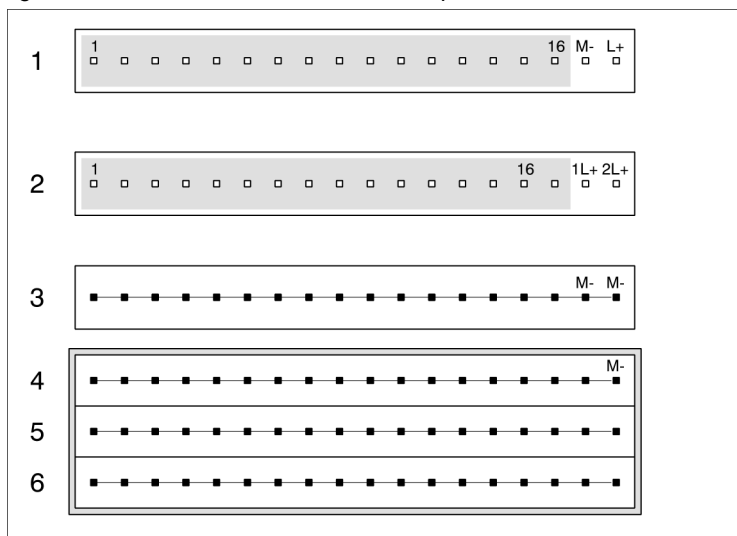
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals on the I/O base and an optional busbar.

Diagram

Rows 1 through 3 show the internal connections between terminals on the base. Rows 4 through 6 show internal connections on the optional busbar.



Field Wiring Guidelines

Overview

This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-, 2-, or 3-row busbar. The following busbars are available from Schneider Automation.

Type	Number of Rows	Part Number
Screw-in	1-row	170 XTS 006 01
	2-row	170 XTS 005 01
	3-row	170 XTS 004 01
Spring-clip	1-row	170 XTS 007 01
	2-row	170 XTS 008 01
	3-row	170 XTS 003 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbars

The following table shows mapping terminal blocks and optional busbars.

Row	Terminal	Function
1	1 ... 16	Outputs for group 1
	17	Return (M-) for the module
	18	+ 24 VDC operating voltage (L+)
2	1 ... 16	Outputs for group 2
	17/18	24 VDC for output group 1 (1L+) and group 2 (2L+)
3	1 ... 16	Return (M-) for the outputs
	17/18	Return (M-) for the output groups
4	1 ... 18	Return (M-)
5	1 ... 18	Protective earth (PE)
6	1 ... 18	Protective earth



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Protective Circuit May Be Required

When contacted switches are used on the input lines or when lines to the peripherals are very long, the outputs of inductive loads require protective circuitry with a clamping/suppressor diode. Install the protective circuit parallel to the operating coil.

Wiring Diagrams

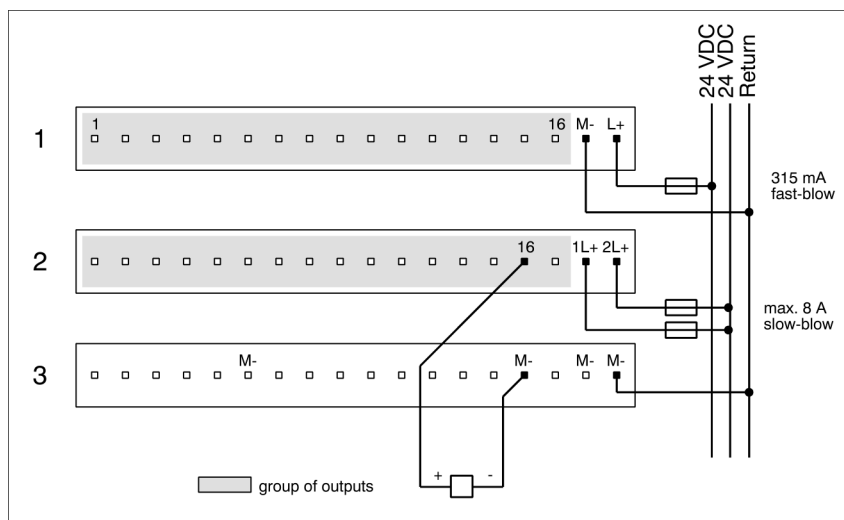
Overview

This section provides diagrams to assist you in wiring the following types of devices:

- Two-wire actuators
- Three-wire actuators

Two-Wire Actuator

The diagram below shows an example of wiring for a two-wire actuator.



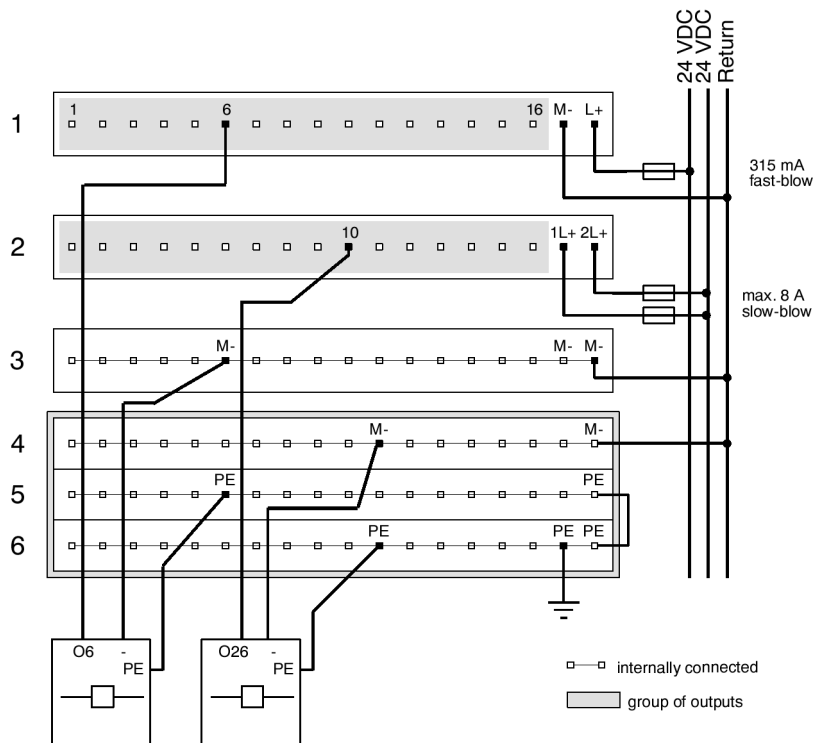
Continued on next page

Wiring Diagrams, Continued

Three-Wire Actuator

The diagram below shows an example of wiring for a three-wire actuator.

If you connect row 4 to the return line by interconnecting rows 3 and 4, make sure that the maximum load current does not exceed 8 A.



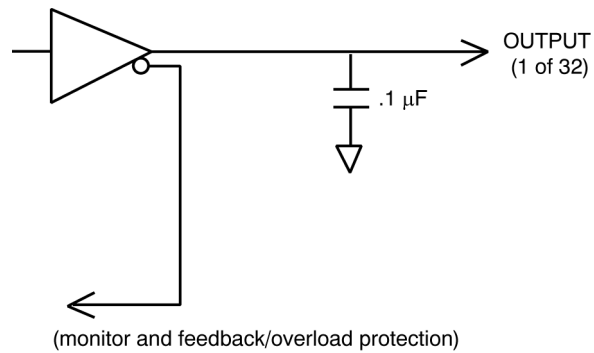
Simplified Schematics

Overview

This section contains a simplified schematic diagram of the field-side output circuitry.

Diagram

The following diagram shows the field-side output circuitry.



Section 22.3

Configuration

Discrete Outputs

Overview This section describes how to map output data from the CPU to the I/O base.

Number of Words The processor sends 32 bits of discrete output data to the base as two consecutive 16-bit words.

This word...	is sent...	And its outputs are field wired to...
Most significant word (MSW)	first	row 2 of the base
Least significant word (LSW)	second	row 1 of the base

IEC vs. Ladder Logic In order to correctly field wire the outputs and map the output data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.

Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.

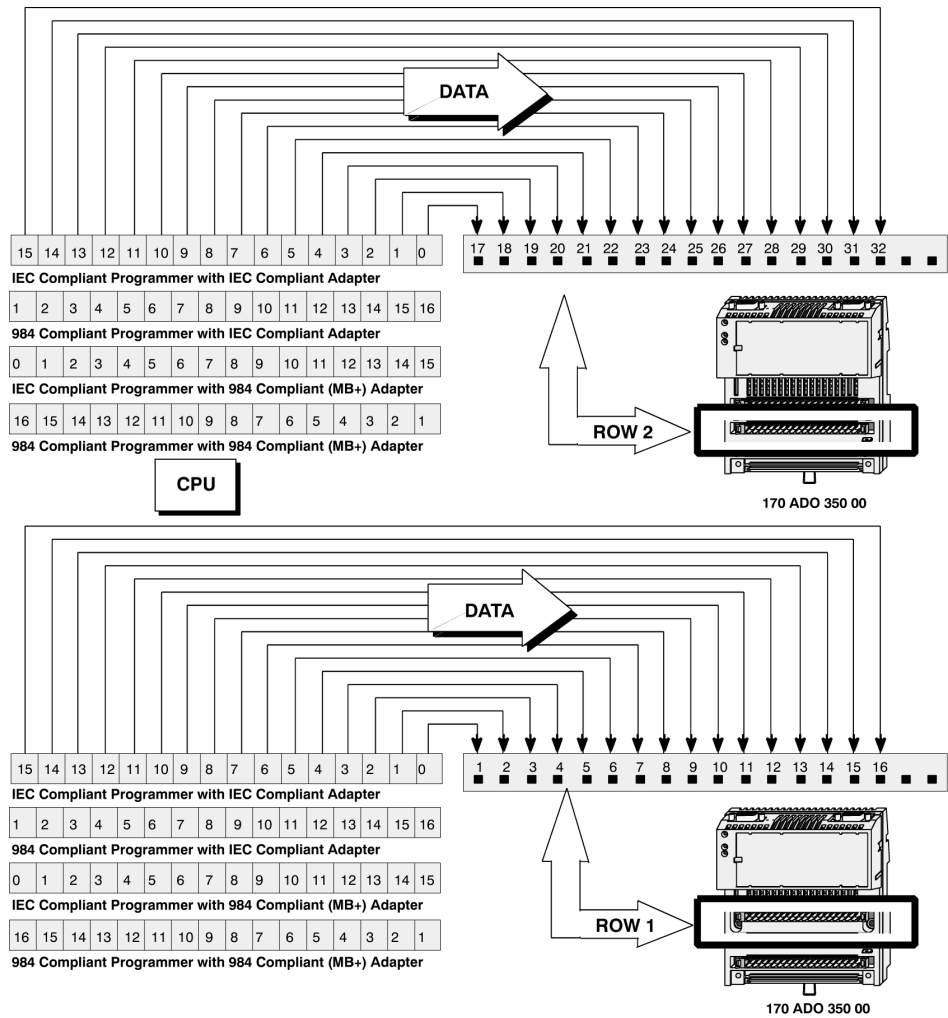
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADO 530 50
120 VAC - 8 Point Discrete Output
@ 2A Module Base

23

At a Glance

Purpose This chapter describes the 170 ADO 530 50 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	442
Wiring	2	449
Configuration	3	456

Section 23.1

Module Overview

Introduction

Purpose This section describes the front panel components of the 170 ADO 530 50 TSX Momentum I/O base and provides specifications.

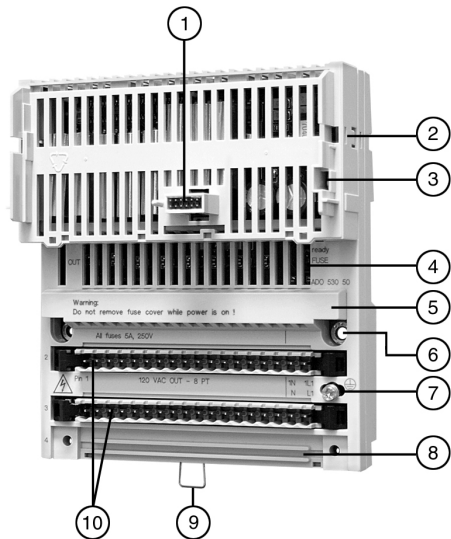
In This Section This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	443
Specifications	445

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADO 530 50 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



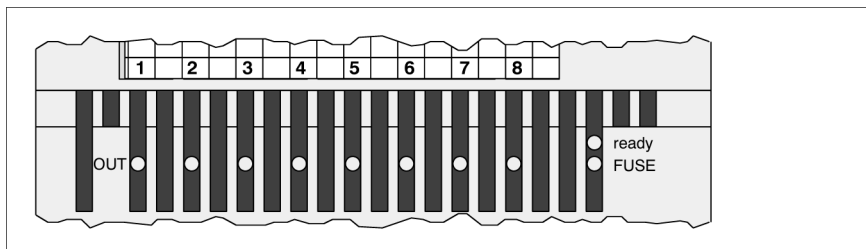
Label	Description
1	Internal interface (ATI) connector
2	Locking tab for the adapter
3	Ground contact for the adapter
4	LED status display
5	Fuses (under the cover)
6	Mounting holes for panel mount
7	Grounding screw
8	Grounding busbar mounting slot
9	Locking tab for DIN rail mount
10	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below

Indicator	Condition	Message
Ready	Green	Module is ready to communicate on network.
	Off	Module is not ready to communicate on network.
Fuse	Green	Output voltage present and fuse 1 and fuse 2 are OK.
	Off	Output voltage is not present or fuse 1 or fuse 2 is not OK.
OUT 1 ... 8	Green	Output status (an LED per output). Output point active, i.e. output carries 1 signal (logically ON).
	Off	Output status (an LED per output). Output point inactive, i.e. output carries 0 signal (logically OFF).

Specifications

Overview

This section contains the specifications for the 170 ADO 530 50 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	8 discrete outputs in 2 groups (4 points/group)
Supply voltage	120 VAC
Supply voltage range	85 ... 132 VAC @ 47 ... 63 Hz
Supply current consumption	125 mA
Power dissipation	5 W + (# of output points on x 3 W)
I/O map	1 output word
Potential isolation	
Point to point	None
Group to group	None
Field to communication adapter	1780 VAC
Fuses	
Internal (replaceable)	5 A slow-blow (Wickmann 19195-5.0A or equivalent)
Internal (non-replaceable)	200 mA slow-blow
External (field power)	10 A slow-blow (Wickmann 19195-10.0A or equivalent)
External (module power)	200 mA slow-blow (Wickmann 19195-200.mA or equivalent)
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 2 kV
Emmissions	EN 55011
Agency approvals	UL, CUL, CE FM class 1, div. 2 pending

Continued on next page

Specifications, Continued

General Specifications, Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	52 mm (2.05in)
Length	141.1 mm (5.6 in) no or one busbar 159.5mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	319.5 g (11.25 oz)

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

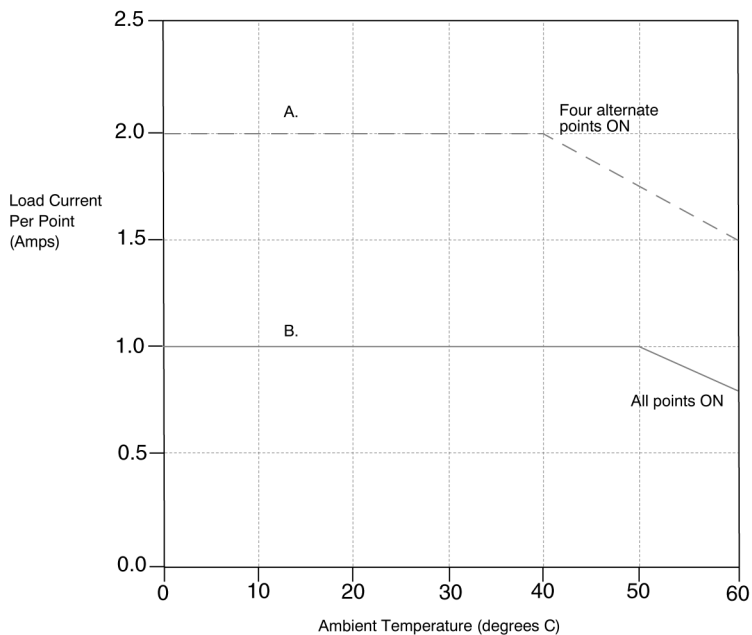
Number of points	8
Number of groups	2 fuse groups, non-isolated
Points per group	4
Output supply voltage	120 VAC
Output supply voltage range	85 ... 132 VAC
Output voltage	External supply - 1.5 VAC
Surge voltage	300 VAC for 10 s 400 VAC for 1 cycle
On state voltage drop	1.5 VAC max @ 2A
Output (load) current	2 A / point (see derating curve in next section) 4 A / group 8 A / module
Minimum output current	5 mA
Maximum surge current (rms)	15 A per point, one cycle 10 A per point, two cycles 5 A per point, three cycles
Output protection	RC snubber
Signal type	True High
Leakage current	1.9 mA @ 120 VAC max
Applied dV / dT	400 V / microseconds
Response time	.5 of one line cycle max OFF to ON .5 of one line cycle max ON to OFF

Continued on next page

Specifications, Continued

Derating Curve

The diagram below shows the ambient temperature in relation to the load current per point in amps.



A. Four alternate points. Maximum current per group is 4 A at 0 ... 60 degrees C.

B. All points ON.

Section 23.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADO 530 50 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	450
Field Wiring Guidelines	451
Wiring Diagrams	453
Simplified Schematics	455

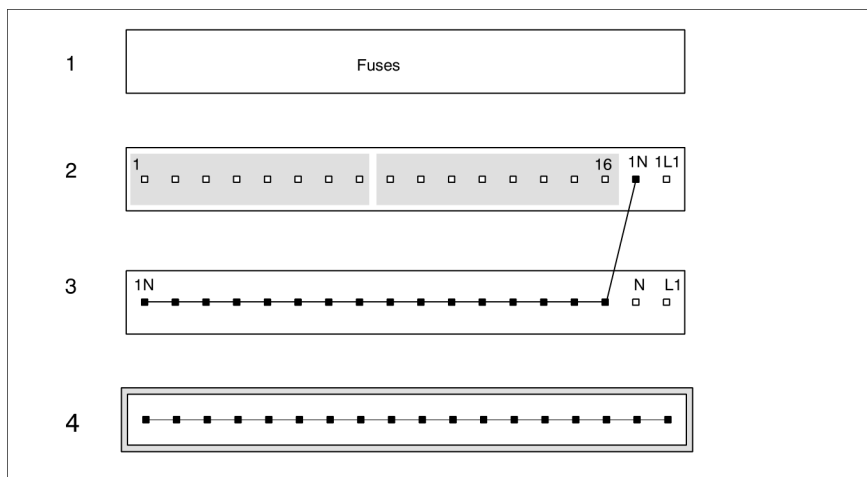
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals on the I/O base and an optional 1-row busbar.

Diagram

Rows 1 through 3 show internal connections between terminals on the base. Row 4 shows internal connections on the optional busbar.



Field Wiring Guidelines

Overview

This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-row busbar. The following busbars are available from Schneider Automation.

Type	Part Number
Screw-in	170 XTS 006 01
Spring-clip	170 XTS 007 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks

The following table shows mapping terminal blocks.

Row	Terminal	Function
1	Fuse 1, Fuse 2	Output fuses
2	1, 3, 5, 7	Outputs for group 1
	9, 11, 13, 15	Outputs for group 2
	17	Neutral for outputs (1N)
	18	Line for outputs (1L1)
3	1 ... 16	Neutrals for individual outputs (1N)
	17	Neutral 120 VAC for module (N)
	18	Line 120 VAC for module (L1)
4	1 ... 18	Protective earth (PE)



CAUTION

VOLTAGE SPIKE MAY BE SUFFICIENT TO DAMAGE OR DESTROY MODULE

If an external switch is wired to control an inductive load in parallel with the module output, then an external varistor (Harris V390ZA05 or equivalent) must be wired in parallel with the switch.

Failure to observe this precaution can result in injury or equipment damage.

Wiring Diagrams

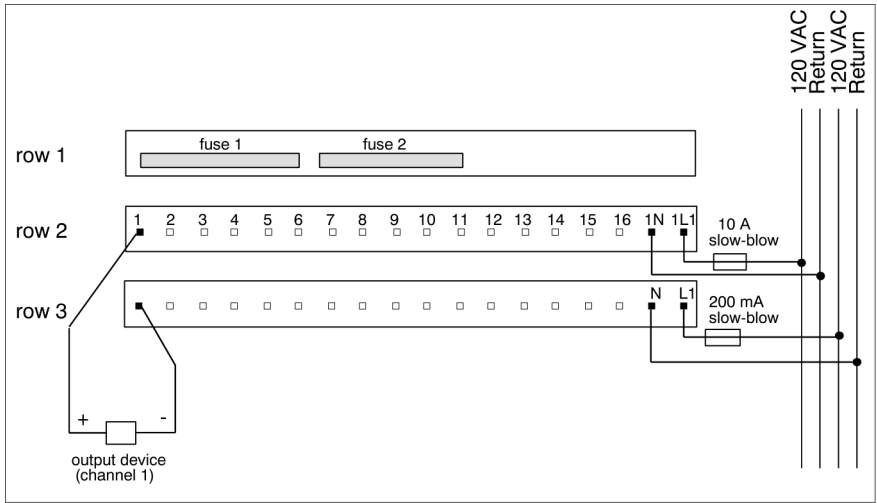
Overview

This section provides diagrams to assist you in wiring the following types of devices:

- Two-wire field devices
- Three-wire field devices

Two-Wire Field Device

The diagram below shows an example of wiring for a two-wire field device.

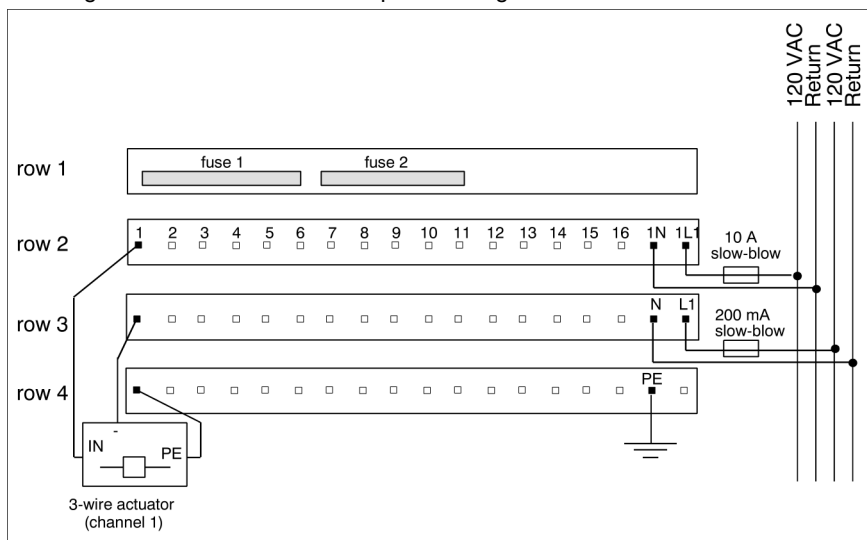


Continued on next page

Wiring Diagrams, Continued

Three-Wire Field Device

The diagram below shows an example of wiring for a three-wire field device..



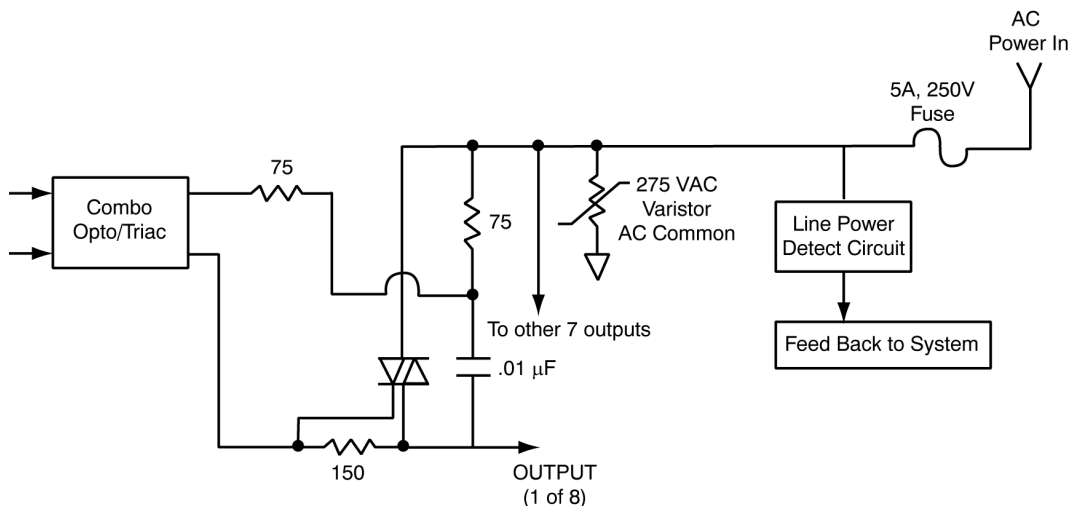
Simplified Schematics

Overview

This section contains a simplified schematic diagram of the field-side output circuitry and information about the behavior of AC outputs when they are off.

Diagram

The following diagram shows the field-side output circuitry.



Output Behavior

The snubber circuit is there to protect the triac. When the triac is turned on, it is almost a short and AC voltage and current travels through it to the output. When the triac is not turned on, AC voltage will still pass through the snubber, as AC will pass through a capacitor, but the impedance through the snubber circuit is so high that usually only 5 mA maximum can flow. (This is generally referred to as leakage current.) Read the specifications for the field device to make sure it cannot be turned on by this leakage current.

Section 23.3

Configuration

Discrete Outputs

Overview	This section describes how to map output data from the CPU to the I/O base.
Number of Words	The processor sends 8 bits of discrete output data to the base as one 16-bit word.
IEC vs. Ladder Logic	<p>In order to correctly field wire the outputs and map the output data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.</p> <p>Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.</p>

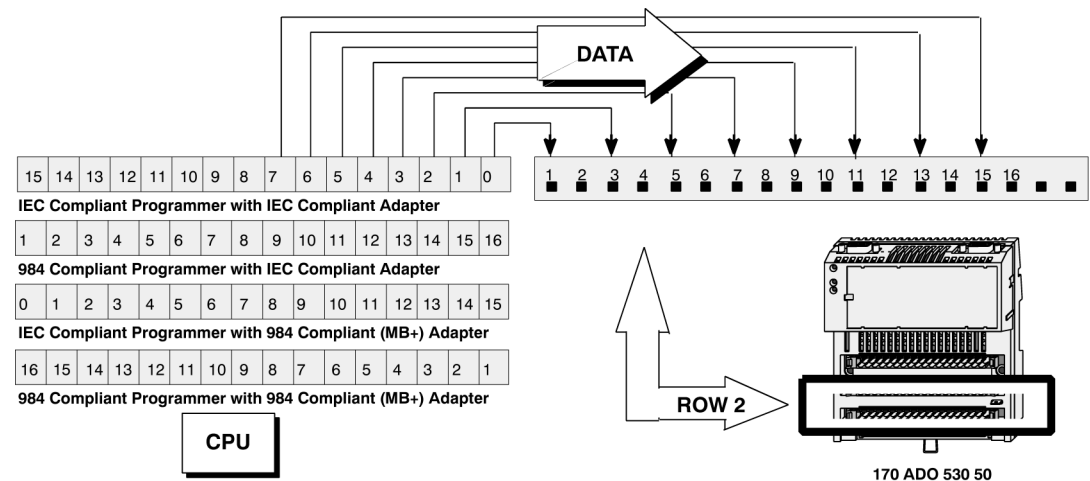
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADO 540 50

120 VAC - 16 Point Discrete

Output Module Base

24

At a Glance

Purpose This chapter describes the 170 ADO 540 50 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	460
Wiring	2	467
Configuration	3	474

Section 24.1

Module Overview

Introduction

Purpose This section describes the front panel components of the 170 ADO 540 50 TSX Momentum I/O base and provides specifications.

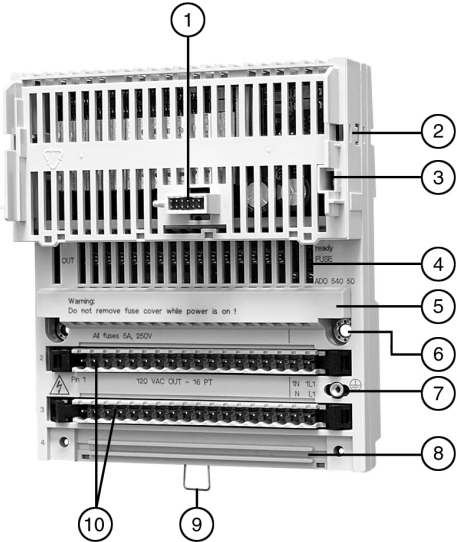
In This Section This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	461
Specifications	463

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADO 540 50 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



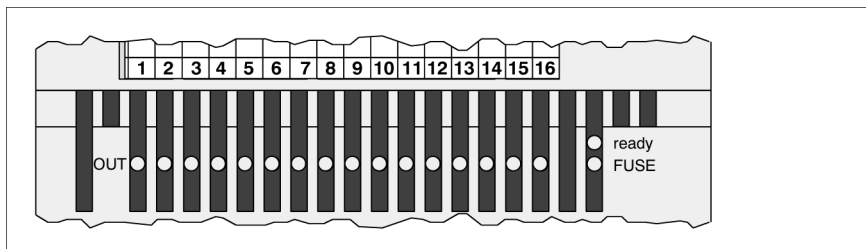
Label	Description
1	Internal interface (ATI) connector
2	Locking tab for the adapter
3	Ground contact for the adapter
4	LED status display
5	Fuses (under the cover)
6	Mounting holes for panel mount
7	Grounding screw
8	Grounding busbar mounting slot
9	Locking tab for DIN rail mount
10	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below

Indicator	Condition	Message
ready	Green	Module is ready to communicate on the network.
	Off	Module is not ready to communicate on the network. Check the L1 voltage source.
FUSE	Green	Output voltage present and fuse 1 and fuse 2 OK.
	Off	Output voltage not present or fuse 1 or fuse 2 not OK.
OUT 1 ... 16	Green	Output status (an LED per output). Output point active.
	Off	Output status (an LED per output). Output point inactive.

Specifications

Overview

This section contains the specifications for the 170 ADO 540 50 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	16 discrete outputs in 2 groups (8 points/group)
Supply voltage	120 VAC
Supply voltage range	85 ... 132 VAC @ 47 ... 63 Hz
Supply current consumption	125 mA
Power dissipation	5 W + (# of output points on x .75 W)
I/O map	1 output word
Potential isolation	
Point to point	None
Group to group	None
Field to communication adapter	1780 VAC
Fuses	
Internal (replaceable)	5 A slow-blow (Wickmann 19195-5.0A or equivalent)
Internal (non-replaceable)	200 mA slow-blow
External (field power)	10 A slow-blow (Wickmann 19195-10.0A or equivalent)
External (module power)	200 mA slow-blow (Wickmann 19195-200.mA or equivalent)
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 2 kV
Emmissions	EN 55011
Agency approvals	UL, CUL, CE FM class 1, div. 2 pending

Continued on next page

Specifications, Continued

General Specifications, Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	52 mm (2.05in)
Length	141.1 mm (5.6 in) no or one busbar 159.5 mm (6.3 in) two busbars 171.5 mm (6.75in) three busbars
Weight	284 g (10 oz)

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

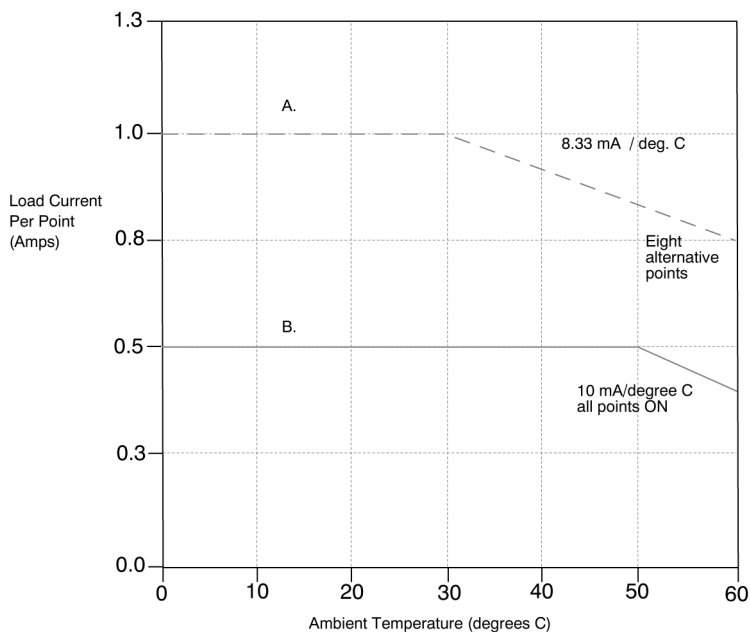
Number of points	16
Number of groups	2 fuse groups, non-isolated
Points per group	8
Output supply voltage	120 VAC
Output supply voltage range	85 ... 132 VAC
Output voltage	External supply - 1.5 VAC
Surge voltage	300 VAC for 10 s 400 VAC for 1 cycle
On state voltage drop	1.5 VAC max @ 0.5 A
Output (load) current	0.5 A / point continuous (see derating curve in next section) 4 A / group 8 A / module
Minimum output current	30 mA
Maximum surge current (rms)	15 A per point, one cycle 10 A per point, two cycles 5 A per point, three cycles
Output protection	RC snubber
Signal type	True High
Leakage current	1.9 mA @ 120 VAC max
Applied dV / dT	400 V / microseconds
Response time	.5 of one line cycle max OFF to ON .5 of one line cycle max ON to OFF

Continued on next page

Specifications, Continued

Derating Curve

The diagram below shows the ambient temperature in relation to the load current per point in amps.



A. Eight alternate points. Maximum current per group is 3 A at 60 degrees C.

B. Sixteen points. Maximum current per point is .4 A at 60 degrees C. Maximum current per group is 3.2 A at 60 degrees C.

Section 24.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADO 540 50 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	468
Field Wiring Guidelines	469
Wiring Diagrams	471
Simplified Schematics	473

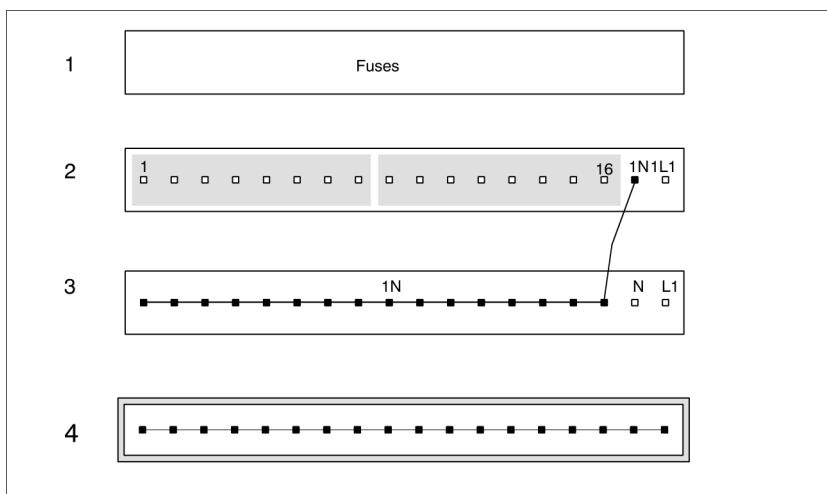
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals on the I/O base and an optional 1-row busbar.

Diagram

Rows 1 through 3 show the internal connections between terminals on the base. Row 4 shows internal connections on the optional busbar.



Field Wiring Guidelines

Overview

The outputs are field wired to row 2 of the base. This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-row busbar. The following busbars are available from Schneider Automation.

Type	Part Number
Screw-in	170 XTS 006 01
Spring-clip	170 XTS 007 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks

The following table shows mapping terminal blocks.

Row	Terminal	Function
1	Fuse 1, Fuse 2	Output fuses
2	1 ... 8	Outputs for group 1
	9 ... 16	Outputs for group 2
	17	Neutral for outputs (1N)
	18	Line for outputs (1L1)
3	1 ... 16	Neutrals for individual outputs (1N)
	17	Neutral 120 VAC for module (N)
	18	Line 120 VAC for module (L1)
4	1 ... 18	Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Protective Circuit May Be Required

When contacted switches are used on the input lines or when lines to the peripherals are very long, the outputs of inductive loads require protective circuitry with a clamping/suppressor diode. Install the protective circuit parallel to the operating coil.

Wiring Diagrams

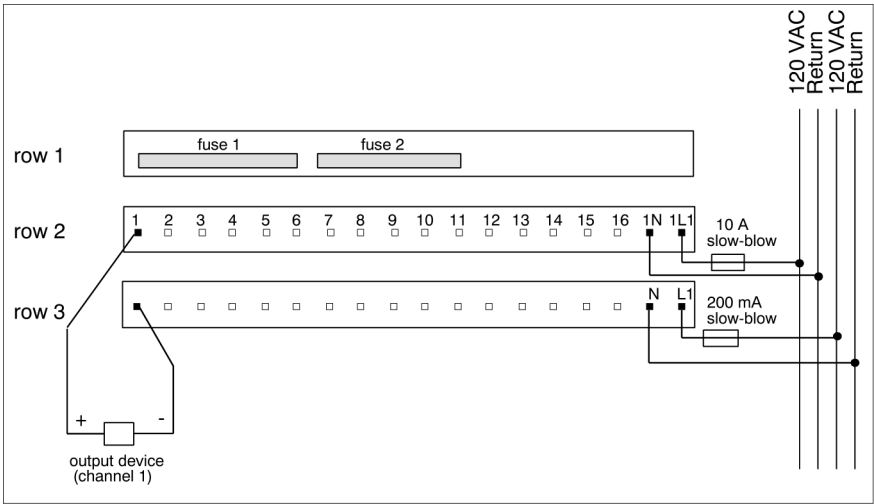
Overview

This section provides diagrams to assist you in wiring the following types of devices:

- Two-wire actuators
- Three-wire actuators

Two-Wire Actuator

The diagram below shows an example of wiring for a two-wire actuator.

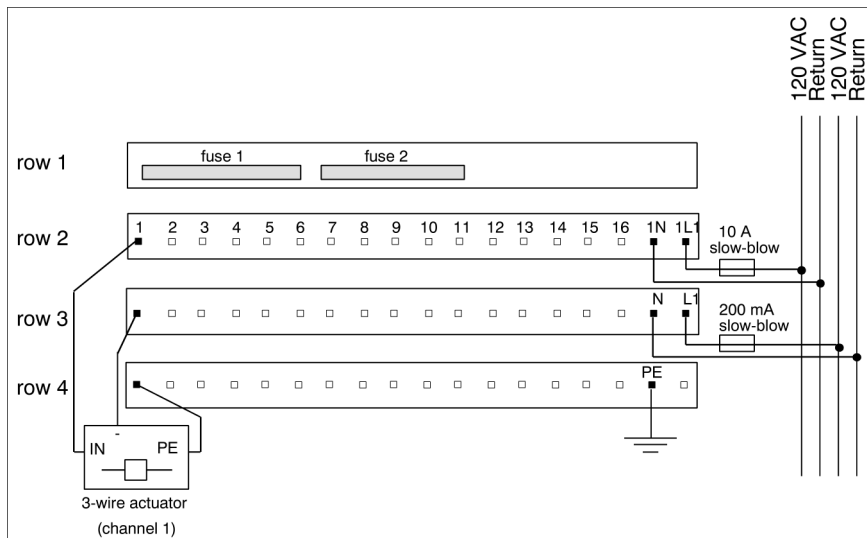


Continued on next page

Wiring Diagrams, Continued

Three-Wire Actuator

The diagram below shows an example of wiring for a three-wire actuator.



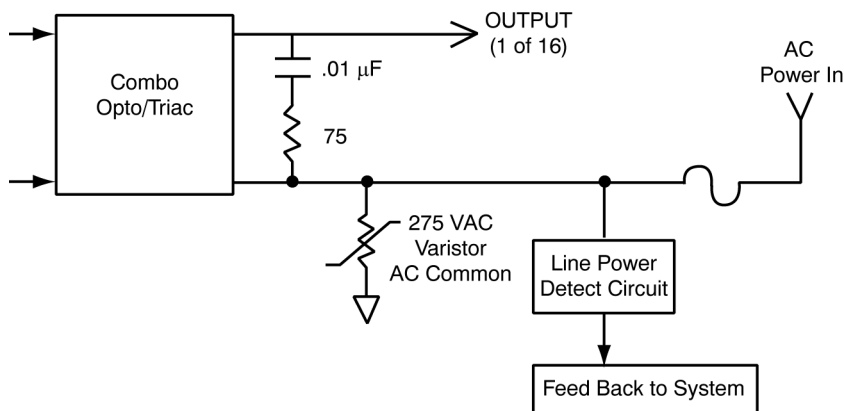
Simplified Schematics

Overview

This section contains a simplified schematic diagram of the field-side output circuitry and information about the behavior of AC outputs when they are off.

Diagram

The following diagram shows the field-side output circuitry.



Output Behavior

The snubber circuit is there to protect the triac. When the triac is turned on, it is almost a short and AC voltage and current travels through it to the output. When the triac is not turned on, AC voltage will still pass through the snubber, as AC will pass through a capacitor, but the impedance through the snubber circuit is so high that usually only 5 mA maximum can flow. (This is generally referred to as leakage current.) Read the specifications for the field device to make sure it cannot be turned on by this leakage current.

Section 24.3

Configuration

Discrete Outputs

Overview	This section describes how to map output data from the CPU to the I/O base.
Number of Words	The processor sends 16 bits of discrete output data to the base as one 16-bit word.
IEC vs. Ladder Logic	<p>In order to correctly field wire the outputs and map the output data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.</p> <p>Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.</p>

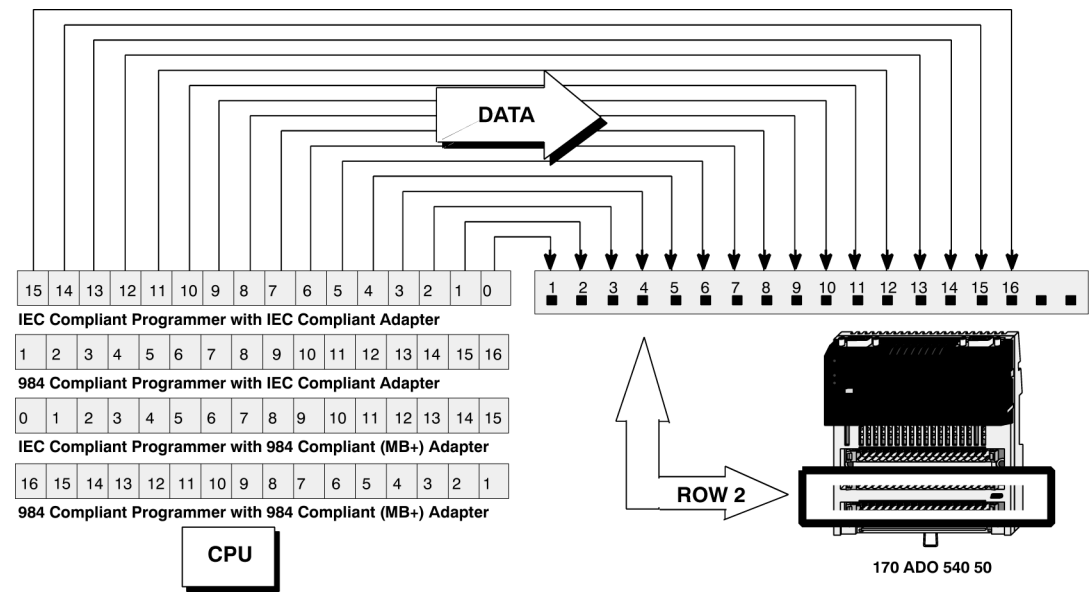
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADO 730 50
230 VAC - 8 Point Discrete Output
@ 2A Module Base

25

At a Glance

Purpose This chapter describes the 170 ADO 730 50 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	478
Wiring	2	485
Configuration	3	492

Section 25.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 ADO 730 50 TSX Momentum I/O base and provides specifications.

In This Section

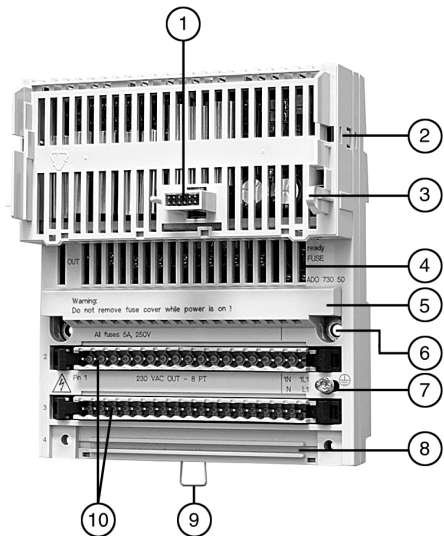
This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	479
Specifications	481

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADO 730 50 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



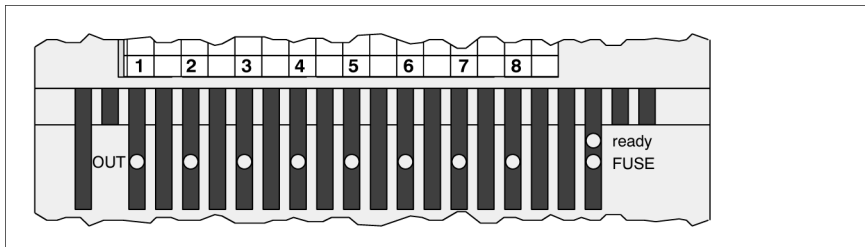
Label	Description
1	Internal interface (ATI) connector
2	Locking tab for the adapter
3	Ground contact for the adapter
4	LED status display
5	Fuses (under the cover)
6	Mounting holes for panel mount
7	Grounding screw
8	Grounding busbar mounting slot
9	Locking tab for DIN rail mount
10	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below

Indicator	Condition	Message
Ready	Green	Module is ready to communicate on network.
	Off	Module is not ready to communicate on network.
Fuse	Green	Output voltage present and fuse 1 and fuse 2 are OK.
	Off	Output voltage is not present or fuse 1 or fuse 2 is not OK.
OUT 1 ... 8	Green	Output status (an LED per output). Output point active, i.e. output carries 1 signal (logically ON).
	Off	Output status (an LED per output). Output point inactive, i.e. output carries 0 signal (logically OFF).

Specifications

Overview

This section contains the specifications for the 170 ADO 730 50 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	8 discrete outputs in 2 groups (4 pts/grp)
Supply voltage	230 VAC
Supply voltage range	170 ... 264 VAC @ 47 ... 63 Hz
Supply current consumption	65 mA
Power dissipation	5 W + (# of output points on x 3 W)
I/O map	1 output word
Potential isolation	
Point to point	None
Group to group	None
Field to communication adapter	1780 VAC
Fuses	
Internal (replaceable)	5 A slow-blow (Wickmann 19195-5.0A or equivalent)
Internal (non-replaceable)	200 mA slow-blow
External (field power)	10 A slow-blow (Wickmann 19195-10.0A or equivalent)
External (module power)	200 mA slow-blow (Wickmann 19195-200.mA or equivalent)
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 2 kV
Emmissions	EN 55011
Agency approvals	UL, CUL, CE FM class 1, div. 2 pending

Continued on next page

Specifications, Continued

General Specifications, Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	52 mm (2.05in)
Length	141.1 mm (5.6 in) no or one busbar 159.5mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	284 g (10 oz)

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

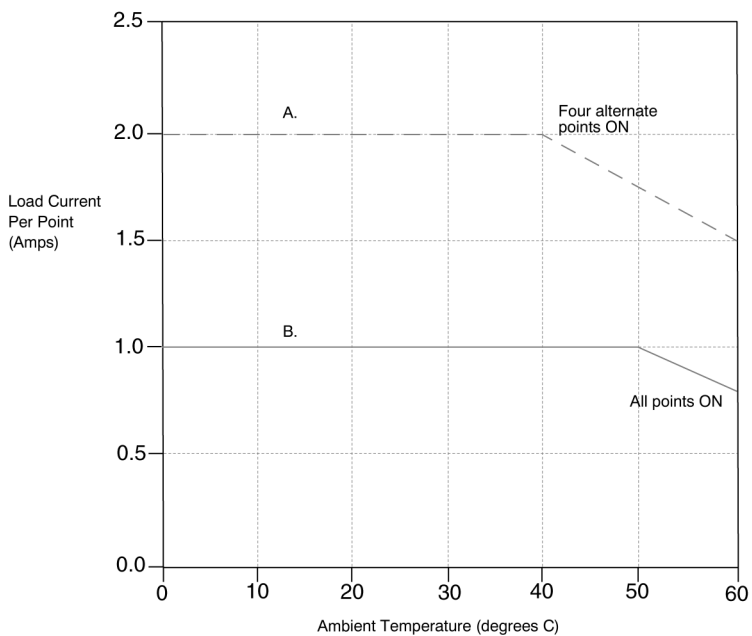
Number of points	8
Number of groups	2 fuse groups, non-isolated
Points per group	4
Output supply voltage	230 VAC
Output supply voltage range	170 ... 264 VAC
Output voltage	External supply - 1.5 VAC
Surge voltage	300 VAC for 10 s 400 VAC for 1 cycle
On state voltage drop	1.5 VAC max @ 2A
Output (load) current	2 A / point (see derating curve in next section) 4 A / group 8 A / module
Minimum output current	5 mA
Maximum surge current (rms)	15 A per point, one cycle 10 A per point, two cycles 5 A per point, three cycles
Output protection	RC snubber
Signal type	True High
Leakage current	2.5 mA @ 230 VAC max
Applied dV / dT	400 V / microseconds
Response time	.5 of one line cycle max OFF to ON .5 of one line cycle max ON to OFF

Continued on next page

Specifications, Continued

Derating Curve

The diagram below shows the ambient temperature in relation to the load current per point in amps.



A. Four alternate points. Maximum current per group is 4 A at 0 ... 60 degrees C.

B. All points ON.

Section 25.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADO 730 50 TSX Momentum I/O base.

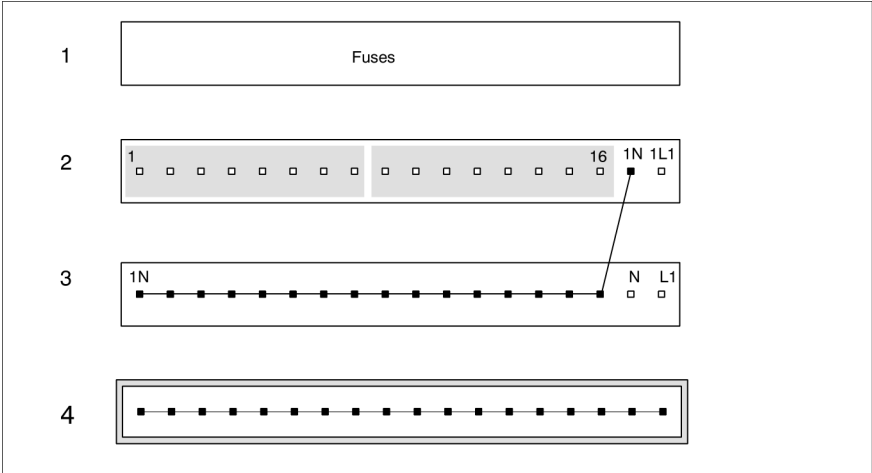
In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	486
Field Wiring Guidelines	487
Wiring Diagrams	489
Simplified Schematics	491

Internal Pin Connections

Overview This section contains a diagram showing the internal connections for terminals on the I/O base and an optional 1-row busbar.

Diagram Rows 1 through 3 show internal connections between terminals on the base. Row 4 shows internal connections on the optional busbar.



Field Wiring Guidelines

Overview

This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-row busbar. The following busbars are available from Schneider Automation.

Type	Part Number
Screw-in	170 XTS 006 01
Spring-clip	170 XTS 007 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbars

The following table shows mapping terminal blocks and optional busbars.

Row	Terminal	Function
1	Fuse 1, Fuse 2	Output fuses
2	1, 3, 5, 7	Outputs for group 1
	9, 11, 13, 15	Outputs for group 2
	17	Neutral for outputs (1N)
	18	Line for outputs (1L1)
3	1 ... 16	Neutrals for individual outputs (1N)
	17	Neutral 230 VAC for module (N)
	18	Line 230 VAC for module (L1)
4	1 ... 18	Protective earth (PE)



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Protective Circuit May Be Required

When contacted switches are used on the input lines or when lines to the peripherals are very long, the outputs of inductive loads require protective circuitry with a clamping/suppressor diode. Install the protective circuit parallel to the operating coil.

Wiring Diagrams

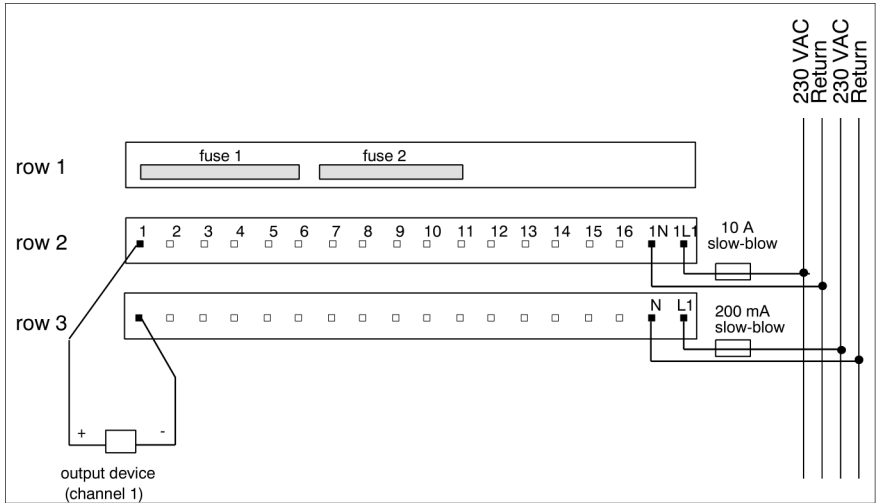
Overview

This section provides diagrams to assist you in wiring the following types of devices:

- Two-wire field devices
- Three-wire field devices

Two-Wire Field Device

The diagram below shows an example of wiring for a two-wire field device.

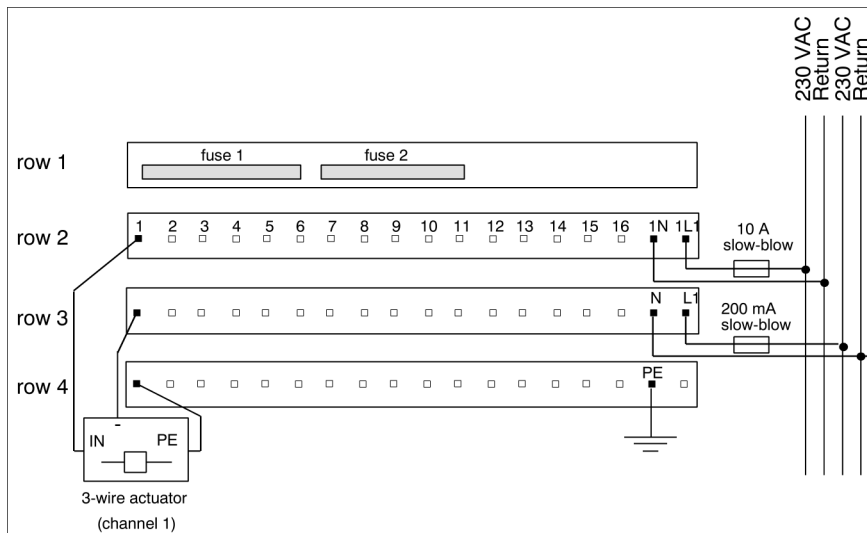


Continued on next page

Wiring Diagrams, Continued

Three-Wire Field Device

The diagram below shows an example of wiring for a three-wire field device..



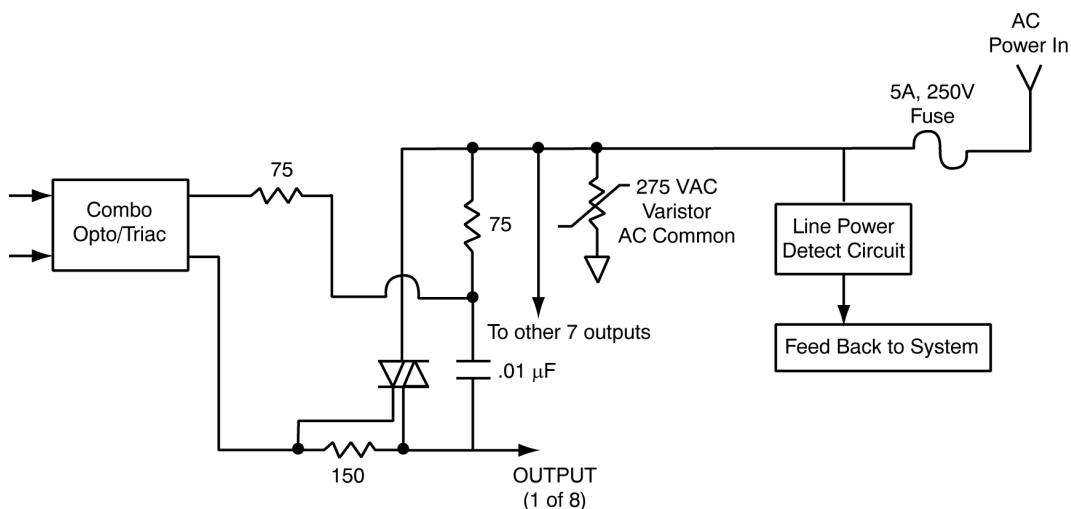
Simplified Schematics

Overview

This section contains a simplified schematic diagram of the field-side output circuitry and information about the behavior of AC outputs when they are off.

Diagram

The following diagram shows the field-side output circuitry.



Output Behavior

The snubber circuit is there to protect the triac. When the triac is turned on, it is almost a short and AC voltage and current travels through it to the output. When the triac is not turned on, AC voltage will still pass through the snubber, as AC will pass through a capacitor, but the impedance through the snubber circuit is so high that usually only 5 mA maximum can flow. (This is generally referred to as leakage current.) Read the specifications for the field device to make sure it cannot be turned on by this leakage current.

Section 25.3

Configuration

Discrete Outputs

Overview This section describes how to map output data from the CPU to the I/O base.

Number of Words The processor sends 8 bits of discrete output data to the base as one 16-bit word.

IEC vs. Ladder Logic In order to correctly field wire the outputs and map the output data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.

Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.

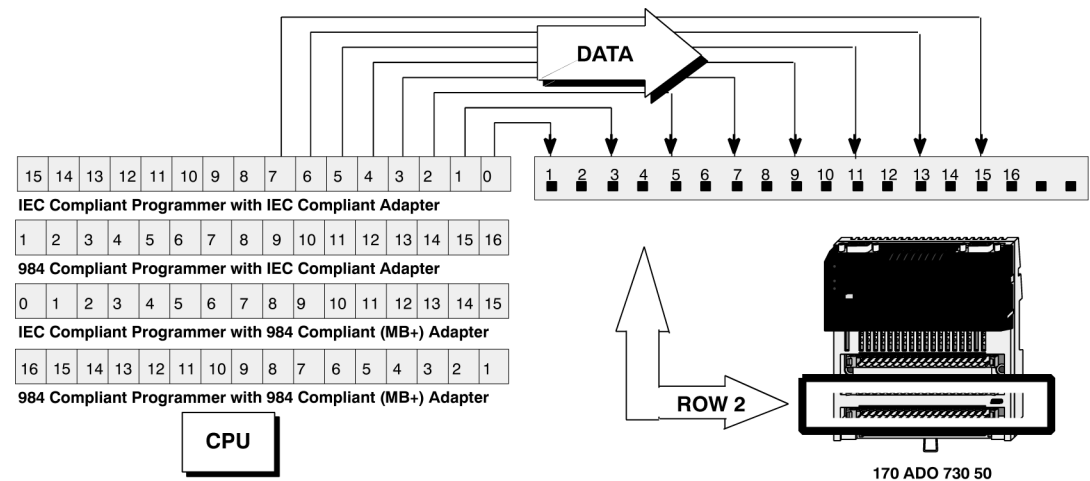
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 ADO 740 50

230 VAC - 16 Point Discrete

Output Module Base

At a Glance

Purpose This chapter describes the 170 ADO 740 50 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	496
Wiring	2	503
Configuration	3	510

Section 26.1

Module Overview

Introduction

Purpose This section describes the front panel components of the 170 ADO 740 50 TSX Momentum I/O base and provides specifications.

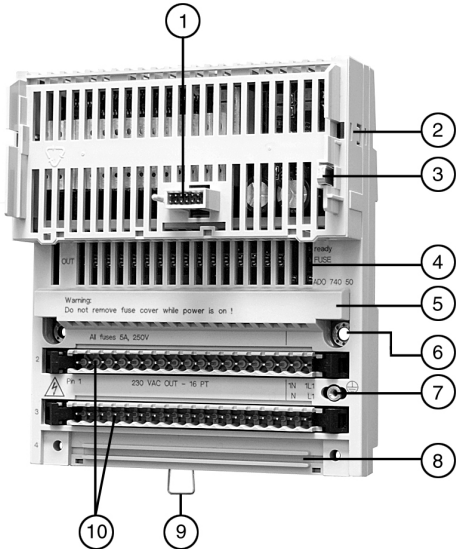
In This Section This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	497
Specifications	499

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 ADO 740 50 discrete I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



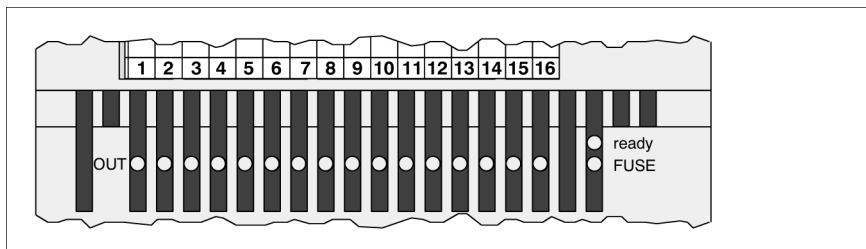
Label	Description
1	Internal interface (ATI) connector
2	Locking tab for the adapter
3	Ground contact for the adapter
4	LED status display
5	Fuses (under the cover)
6	Mounting holes for panel mount
7	Grounding screw
8	Grounding busbar mounting slot
9	Locking tab for DIN rail mount
10	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs are described in the table below

Indicator	Condition	Message
ready	Green	Module is ready to communicate on the network.
	Off	Module is not ready to communicate on the network. Check the L1 voltage source.
FUSE	Green	Output voltage present and fuse 1 and fuse 2 OK.
	Off	Output voltage not present or fuse 1 or fuse 2 not OK.
OUT 1 ... 16	Green	Output status (an LED per output). Output point active.
	Off	Output status (an LED per output). Output point inactive.

Specifications

Overview

This section contains the specifications for the 170 ADO 740 50 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	16 discrete outputs in 2 groups (8 points/group)
Supply voltage	230 VAC
Supply voltage range	170 ... 264 VAC @ 47 ... 63 Hz
Supply current consumption	65 mA
Power dissipation	5 W + (# of output points on x .75 W)
I/O map	1 output word
Potential isolation	
Point to point	None
Group to group	None
Field to communication adapter	1780 VAC
Fuses	
Internal (replaceable)	5 A slow-blow (Wickmann 19195-5.0A or equivalent)
Internal (non-replaceable)	200 mA slow-blow
External (field power)	10 A slow-blow (Wickmann 19195-10.0A or equivalent)
External (module power)	200 mA slow-blow (Wickmann 19195-200.mA or equivalent)
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 2 kV
Emmissions	EN 55011
Agency approvals	UL, CUL, CE FM class 1, div. 2 pending

Continued on next page

Specifications, Continued

General Specifications, Continued

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	52 mm (2.05in)
Length	141.1 mm (5.6 in) no or one busbar 159.5mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	284 g (10 oz)

Continued on next page

Specifications, Continued

Discrete Outputs The following table contains specifications for discrete outputs.

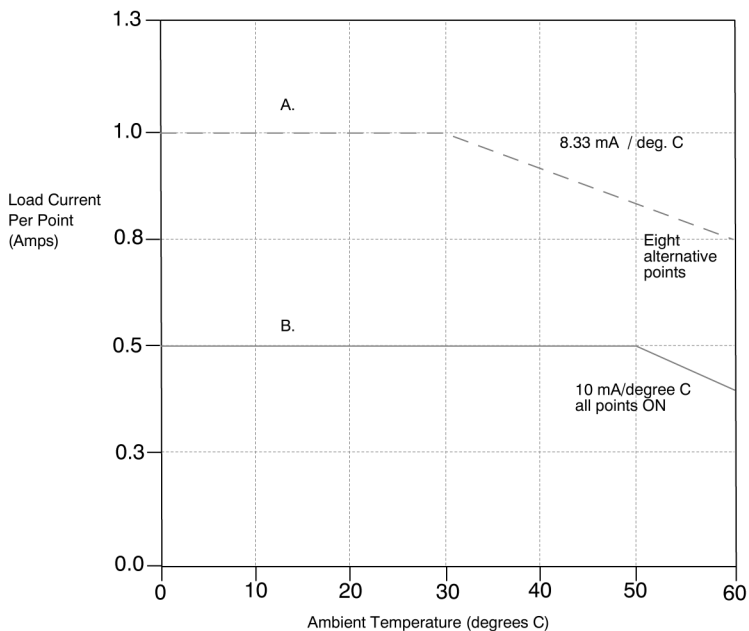
Number of points	16
Number of groups	2 fuse groups, non-isolated
Points per group	8
Output supply voltage	230 VAC
Output supply voltage range	170 ... 264 VAC
Output voltage	External supply - 1.5 VAC
Surge voltage	300 VAC for 10 s 400 VAC for 1 cycle
On state voltage drop	1.5 VAC max @ 0.5 A
Output (load) current	0.5 A / point continuous (see derating curve in next section) 4 A / group 8 A / module
Minimum output current	30 mA
Maximum surge current (rms)	15 A per point, one cycle 10 A per point, two cycles 5 A per point, three cycles
Output protection	RC snubber
Signal type	True High
Leakage current	2.4 mA @ 230 VAC max
Applied dV / dT	400 V / microseconds
Response time	.5 of one line cycle max OFF to ON .5 of one line cycle max ON to OFF

Continued on next page

Specifications, Continued

Derating Curve

The diagram below shows the ambient temperature in relation to the load current per point in amps.



A. Eight alternate points. Maximum current per group is 3 A at 60 degrees C.

B. Sixteen points. Maximum current per point is .4 A at 60 degrees C. Maximum current per group is 3.2 A at 60 degrees C.

Section 26.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ADO 740 50 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	504
Field Wiring Guidelines	505
Wiring Diagrams	507
Simplified Schematics	509

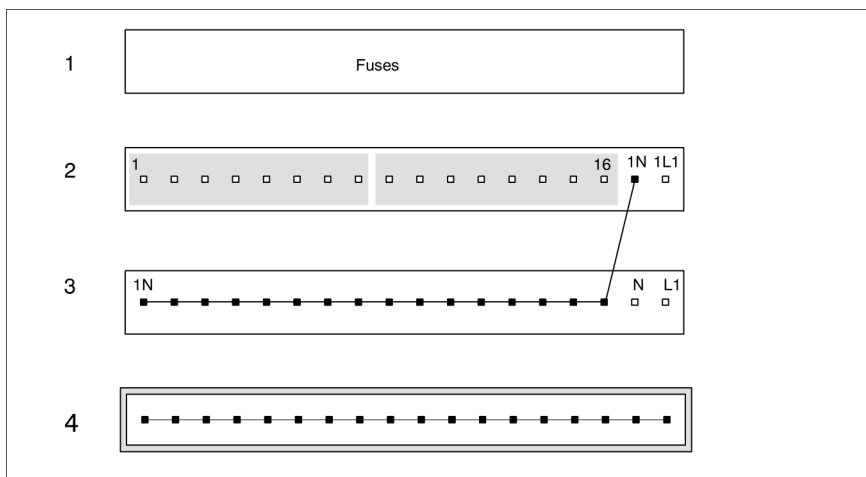
Internal Pin Connections

Overview

This section contains a diagram showing the internal connections for terminals on the I/O base and an optional 1-row busbar.

Diagram

Rows 1 through 3 show the internal connections between terminals on the base. Row 4 shows internal connections on the optional busbar.



Field Wiring Guidelines

Overview

The outputs are field wired to row 2 of the base. This section contains guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automation sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-row busbar. The following busbars are available from Schneider Automation.

Type	Part Number
Screw-in	170 XTS 006 01
Spring-clip	170 XTS 007 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbars

The following table shows mapping terminal blocks and optional busbars.

Row	Terminal	Function
1	Fuse 1, Fuse 2	Output fuses
2	1 ... 8	Outputs for group 1
	9 ... 16	Outputs for group 2
	17	Neutral for outputs (1N)
	18	Line for outputs (1L1)
3	1 ... 16	Neutrals for individual outputs (1N)
	17	Neutral 230 VAC for module (N)
	18	Line 230 VAC for module (L1)
4	1 ... 18	Protective earth (PE)



CAUTION

VOLTAGE SPIKE MAY BE SUFFICIENT TO DAMAGE OR DESTROY MODULE

If an external switch is wired to control an inductive load in parallel with the module output, then an external varistor (Harris V390ZA05 or equivalent) must be wired in parallel with the switch.

Failure to observe this precaution can result in injury or equipment damage.

Wiring Diagrams

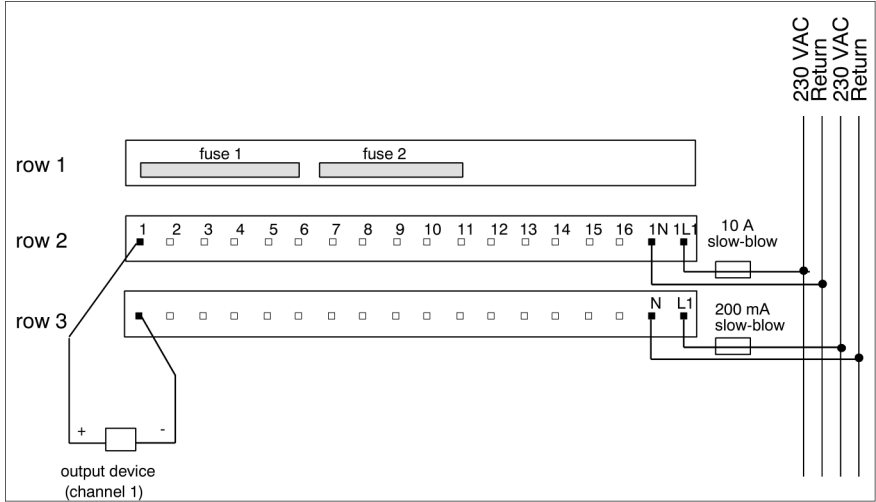
Overview

This section provides diagrams to assist you in wiring the following types of devices:

- Two-wire actuators
- Three-wire actuators

Two-Wire Actuator

The diagram below shows an example of wiring for a two-wire actuator.

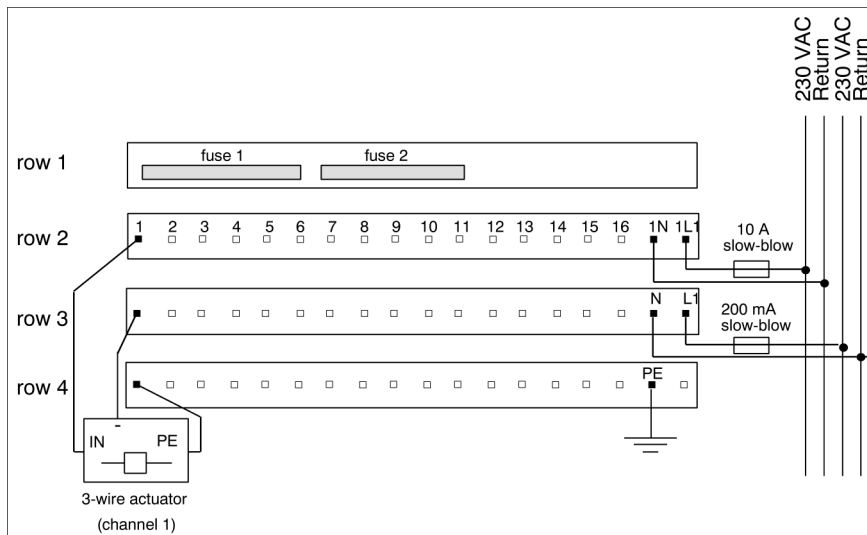


Continued on next page

Wiring Diagrams, Continued

Three-Wire Actuator

The diagram below shows an example of wiring for a three-wire actuator.



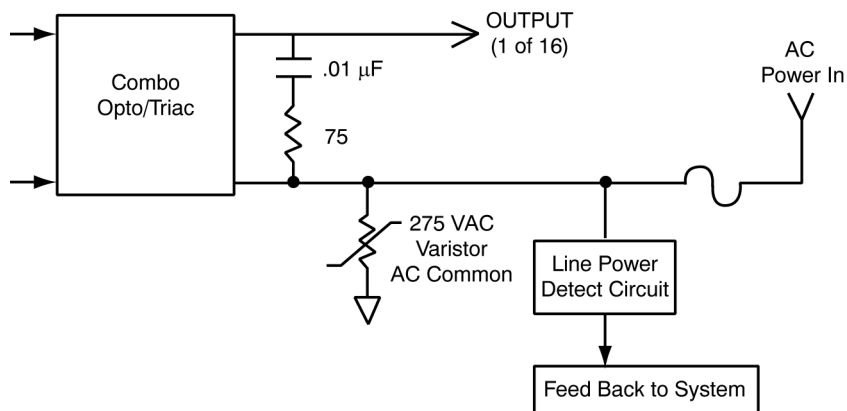
Simplified Schematics

Overview

This section contains a simplified schematic diagram of the field-side output circuitry and information about the behavior of AC outputs when they are off.

Diagram

The following diagram shows the field-side output circuitry.



Output Behavior

The snubber circuit is there to protect the triac. When the triac is turned on, it is almost a short and AC voltage and current travels through it to the output. When the triac is not turned on, AC voltage will still pass through the snubber, as AC will pass through a capacitor, but the impedance through the snubber circuit is so high that usually only 5 mA maximum can flow. (This is generally referred to as leakage current.) Read the specifications for the field device to make sure it cannot be turned on by this leakage current.

Section 26.3

Configuration

Discrete Outputs

Overview	This section describes how to map output data from the CPU to the I/O base.
Number of Words	The processor sends 16 bits of discrete output data to the base as one 16-bit word.
IEC vs. Ladder Logic	<p>In order to correctly field wire the outputs and map the output data, you need to know which type of Momentum Adapter is mounted on the base and which type of programming software has been used to configure and program the CPU.</p> <p>Adapters and programming software may be either IEC compliant or 984 Ladder Logic compliant.</p>

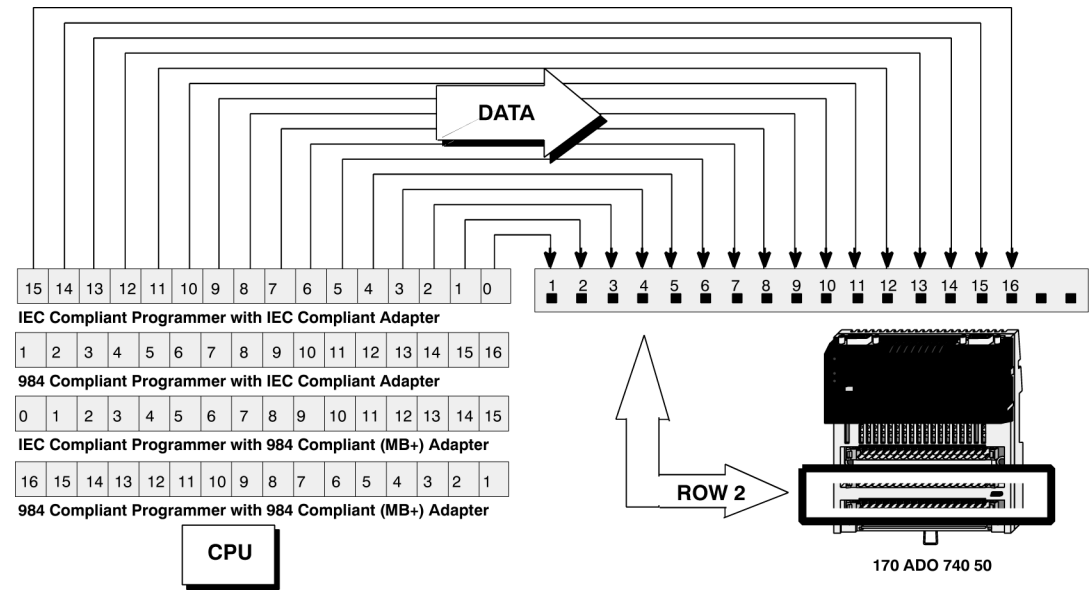
	IEC Compliant	984 Ladder Logic Compliant
Momentum Processor Adapters	All	None
Momentum Communication Adapters	All, except 170 NEF 110 21 170 NEF 160 21	170 NEF 110 21 170 NEF 160 21
Programming Software	Concept 2.1 or higher	Modsoft 2.5

Continued on next page

Discrete Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the I/O base and the CPU with different combinations of programming software and adapters.



170 AMM 090 00
Analog 4 Ch. In / 2 Ch. Out Module
Base w/ 24 VDC I/O Pts

27

At a Glance

Purpose This chapter describes the 170 AMM 090 00 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:.

For This Topic...	See Section...	On Page...
Module Overview	1	514
Wiring	2	522
Configuration	3	530
Analog/Digital Relation	4	538
Error Messages	5	546

Section 27.1

Module Overview

Introduction

Purpose

This section describes the front panel components of the 170 AMM 090 00 TSX Momentum I/O base and provides specifications.

In This Section

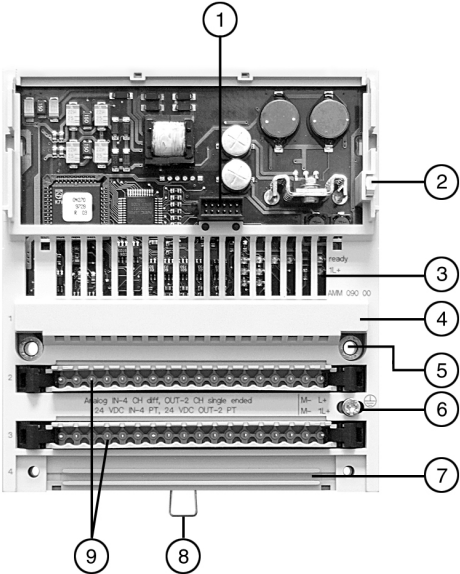
This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	515
Specifications	517

Front Panel Components

Overview This section contains a photograph of the front panel of the 170 AMM 090 00 I/O base and a description of the LEDs.

Front Panel The front panel of the I/O base is shown in the photograph below:



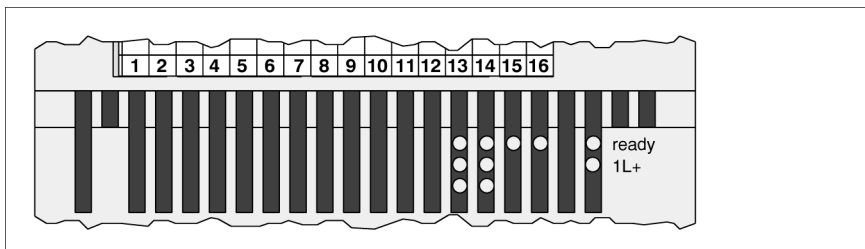
Label	Description
1	Internal interface (ATI) connector
2	Ground contact for the adapter
3	LED status display
4	Protective cover
5	Mounting holes for panel mount
6	Grounding screw
7	Busbar mounting slot
8	Locking tab for DIN rail mount
9	Sockets for the terminal connectors

Continued on next page

Front Panel Components, Continued

LED Illustration

The LEDs are shown in the illustration below.



LED Descriptions

The LEDs for this I/O base are described in the table below.

Indicator	Condition	Message
Ready	Green	Module is ready to communicate. Operating voltage for internal logic is present and self-test has been passed.
	Off	Module is not ready
1L+	Green	Supply voltage for outputs 1, 2 applied.
	Off	Supply voltage for outputs 1, 2 not applied.
Top row 13 ... 16	Green	Discrete input status (an LED per input) Input point active, i.e. input carries "1" signal (logically "ON").
	Off	Discrete input status (an LED per input) Input point inactive, i.e. input carries "0" signal (logically "OFF").
Middle row 13, 14	Green	Discrete output status (one LED per output) Output point enabled, i.e. "1" signal at output (logic "ON").
	Off	Discrete output status (one LED per output). Output point disabled, i.e. "0" signal at output (logic "OFF").
Bottom row 13, 14	Red	Analog output overload (one LED per output) Output concerned short-circuited or overloaded.
	Off	Analog outputs 1 ... 2 operating normally.

Specifications

Overview

This section contains specifications for the 170 AMM 090 00 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base.

Module type	4 differential inputs, 2 outputs (analog)
	4 inputs, 2 outputs (discrete)
Supply voltage	24 VDC
Supply voltage range	20 ... 30 VDC
Supply current consumption	max. 350 mA at 24 VDC
Power dissipation	4 W typical 6 W maximum
I/O map	5 input words 5 output words
Potential isolation	
Discrete inputs from outputs	None
Analog inputs from outputs	None
Analog inputs and outputs from operating voltage	500 VAC for 1 min
Operating voltage and all inputs and outputs from ground	500 VAC for 1 min
Fuses	
Internal	None
Operating voltage L+	325 mA fast-blow (with bus adapter) (Wickmann 19193-325 mA or equivalent)
Output voltage 1L+	Depending on the application, max. 5 A fast-blow
Input voltage 1L+	Depending on the application, max. 1 A fast-blow

Continued on next page

Specifications, Continued

General Specifications, Continued

EMC for industrial environment	
Noise immunity	IEC 1131 (500 V disturbance pulse in operating voltage)
Radiated noise	EN 50081-2 (threshold A)
Agency approvals	UL, CUL, CE FM class 1, div 2, pending
Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54 in)
Length	141.5 mm (5.5 in) with single-row or no busbar 159.5 mm (6.3 in) with two-row busbar 171.5 mm (6.75 in) with three-row busbar
Weight	240 g (0.55 lb)

Continued on next page

Specifications, Continued

Analog Inputs

The following tables contain specifications for analog inputs.

Number of channels	4 differential inputs
Common mode voltage	Input voltage from Ag +/- 11 V
Common mode suppression	> 54 dB
Overvoltage (1 input) Static Dynamic	Voltage ranges +/- 30 V when voltage source is 24 V +/- 50 V max. 100 s Current ranges, input current < 48 mA
Input resistance	> 1 MOhm voltage range 250 Ohm current range
Input filter time constant	120 microsec. (typ.)
Crosstalk	Input channel from input channel approx -80 dB

Range	+/-10V	+/-5V	1 ... 5 V	+/- 20 mA	4 ... 20 mA
Conversion time	10 ms for all channels	10 ms for all channels	10 ms for all channels	10 ms for all channels	10 ms for all channels
Conversion error at 25 deg. C	max. 0.08 % of upper measuring range value	max. 0.16 % of upper measuring range value	max. 0.16 % of upper measuring range value	current measurement	current measurement
Error at 0 ... 60 deg. C	max. 0.15 % of upper measuring range value	max. 0.3 % of upper measuring range value	max. 0.3 % of upper measuring range value	current measurement	current measurement
Conversion consistency	max. 0.02 % of upper measuring range value	max. 0.04 % of upper measuring range value	max. 0.04 % of upper measuring range value	current measurement	current measurement
Resolution (see note)	14 bits	13 bits	12 bits	13 bits	12 bits

Continued on next page

Specifications, Continued

Analog Outputs

The following tables contain specifications for analog outputs.

Number of channels	2	
Conversion time	1 ms for all channels	
Conversion error at 25 deg. C	max +/- 0.35 % of upper measuring range value	
Loop power supply	None required	
Error at 0 ... 60 deg. C	max +/- 0.7 % of upper measuring range value	
Linearity	+/- 1 LSB (monotonous)	
Crosstalk	Output channel from output channel approx. - 80 dB	
Range	+/-10 V Voltage	0 ... 20 mA Current
Output load	>= 3 KOhm	<= 600 Ohms
Resolution	12 bits	12 bits

Discrete Inputs

The following table contains specifications for discrete inputs:

Number of points	4
Number of groups	1
Point/group	4
Signal type	True High
IEC 1131 type	1+ (See Appendix on page 607 for definitions of IEC input types.)
ON voltage	+11 ... +30 VDC
OFF voltage	-3 ... +5 VDC
Input current	2.5 mA min. ON (6 mA at 24VDC) 1.2 mA maximum OFF
Input resistance	4 kOhm
Response time	2.2 ms OFF to ON 3.3 ms ON to OFF

Continued on next page

Specifications, Continued

Discrete Outputs A 2-point temperature monitoring circuit protects each discrete output against short-circuiting and overload. The outputs will keep disconnecting and reconnecting until the cause of the error has been eliminated.

The following table contains specifications for discrete outputs.

Output type	Semiconductor
Output voltage	External supply - .5 VDC
Number of points	2
Number of groups	1
Points per group	2
Output current	1 A/point maximum 2 A/group 2 A/module
Signal type	True High
Leakage current (output out)	< 1 mA @ 24 VDC
On state voltage drop	< 0.5 VDC @ 0.5 A
Output protection (See Note Below)	Outputs are electronically safeguarded to assist in short circuit and overload protection
Fault reporting	1 red LED/point (row 3) ON when short current/overload occurs
Error indication	Message "I/O Error" on bus adapter if module is defective
Response time (resistive load / 1 A)	< 0.1 ms OFF to ON < 0.1 ms ON to OFF
Maximum switching cycles	1000/h for 1 A inductive load 100/s for 1 A resistive load 8/s for 2.4 W Tungsten load



Note: Discrete 24 Vdc outputs incorporate thermal shutdown and overload protection. The output current of a shortened output is limited to a nondestructive value. The short circuit heats the output driver and the output will switch off. The output will switch on again if the driver leaves the overtemperature condition. If the short circuit still exists, the driver will reach the overtemperature condition again and will switch off again.

Section 27.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 AMM 090 00 TSX Momentum I/O base.

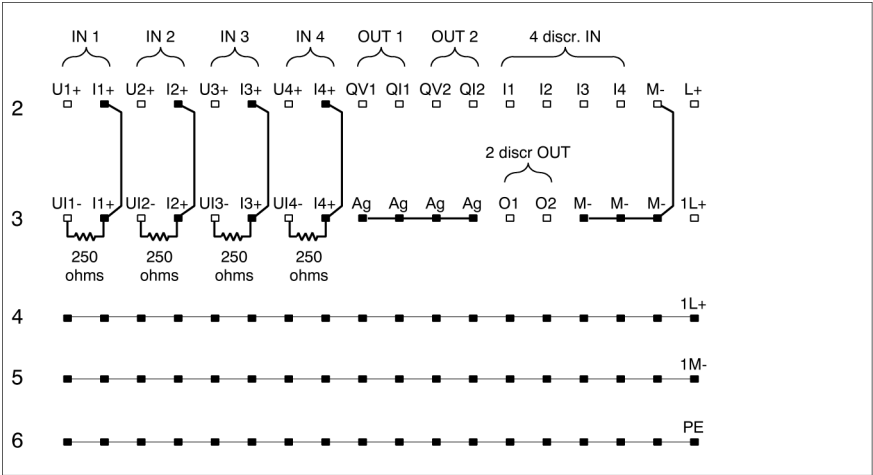
In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	523
Field Wiring Guidelines	524
Wiring Diagrams	527

Internal Pin Connections

Overview This section contains a diagram showing the internal connections for terminals on the I/O base and an optional busbar.

Diagram Rows 1 through 3 show the internal connections between terminals on the I/O base. Rows 4 through 6 show internal connections on the optional busbar.



Field Wiring Guidelines

Overview

The discrete input points are field wired to row 2 of the base. The discrete output points are wired to row 3. This section contains wiring guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automations sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-, 2-, or 3-row busbar. The following busbars are available from Schneider Automation.

Type	Number of Rows	Part Number
Screw-in	1-row	170 XTS 006 01
	2-row	170 XTS 005 01
	3-row	170 XTS 004 01
Spring-clip	1-row	170 XTS 007 01
	2-row	170 XTS 008 01
	3-row	170 XTS 003 01

Continued on next page

Field Wiring Guidelines, Continued

Mapping Terminal Blocks and Busbars

Mapping terminal blocks and busbars is described in the table below.

Row	Connection	Signal	Meaning
2	1, 3, 5, 7	U1+ ... U4+	pos. voltage input (analog)
	2, 4, 6, 8	IS1 ... IS4	current sensing inputs (analog)
	9, 11	QV1, QV2	analog output channels 1 ... 2 (voltage mode)
	10, 12	QI1, QI2	analog outputs, channels 1 ... 2 (current mode)
	13 ... 16	I1 ... I4	discrete inputs 1...4
	17/ 18	M-/ L+	reference potential and operating voltage
3	1, 3, 5, 7	UI1- ... UI4-	neg. voltage mode and current mode inputs (analog)
	2, 4, 6, 8	I1+ ... I4+	pos. analog inputs, channels 1 ... 4 (current mode)
	9 ... 12	Ag	reference potential for analog channels
	13, 14	O1, O2	discrete outputs 1,2
	15, 16, 17	M-	reference potential for discrete outputs
	18	1L+	output voltage mode for discrete outputs
4	1 ... 18	1L+	sensor supply
5	1 ... 18	1M-	reference potential for sensors
6	1 ... 18	PE	protective ground



CAUTION

POTENTIAL FOR SHORT CIRCUITS AND/OR POWER-UP SPIKES

Provide external fuses on the operating voltage to protect the module. Appropriate fuse values are shown in the wiring diagram. An unprotected module may be subject to short circuits and/or power-up spikes. See *Protective Actuator Circuit* on page 84.

Failure to observe this precaution can result in injury or equipment damage.

Continued on next page

Field Wiring Guidelines, Continued

**Protective
Circuit May Be
Required**

When contacted switches are used on the input lines or when lines to the peripherals are very long, the outputs of inductive loads require protective circuitry with a clamping/suppressor diode. Install the protective circuit parallel to the operating coil.

Wiring Diagrams

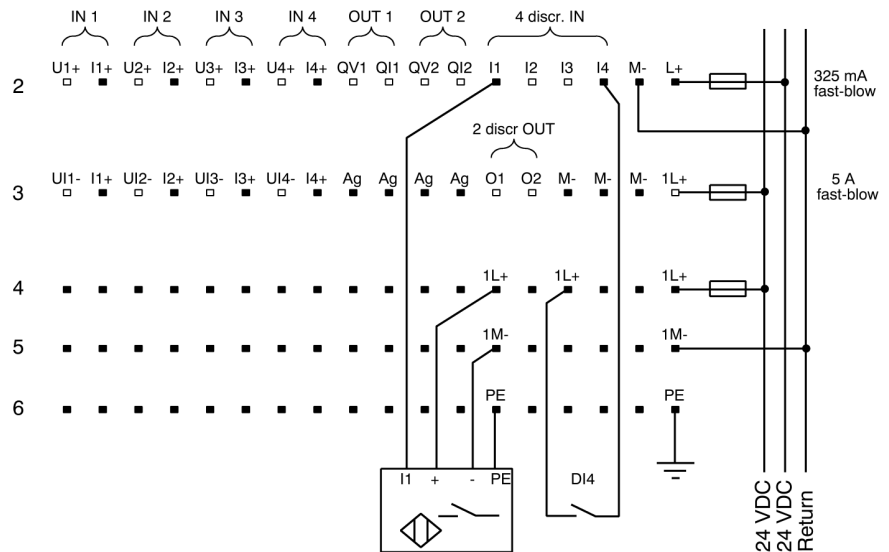
Overview

This section contains diagrams to assist you in wiring the following types of devices:

I/O Type	Diagram
Discrete input	2- and 4-wire sensors
Discrete output	3-wire actuators
Analog output	2-wire actuators
Analog input	3-wire sensors

Discrete Inputs

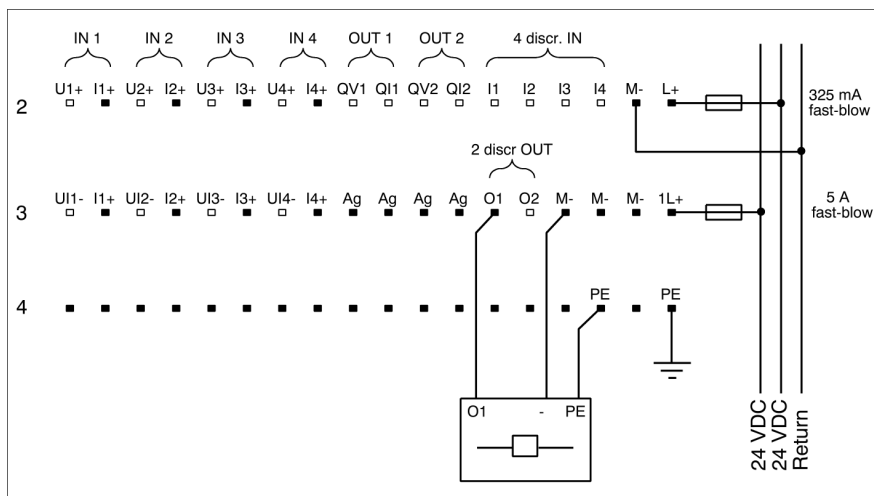
The wiring diagram below depicts sample wiring for discrete inputs.



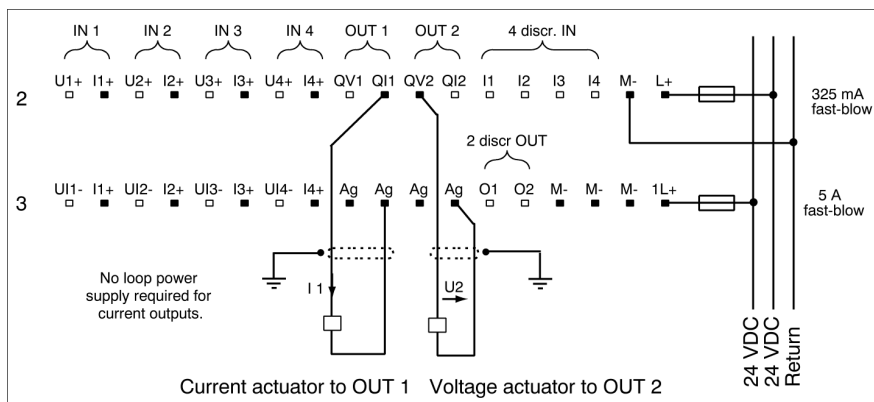
Continued on next page

Wiring Diagrams, Continued

Discrete Outputs The wiring diagram below depicts sample wiring for discrete outputs.



Analog Outputs The wiring diagram below depicts sample wiring for analog outputs.

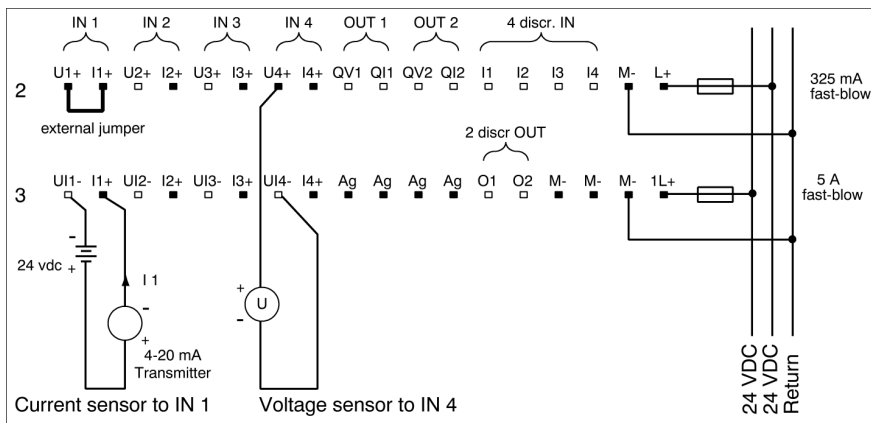


Continued on next page

Wiring Diagrams, Continued

Analog Inputs

The wiring diagram below depicts sample wiring for analog inputs. To achieve common mode voltage you must wire the return of your analog sensors to one of the terminal pins ranging from 9 ... 12 in row 3.



Section 27.3

Configuration

Configuration Overview

Introduction

The 170 AMM 090 00 TSX Momentum I/O base supports the following inputs and outputs:

I/O Type	Analog	Discrete
Inputs	4	4
Outputs	2	2

I/O Map

The I/O base must be mapped as five contiguous input words and five contiguous output words, as follows:

Word	Input Data	Output Data
Word 1 = LSW	Value, input channel 1	Parameters for input channels 1 ... 4
Word 2	Value, input channel 2	Parameters for output channels 1, 2
Word 3	Value, input channel 3	Value, output channel 1
Word 4	Value, input channel 4	Value, output channel 2
Word 5 = MSW	Discrete inputs	Discrete outputs

In This Section

This section contains the following topics:

For This Topic...	See Page...
Analog Channel Parameters	531
Analog Outputs	534
Analog Inputs	535
Discrete Inputs and Outputs	536

Analog Channel Parameters

Overview

Parameters must be set for all of the analog channels before the module can be commissioned. This section provides the codes for setting the parameters and gives examples of parameter settings.



Note: If you set new parameters for the module, always send a complete set of parameters (all channels, inputs and outputs), even if you only want to change a single parameter. Otherwise the module will refuse the new parameters and continue working with the old ones.

Key

This section focuses on output words 1 and 2, as highlighted in the table below:

Word	Input Data	Output Data
Word 1 = LSW	Value, input channel 1	Parameters for input channels 1 ... 4
Word 2	Value, input channel 2	Parameters for output channels 1, 2
Word 3	Value, input channel 3	Value, output channel 1
Word 4	Value, input channel 4	Value, output channel 2
Word 5 = MSW	Discrete inputs	Discrete outputs

Diagram

Parameters are set by entering a four-bit code in output words 1 and 2 as follows:

Output Word 1															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
for input channel 4				for input channel 3				for input channel 2				for input channel 1			

Output Word 2															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
not used				not used				for output channel 2				for output channel 1			

Continued on next page

Analog Channel Parameters, Continued

Codes for Analog Input Parameters

Use the following codes to set the parameters for each analog input channel:

Code (Binary)	Code (Hex)	Parameter
0 1 0 0	4	Channel inactive
0 0 1 0	2	+/- 5 V or +/- 20 mA
0 0 1 1	3	+ / - 10 VDC
1 0 1 0	A	1 ... 5 V or 4 ... 20 mA

Example of Analog Input Parameters

If output word 1 is initialized as A324 hex, then the input channels have the following parameters:

Channel	Parameter
1	Disabled
2	at +/- 5 V
3	at +/- 10 V
4	at 1 ... 5 V

Codes for Analog Output Parameters

Use the following codes to set the codes for each analog output channel. The remaining bit combinations are reserved.

Code (Binary)	Code (Hex)	Parameter	Reset Behavior of Outputs
0 1 0 0	0	Channel inactive	0 V / 0 mA
0 0 0 1	1	0 ... 20 mA	0 mA
0 0 1 1	3	+ / - 10 VDC	0 V
0 1 0 1	5	0 ... 20 mA	20 mA
0 1 1 1	7	+ / - 10 VDC	+ 10 VDC
1 0 0 1	9	0 ... 20 mA	Output is held
1 0 1 1	B	+ / - 10 VDC	Output is held

Continued on next page

Analog Channel Parameters, Continued

Example of Analog Output Parameters

If output word 2 is initialized as 0091 hex, then the output channels have the following parameters:

Channel	Parameter
1	0 ... 20 mA with reset to 0
2	0 ... 20 mA with reset to hold

Analog Outputs

Overview This section describes how to interpret the value of the analog output channels.

Key This section describes output words 3 and 4, as highlighted in the table below.

Word	Input Data	Output Data
Word 1 = LSW	Value, input channel 1	Parameters for input channels 1 ... 4
Word 2	Value, input channel 2	Parameters for output channels 1, 2
Word 3	Value, input channel 3	Value, output channel 1
Word 4	Value, input channel 4	Value, output channel 2
Word 5 = MSW	Discrete inputs	Discrete outputs

Diagram The following diagrams explain how to interpret the value of output words 3 and 4.

Output Word 3															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sign	value output channel 1														

Output Word 4															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sign	value input channel 2														

Analog Inputs

Overview This section describes how to interpret the value of the analog input channels.

Key This section describes input words 1 through 4, as highlighted in the table below.

Word	Input Data	Output Data
Word 1 = LSW	Value, input channel 1	Parameters for input channels 1 ... 4
Word 2	Value, input channel 2	Parameters for output channels 1, 2
Word 3	Value, input channel 3	Value, output channel 1
Word 4	Value, input channel 4	Value, output channel 2
Word 5 = MSW	Discrete inputs	Discrete outputs

Analog Input Values Mapping of analog input values is shown below.

Input Word 1															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sign	value input channel 1														

1
1
1

Input Word 4															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sign	value input channel 4														

Resolution The resolution of the module is 12-, 13- or 14-bit, depending on the range.

Discrete Inputs and Outputs

Overview

This module supports four discrete inputs and two discrete outputs. This section describes how to map I/O data between the I/O base and the CPU.



Note: You cannot commission the discrete I/O until parameters have been set for all six analog channels.

Key

The discrete inputs and outputs are I/O mapped as word 5, the most significant word, as shown in the table below:

Word	Input Data	Output Data
Word 1 = LSW	Value, input channel 1	Parameters for input channels 1 ... 4
Word 2	Value, input channel 2	Parameters for output channels 1, 2
Word 3	Value, input channel 3	Value, output channel 1
Word 4	Value, input channel 4	Value, output channel 2
Word 5 = MSW	Discrete inputs	Discrete outputs

Number of Words

The processor sends two discrete output data bits in one 16-bit word to the I/O base.

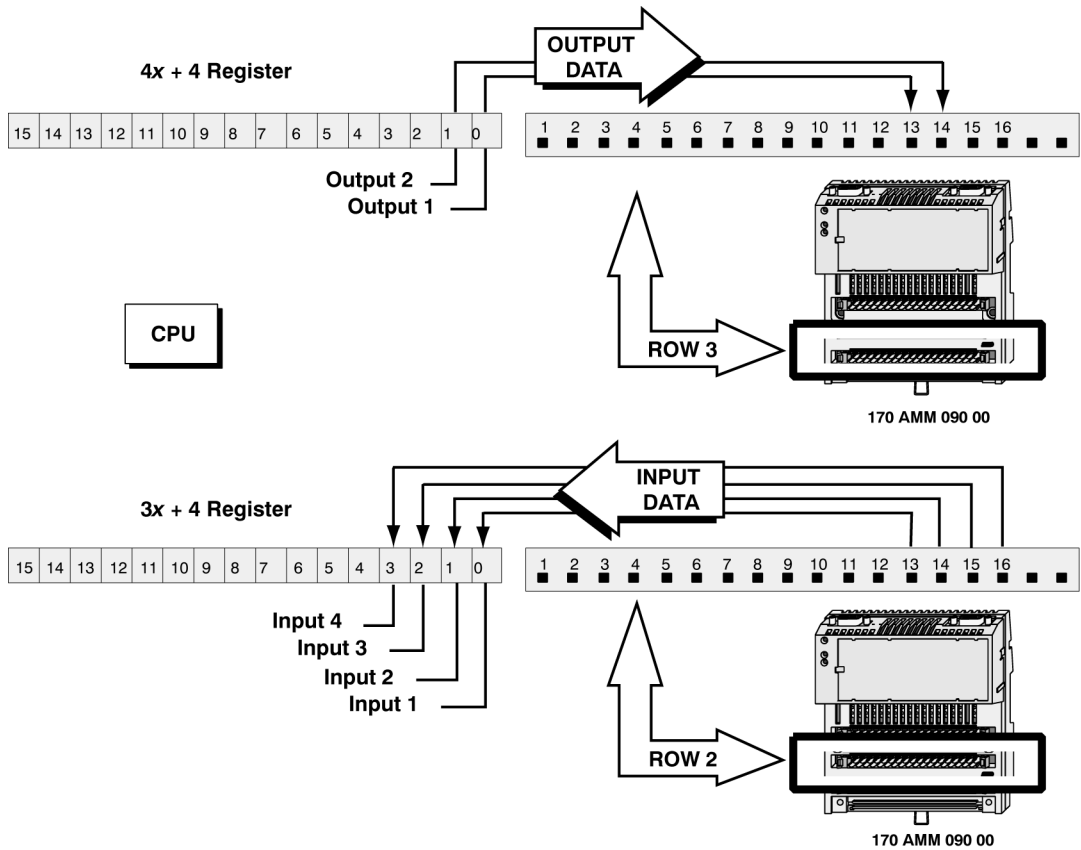
The base returns four discrete input data bits, and possibly an error message, if one has been detected, to the processor in one 16-bit word.

Continued on next page

Discrete Inputs and Outputs, Continued

Data Mapping

The figure below shows how data is mapped between the base and the CPU.



Section 27.4

Analog/Digital Relation

Input and Output Ranges

Overview

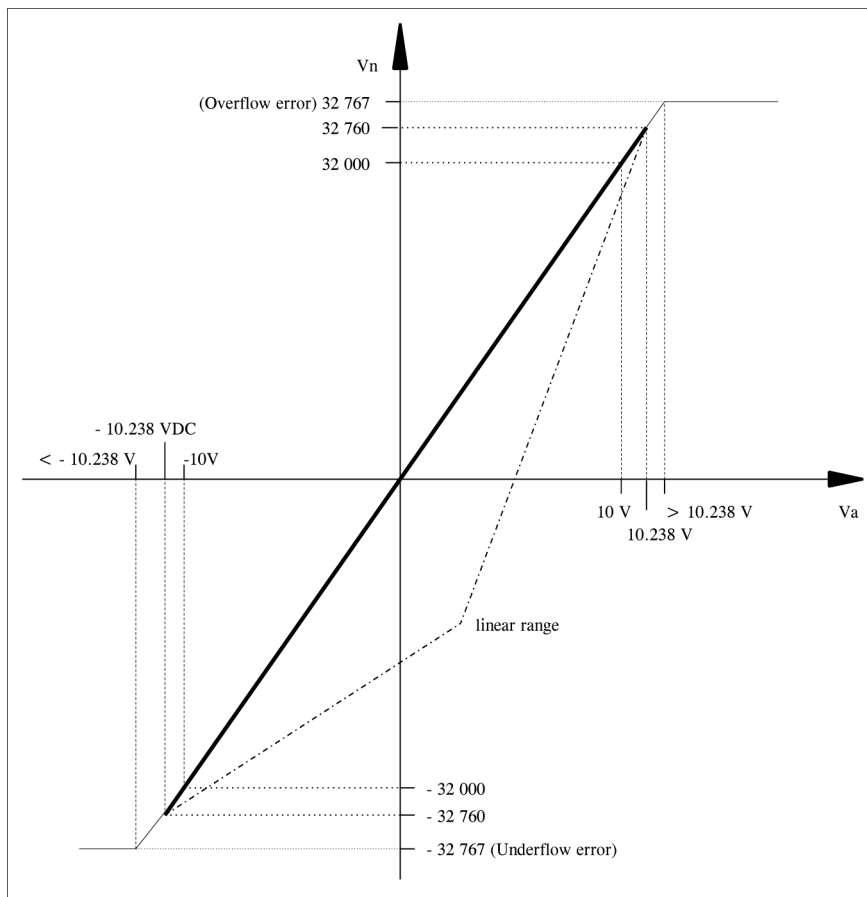
This section contains diagrams explaining the analog/digital relation for the various input and output measuring ranges.

Continued on next page

Input and Output Ranges, Continued

Input Measuring Range +/- 10 V

The following diagram shows the analog/digital relation for the input measuring range +/- 10 V. The voltage value is calculated along the following formula using the digital measurand: **$V_n = 3200 \times V_a$ (for the linear range)**.

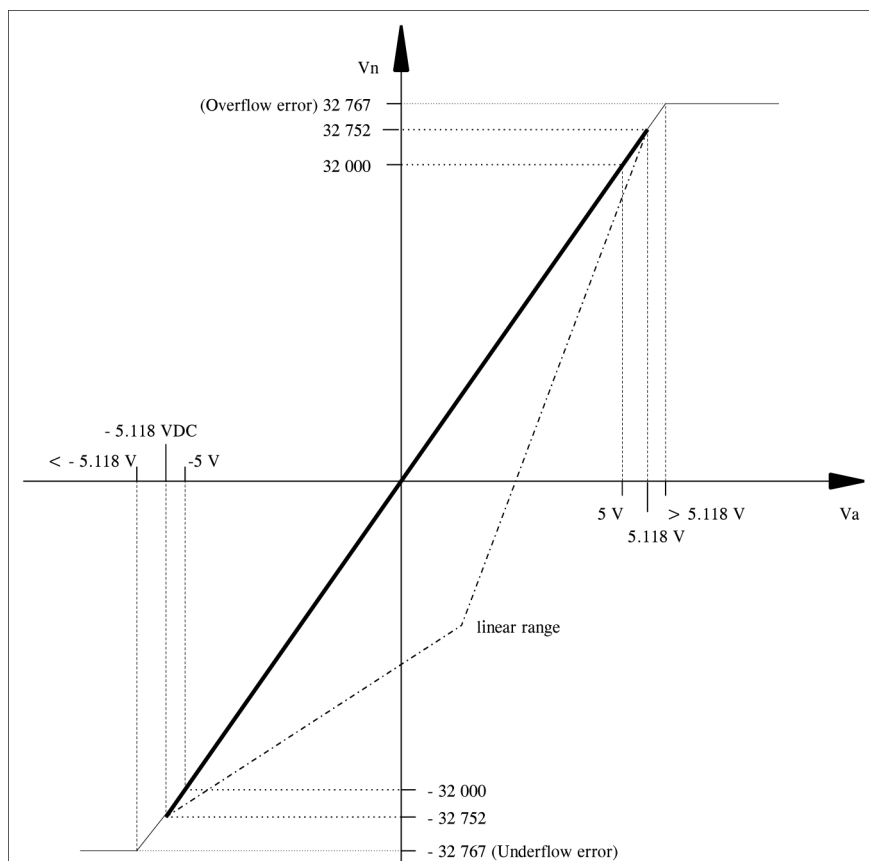


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Input and Output Ranges, Continued

Input Measuring Range ± 5 V

The following diagram shows the analog/digital relation for the input measuring range ± 5 V. The voltage value is calculated along the following formula using the digital measurand: **$V_n = 6400 \times V_a$ (for the linear range).**

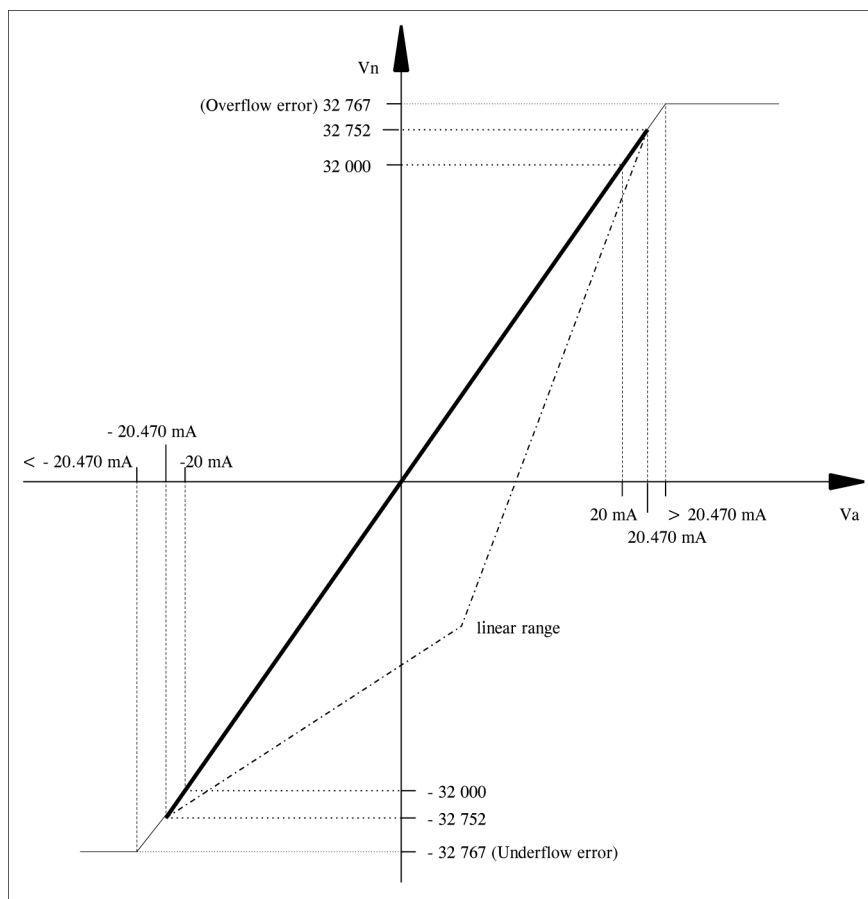


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Input and Output Ranges, Continued

Input Measuring Range +/- 20 mA

The following diagram shows the analog/digital relation for the input measuring range +/- 20 mA. The current value is calculated along the following formula using the digital measurand: **$V_n = 1600 \times I_a$ (for the linear range).**

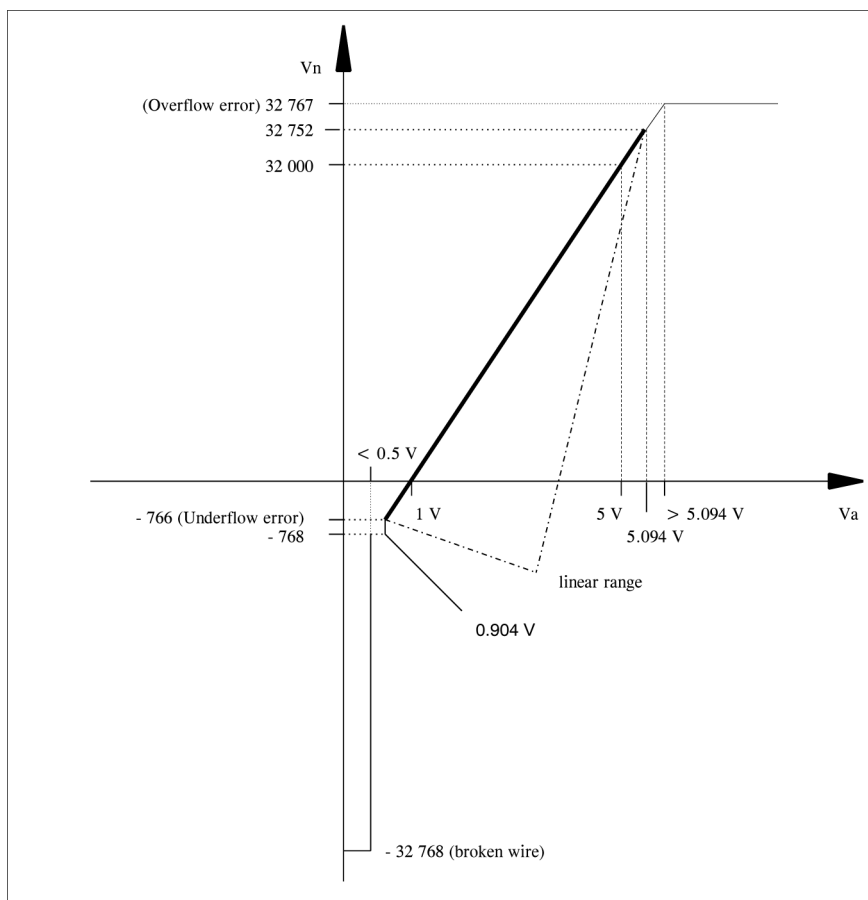


Continued on next page

Input and Output Ranges, Continued

Input Measuring Range 1 ... 5 V

The following diagram shows the analog/digital relation for the input measuring range 1 ... 5 V. The voltage value is calculated along the following formula using the digital measurand: $V_n = 8000 \times V_a - 8000$ (for the linear range)..

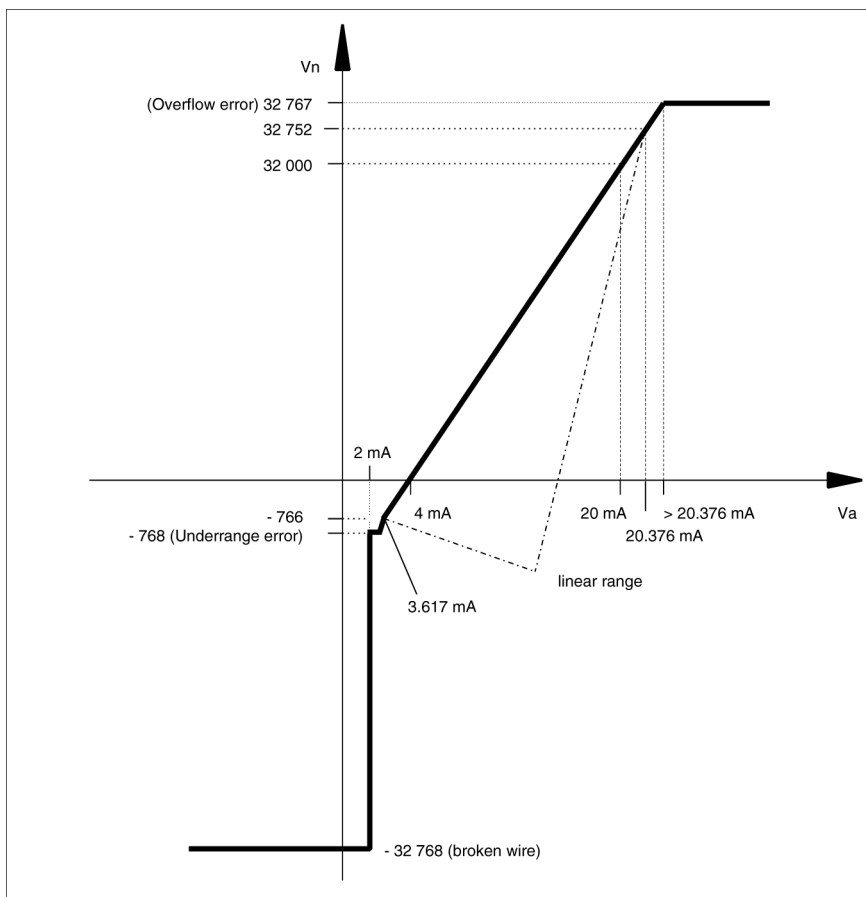


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Input and Output Ranges, Continued

Input Measuring Range 4 ... 20 mA

The following diagram shows the analog/digital relation for the input measuring range 4 ... 20 mA. The current value is calculated along the following formula using the digital measurand: **$V_n = 2000 \times I_a - 8000$ (for the linear range)**. Disabled channels deliver a value of 0..



Continued on next page

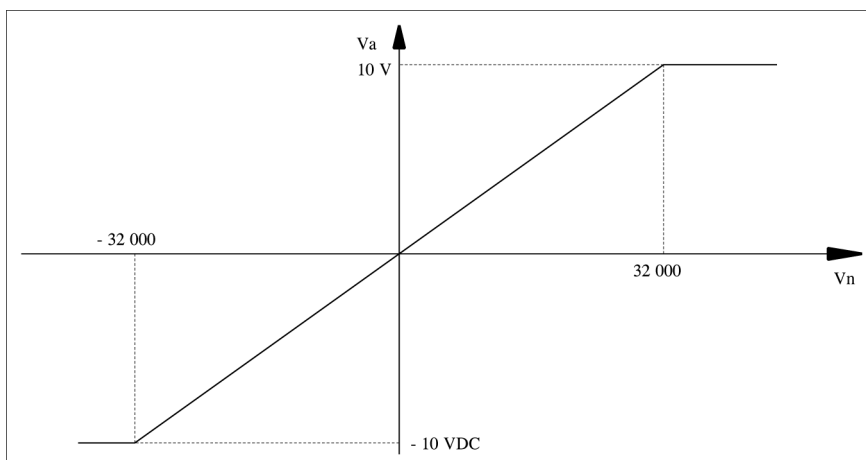
Input and Output Ranges, Continued

Output Range +/- 10 V

The following diagram shows the analog/digital relation for the output range +/- 10 V.

When the bus is reset, the outputs use the configured parameters. If the module does not have valid parameters, the outputs will go to 0 V resp. 0 mA.

The output voltage value is calculated along the following formula using the digital default value: $V_a = 1/3200 \times V_n$.



Continued on next page

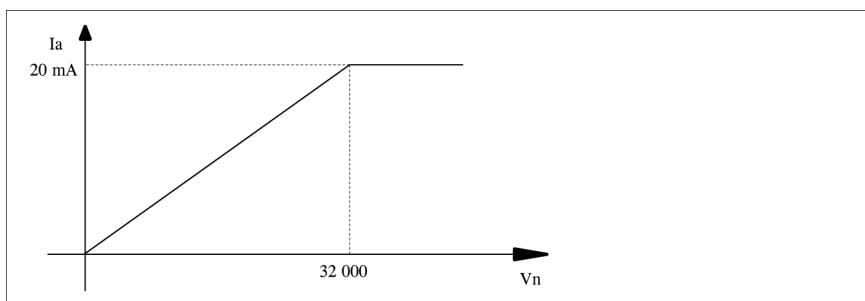
Input and Output Ranges, Continued

Output Range 0 ... 20 mA

The following diagram shows the analog/digital relation for the output range 0 ... 20 mA.

When the bus is reset, the outputs use the configured parameters. If the module does not have valid parameters, the outputs will go to 0 V resp. 0 mA.

The output current value is calculated along the following formula using the digital default value: $I_a = 1/1600 \times V_n$.



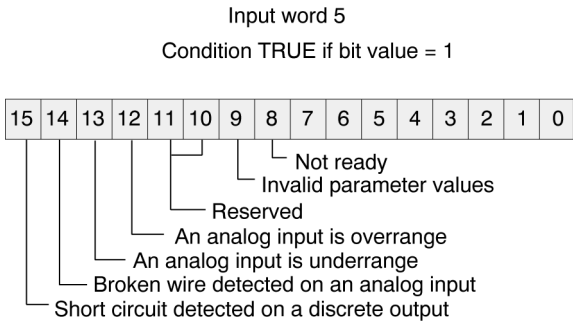
Section 27.5

Error Messages

Interpreting the Error Bits

Overview Error messages are stored in input word 5 (the $3x+4$ register). This section explains how to interpret the bits in that register.

Diagram This diagram explains the error message displayed by each bit. A value of 1 indicates the error has occurred.



Not Ready (Bit 8) This error occurs when the I/O base has not yet received valid parameters or has just received parameters for the first time and is checking them.

Invalid Parameters (Bit 9) This error occurs when the I/O base refuses one or more invalid parameters. The base will continue working with the old parameters until it receives a complete set of valid parameters.

Continued on next page

Interpreting the Error Bits, Continued

**Overrange
Indication
(Bit 12)**

This error occurs when the I/O base detects an overrange analog input value. The threshold is range-dependent.

**Underrange
Indication
(Bit 13)**

This error occurs when the I/O base detects an underrange analog input value. The threshold is range-dependent.

**Broken Wire
Detection
(Bit 14)**

Broken wire detection is possible for the 4 ... 20 mA range. In this case, a current signal that is less than 2 mA on one of the inputs is detected as a broken wire. The input word of that channel returns the value -32,768.

In the 1 ... 5 VDC range, broken wire detection is correctly seen as undervoltage detection. A voltage of less than 0.5 VDC on one of the input channels is recognized as broken wire. The input word of that channel returns the value -32,768.

In case of a broken wire, the input floats and bit 14 is not set in all cases. A reliable broken wire detection is only possible if a resistor is wired in parallel to the input terminals. This resistor will discharge the input capacity and broken wire detection will be available.

The value of this resistor depends on internal resistance of the sensor. Values too low might influence the input signal and values too high lengthen the time for broken wire detection. Normally, values of less than 100 kOhm are appropriate.

**Short Circuit
(Bit 15)**

When a short circuit or overload occurs on at least one digital output, the output is set to zero and the error is reported. The output will be automatically reconnected when the cause of the short circuit has been eliminated.

170 ANR 120 90
Analog 6 Ch. In / 4 Ch. Out Module
Base w/ 24 VDC I/O pts

28

At a Glance

Purpose This chapter describes the 170 ANR 120 90 TSX Momentum I/O base.

In This Chapter This chapter contains the following sections:.

For This Topic...	See Section...	On Page...
Module Overview	1	550
Wiring	2	557
Configuration	3	563
Analog/Digital Relation	4	572
Error Messages	5	575

Section 28.1

Module Overview

Introduction

Purpose This section describes the front panel components of the 170 ANR 120 90 TSX Momentum I/O base and provides specifications.

In This Section This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	551
Specifications	553
Configuration Overview	563
Input and Output Ranges	572
Interpreting the Error Bits	575

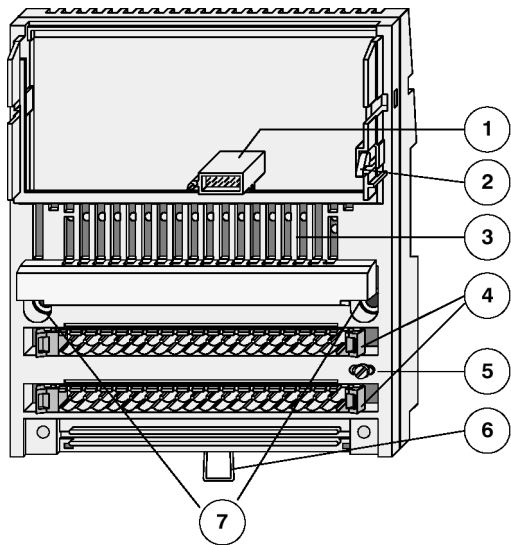
Front Panel Components

Overview

This section contains an illustration of the 170 ANR 120 90 I/O base front panel and a description of the LEDs.

Front Panel

The front panel of the I/O base is shown below:

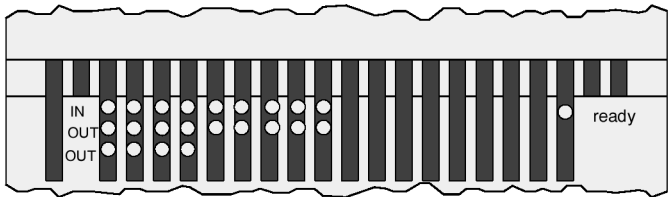


Label	Description
1	Internal interface (ATI) connector
2	Locking and ground contact for the adapter
3	LED status display
4	Sockets for the terminal connectors
5	Grounding screw
6	Locking tab for DIN rail mount
7	Mounting holes for a panel mount

Continued on next page

Front Panel Components, Continued

LED Illustration The LEDs are shown in the illustration below.



LED Descriptions

The LEDs for this I/O base are described in the table below.

LED	Color	Status	Meaning
Ready	Green	ON	I/O base is communicating with the comm adapter/CPU top hat. CPU must be in RUN state.
O1, O2, O3, O4, O5, O6, O7, O8	Green	ON	Indicates the corresponding discrete output point is ON
I1, I2, I3, I4, I5, I6, I7, I8	Green	ON	Indicates the corresponding input point is ON
AO1, AO2, AO3, AO4	Green	ON	Indicates the corresponding analog output channel is active

Specifications

Overview

This section contains specifications for the 170 ANR 120 90 TSX Momentum I/O base.

General Specifications

The following table contains general specifications for the I/O base. Each discrete output is protected against short-circuiting and overload

Electrical	
Module Current	400mA at 19.2Vdc to 30Vdc
EMC for industrial environment	
Immunity	IEC 1131 Surge on auxiliary power supply 500V
Emissions	EN 50081-2 (limitation A)
ENV 50140	10V/M
Isolation	
Isolation between points	None
Isolation between groups	None
Environmental	
Storage Temperature	-40 TO 85 °C
Operating Temperature	0 TO 60 °C
Humidity Operating	95% RH @ 60 °C
Humidity Non-operating	95% RH @ 60 °C
Vibration Operating	10 - 57 HZ 0.075 MMDA 57-150 HZ 1 G
Shock Non- Operating	15 G, 11MS, 3 shocks/axis
Free Fall (Unpackaged)	0.1 meter

Continued on next page

Specifications, Continued

Analog Inputs

The following tables contain specifications for analog inputs.

Analog Inputs		
Number of Input Channels	Six single ended	
Range	0 to 10V	
Input Impedance	>1 megohm	
Resolution	14 bits	
Accuracy, 25 °C	0.2%	
Linearity	In	Out
Linearity Integral	± 1LSB	± 2LSB
Linearity Differential	Guaranteed Monotonic	
Temp Coefficient	+ 100PPM/°C	
Update Time	0.75msec for all six channels	
Data Format	Left justified	

Analog Outputs

The following tables contain specifications for analog outputs.

Analog Outputs		
Number of output channels	4	
Range	0 to 10V	
Resolution	14 bits	
Accuracy, 25 °C	0.4%	
Linearity	In	Out
Linearity Integral	± 1LSB	± 2LSB
Linearity Differential	Guaranteed Monotonic	
Temp Coefficient	+ 100PPM/°C	
Update time	1.20msec for all four channels	
Data Format	Left justified	

Continued on next page

Specifications, Continued

Discrete Inputs

The following table contains specifications for discrete inputs:

Discrete Inputs	
Number of Points	8 sinking, Type 2
Voltage and Current Thresholds	
ON (Voltage)	>11Vdc
OFF (Voltage)	<5Vdc
ON (Current)	>6mA
OFF (Current)	<2mA
Absolute Maximum Input Continuous	32Vdc
Input Response	
ON - OFF, OFF - ON	1.20msec maximum
Input Protection	Resistor limited, varistors

Discrete Outputs

The following table contains specifications for discrete outputs.

Discrete Outputs	
Number of Output Points	8 sourcing
Operating Voltage	
Working	10 ... 30Vdc
Absolute Maximum	50Vdc for 1msec
ON State Drop / Point	0.4Vdc max at 0.25A
Maximum load current	
Each Point	0.25A
Per Module	2A
Off State Leakage / Point (max)	0.4mA @ 30Vdc
Surge Current Maximum	
Per point	2.5A for 1msec
Response	
OFF-ON, ON-OFF	1.20msec max
Output Protection (Internal)	Voltage suppressor diodes, Wickman 2.5A Fuse



CAUTION

Discrete 24 Vdc outputs incorporate thermal shutdown and overload protection.

The output current of a shortened output is limited to a nondestructive value. The short circuit heats the output driver and the output will switch off. The output will switch on again if the driver leaves the overtemperature condition and the user resets the output under program control. If the short circuit still exists after the output point is reset, the driver will reach the overtemperature condition again and will switch off again.

Failure to observe this precaution can result in equipment damage.

Continued on next page

Specifications, Continued

**General
Specifications,
Continued**

Physical dimensions	
Width	125 mm (4.9 in)
Depth (with no adapter)	40 mm (1.54in)
Length	141.5 mm (5.5in) no or one busbar 159.5 mm (6.3in) two busbars 171.5 mm (6.75in) three busbars
Weight	220 g (0.49 lb.)

Section 28.2

Wiring

Introduction

Purpose This section describes internal pin connections and field wiring guidelines and provides wiring diagrams for the 170 ANR 120 90 TSX Momentum I/O base.

In This Section This section contains the following topics:

For This Topic...	See Page...
Internal Pin Connections	558
Field Wiring Guidelines	559
Wiring Diagrams	561

Internal Pin Connections

Overview

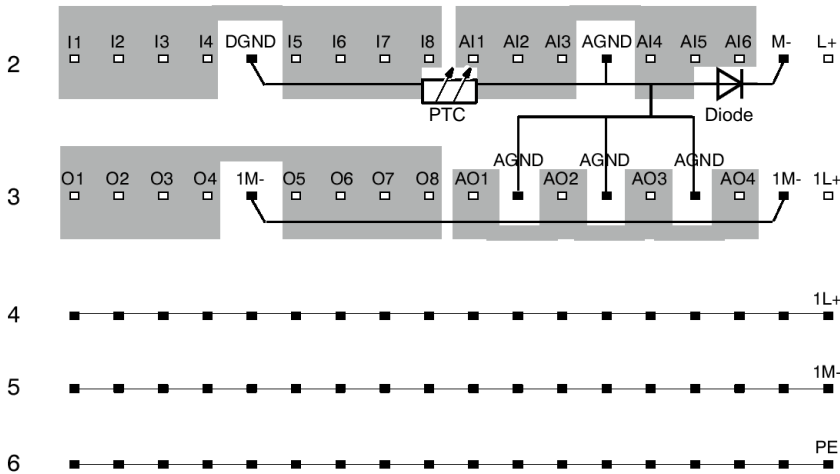
This section contains a diagram showing the internal connections for terminals on the I/O base and an optional busbar.

Diagram Internal Pin Connections

The following illustration shows the internal connections between terminals.



Note: AGND and DGND are connected at a single point inside the module. External digital inputs must be returned to the DGND terminal. External analog circuits must be returned to AGND terminals.



Field Wiring Guidelines

Overview

This section contains wiring guidelines and precautions.

Terminal Connector Required

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Automations sells terminal connectors in sets of three:

Type	Part Number
Screw-in	170 XTS 001 00
Spring-clip	170 XTS 002 00

Busbar May Be Required

Depending on the type of field devices you are using, you may need a 1-, 2-, or 3-row busbar. The following busbars are available from Schneider Automation.

Type	Number of Rows	Part Number
Screw-in	1-row	170 XTS 006 01
	2-row	170 XTS 005 01
	3-row	170 XTS 004 01
Spring-clip	1-row	170 XTS 007 00
	2-row	170 XTS 008 00
	3-row	170 XTS 003 00

Continued on next page

Field Wiring Guidelines, Continued

Terminal block and busbar mapping

Mapping terminal blocks and busbars is described in the table below

Row	Terminal	Connection	Description
2	1-4	I1 ... I4	Discrete inputs 1 through 4
	5	Digital ground	Return for discrete inputs
	6-9	I5 ... I8	Discrete inputs 5 through 8
	10-12	AI1 ... AI3	Analog inputs 1, 2, 3
	13	Analog ground	Return for analog inputs
	14-16	AI4 ... AI6	Analog inputs 4, 5, 6
	17	M-	Module operating voltage, 24Vdc return
	18	L+	Module operating voltage, 24Vdc
3	1-4	O1 ... O4	Discrete outputs 1 through 4
	5	1M-	Return for discrete outputs
	6-9	O5 ... O8	Discrete outputs 5 through 8
	10, 12, 14, 16	AO1, AO2, AO3, AO4	Analog outputs 1, 2, 3, 4
	11, 13, 15	Analog ground	Return for analog outputs
	17	1M-	Voltage for field devices, 24Vdc return
	18	1L+	Voltage for field devices, 24Vdc
	1-18	PE	Earth ground for field devices

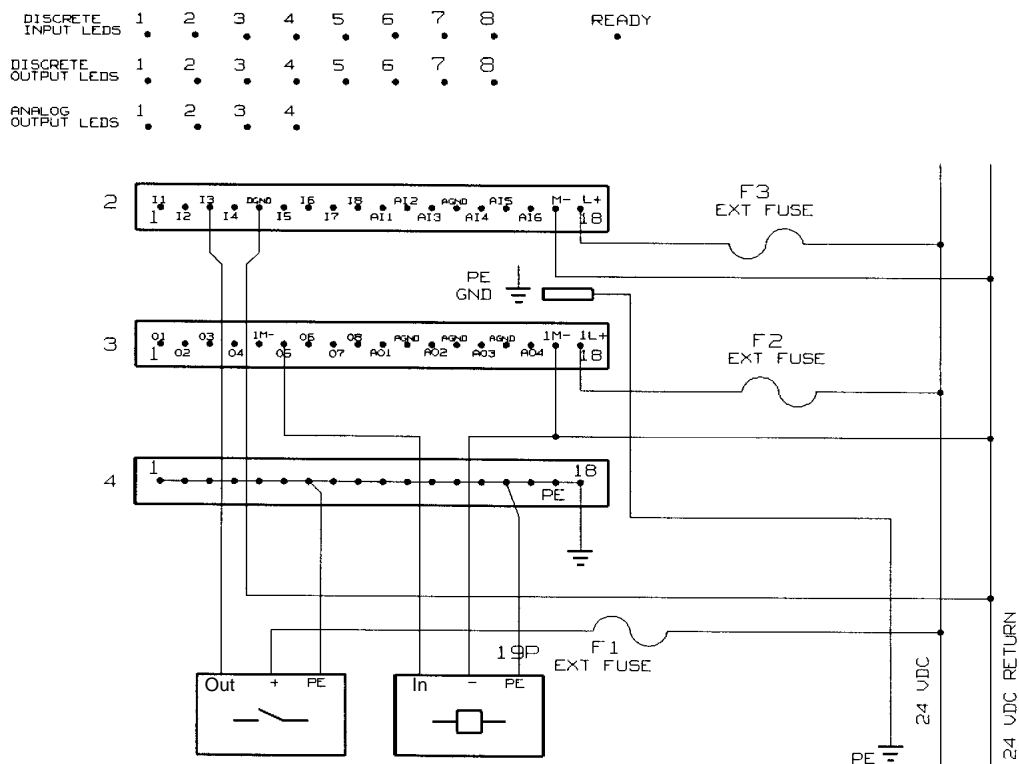
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Wiring Diagrams

Overview

This section contains diagrams.

Wiring Diagram 1 The wiring diagram below shows field wiring for discrete input and discrete output devices.

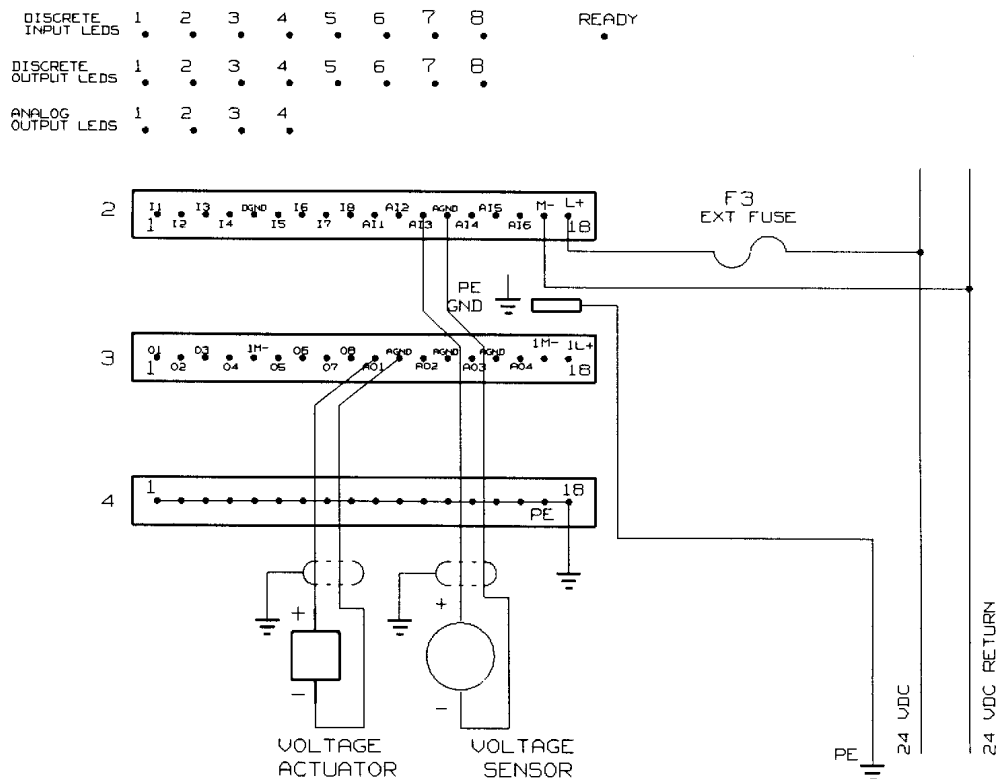


- F1, F3 - use a 1A fuse, Wickman 19181-1A or equivalent
- F2 - use a 2.5A fuse, Wickman 19181-2.5A or equivalent

Continued on next page

Wiring Diagrams, Continued

Wiring Diagram 2 The wiring diagram below shows field wiring for analog input and analog output devices.



- F3 - use a 1A fuse, Wickmann 19181-1A or equivalent
- See Chapter 5 for correctly grounding shields.

Section 28.3

Configuration

Configuration Overview

In This Section This section contains the following topics:

For This Topic...	See Page...
I/O Map	564
Register for Outputs	564
4x Registers	566
Register for Inputs	567
Analog Map	570
Discrete I/O Points and IEC Compliant Data Mapping	571

Introduction The 170 ANR 120 90 TSX Momentum I/O base supports the following inputs and outputs:

- Six analog input channels
- Four analog output channels
- Eight discrete inputs
- Eight discrete outputs
- Module ID code - 17E3 Hex

Continued on next page

Configuration Overview, Continued

I/O Map Module Configuration



The module must be I/O Mapped as 12 contiguous input and output words. The first 7 output words are parameter data.

Note: If you are using Modsoft, the parameter words are modified through the zoom screen.

Register for Outputs



170 ANR 120 90 analog and discrete output channels are configured by entering the appropriate information in output words 1 through 7 as follows:

Note: The module will go to fail state values if network or communication adapter ATI communication is lost.

Word	Function
1	System information
2	Register for discrete reaction in a fail state
3	Register for analog reaction in a fail state
4	User defined analog fail state values for channel 1
5	User defined analog fail state values for channel 2
6	User defined analog fail state values for channel 3
7	User defined analog fail state values for channel 4
8	State of the 8 discrete outputs
9	Analog output word channel 1
10	Analog output word channel 2
11	Analog output word channel 3
12	Analog output word channel 4

Word 1

System Info Register

This word enables the module's operation and specifies if user shutdown values are expected.

Word 1	User Shutdown Values	description
Bits 0 ... 14	N/A	Not used or can be used to enable the module's operation.
Bit 15	1	All channels have user defined shutdown values

Continued on next page

Configuration Overview, Continued

- Valid setting for word one are 0001 ... FFFF
It is essential for the module's operation to have a value larger than 0 in this register.
- The module's default value at power-up for this register is zero (module shut down)



CAUTION

Zero is an illegal value for the system information register.

A zero value in word one will cause an output shut down state and no inputs or outputs are updated.

Failure to observe this precaution can result in injury or equipment damage.

Word 2

Discrete Fail State Reaction and Value Register

This word combines the value and reaction in a fail state.

Bit 0 ... 7	Discrete Fail State values for each output
Bit 8 ... 13	Not used
Bit 14	0= hold last value, 1= user defined value
Bit 15	0= all outputs reset, 1=check bit 14

Word 3

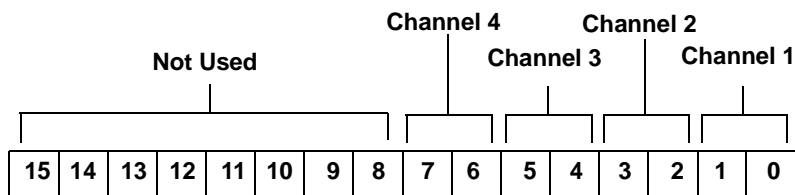
Analog Fail State Reaction Register

This word contains four 2 bit fields which define the fail state for each channel. The four possible values of fail state are as follows:

2 bit value	Fail State
00	Minimum output voltage
01	Hold last value (default)
10	User defined shutdown value
11	Hold last value (not normally used)

Continued on next page

Configuration Overview, Continued



Words 4 ... 7

Analog Fail State Value Register

The module always expects four words of user defined data, even if the data is not used. The first word of the user shutdown field is used for channel 1, the second for channel 2, . . .

Word 8

Discrete Output Register

This word contains a right justified binary eight bit data field.

Words 9 ... 12

Map to Analog Output Register

Each word in this range contains a left justified, binary 15 bit data field. The range is 0 ... 7FFE hex (0 ... 32766 decimal), but the resolution is only 14 bit. See page 570.



Note: If a user shutdown value is greater than the count range for the channel, then the count range maximum value will be used as the shutdown value.

4x Registers

The 4x registers traffic copped to this module are used for output data as follows:

I/O Map Register	Data Type
4x +7	Data for discrete output
4x +8	Data for analog output channel 1
4x +9	Data for analog output channel 2
4x +10	Data for analog output channel 3
4x +11	Data for analog output channel 4

Continued on next page

Configuration Overview, Continued

Range

Output operating range.

	Output Voltage	Data is left justified	Comment
Output Range	0 ... 10.000V	0 ... 32000	Nominal Output Voltage Range
Output Over Range	10.000 ... 10.238V	32002 ... 32764	Linear Over Range Output Voltage
Output Out of Range	≥ 10.238	32766 (7FFE Hex)	Threshold Will Be Limited To 32766 Decimal

Register for inputs

The Input Register is arranged as follows:

Word	Function
1	Status word (module status)
2	State of the eight discrete inputs
3	Analog input word channel 1
4	Analog input word channel 2
5	Analog input word channel 3
6	Analog input word channel 4
7	Analog input word channel 5
8	Analog input word channel 6
9 ... 12	Not used

Word 1

The Status word (word 0) contains information about the health of the module and the status of the discrete outputs. Word 0 also contains network communication loss, over temperature of the discrete outputs and short circuit at the discrete outputs.

Bits 15 ... 9	Bit 8	Bits 7 ... 4	Bit 3 (Channel 7, 8)
Not used	0 = Bad module health (module lost communication) 1 = Healthy module	Not used	0 = Fault 1 = No fault

Continued on next page

Configuration Overview, Continued

Bit 2 (Channel 5, 6)	Bit 1 (Channel 4, 3)	Bit 0 (Channel 1, 2)
0 = Fault 1 = No fault	0 = Fault 1 = No fault	0 = Fault 1 = No fault

Word 2 Discrete input register

This word contains a right justified binary eight bit data field

Words 3 ... 8 Analog input register

Words 3 ... 8 map to the analog input register. Each word in this range contains a left justified 15 bit data field. The range is from 0H to 7FFE hex, but the resolution is 14 bit. (0 ... 32766 decimal or 0 ... 7FFE hex). See page 570.

Words 9 ... 12 Words 9 ... 12 are not used.

3x Registers The 3x registers traffic copped to this module are used for input data as follows:

I/O Map Register	Data Type
3x +1	Data for discrete input
3x +2	Data for analog input channel 1
3x +3	Data for analog input channel 2
3x +4	Data for analog input channel 3
3x +5	Data for analog input channel 4
3x +6	Data for analog input channel 5
3x +7	Data for analog input channel 6

Continued on next page

Configuration Overview, Continued

Range

Input operating range.

	Input Voltage	Data is left justified	Comment
Input Range	0 ... 10.000V	0 ... 32000	Nominal Input Voltage Range
Input Over Range	10.000 ... 10.238V	32002 ... 32764	Nondestructive Tolerated Input Over Range Voltage
Input Out of Range	>=10.238	32766 (7FFE Hex)	Input Voltage Exceeding This Threshold May Damage The Module

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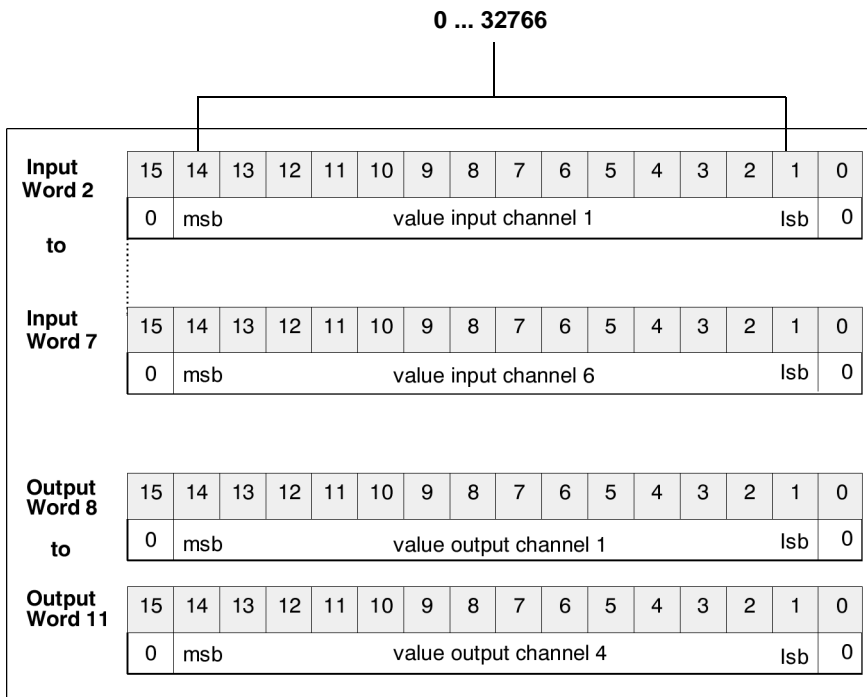
Configuration Overview, Continued

Analog Map

170 ANR 120 90 analog values are mapped as follows:



Note: The display is standardized and in each case the analog value will appear flush left.



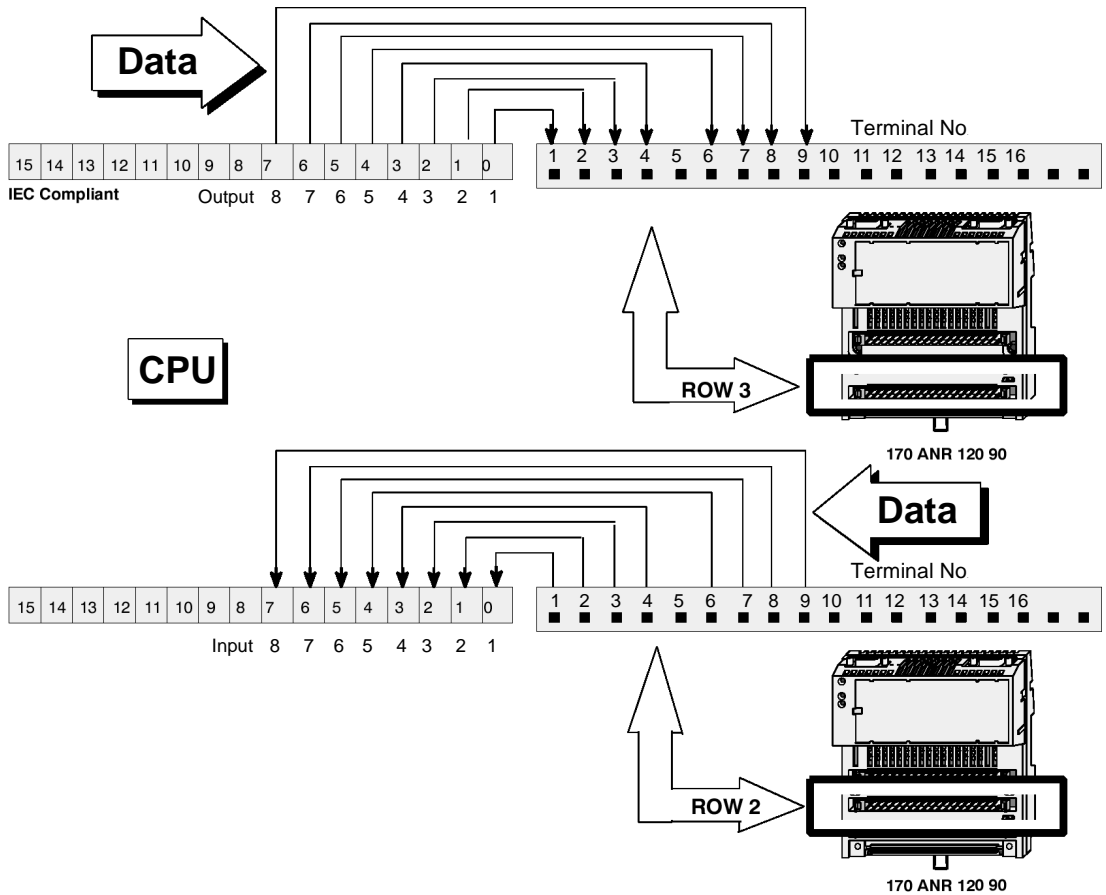
Note: The module resolution is 14-bit (0 ... 32766 decimal or 0 ... 7FFE hex).

Continued on next page

Configuration Overview, Continued

**Discrete I/O
Points and IEC
Compliant Data
Mapping**

The 170 ANR 120 90 base returns eight discrete input bits to the Processor in one 16-bit word. The input points are field wired to row 2 of the base. The Processor sends eight discrete output bits to the base as a single 16-bit word. The output points are field wired to row 3. The figure below shows how the data is mapped (in an IEC compliant format) between the base and the CPU.



Section 28.4

Analog/Digital Relation

Input and Output Ranges

Overview

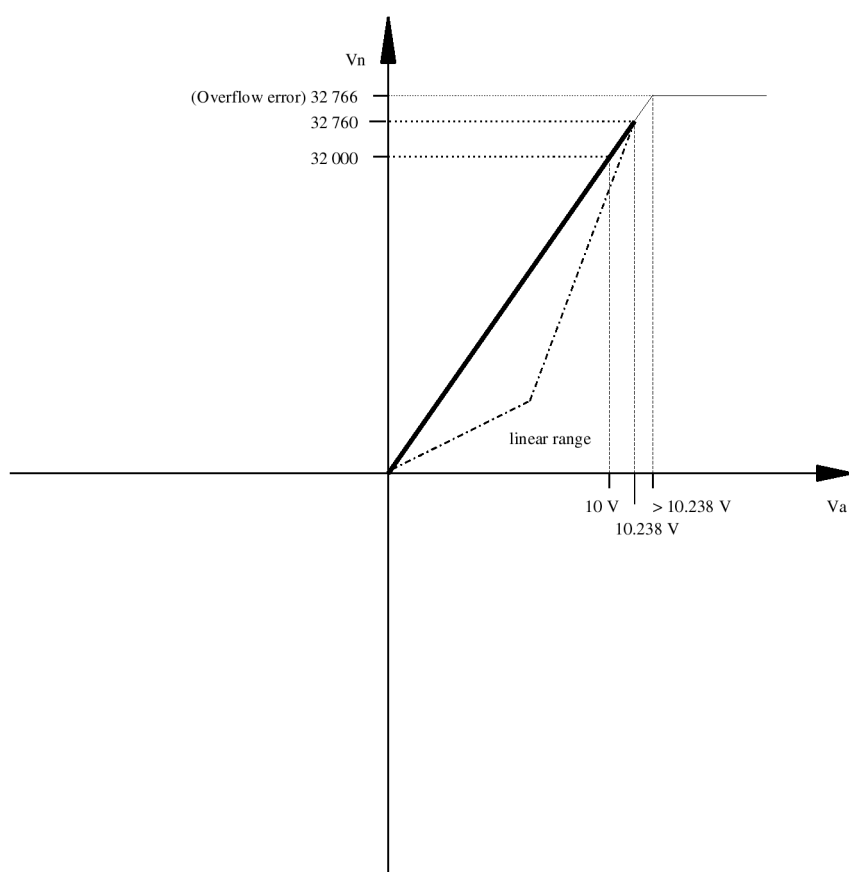
This section contains diagrams explaining the analog/digital relation for the various input and output measuring ranges.

Continued on next page

Input and Output Ranges, Continued

Ranges and Decimal Values Input measuring range 0 - 10 V

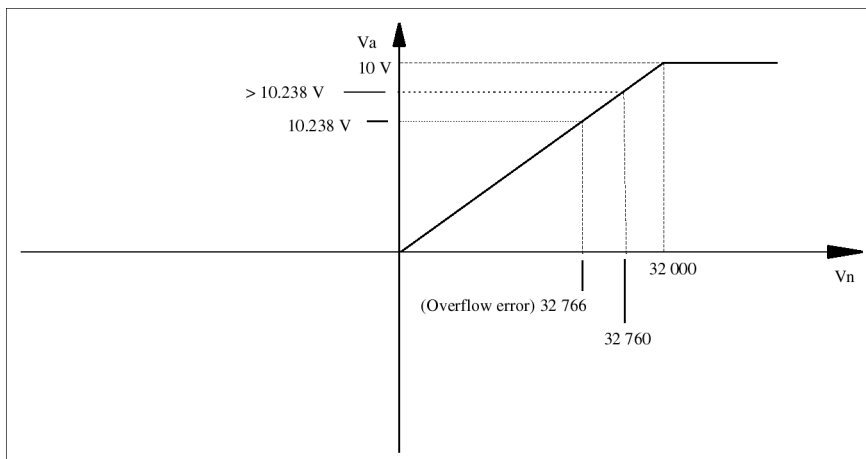
The voltage value is calculated in the following formula using the digital measurand: $V_n = 3200 \times V_a$ (for the linear range).



Input and Output Ranges, Continued

Output measuring range 0 - 10 V

The voltage value is calculated in the following formula using the digital measurand: $V_n = 3200 \times V_a$ (for the linear range).



Section 28.5

Error Messages

Interpreting the Error Bits

Overview

If an internal error is detected in the module, the module becomes nonoperational, Other error messages are posted in the four least significant bits of the status word.

170 CPS 110 00

TIO Power Supply Module

At a Glance

Purpose This chapter describes the 170 CPS 110 00 TIO Power Supply module. The module provides a regulated output voltage with protection against overload and overvoltage. It can be used to power TSX Momentum I/O bases.

In This Chapter This chapter contains the following sections:

For This Topic...	See Section...	On Page...
Module Overview	1	578
Wiring	2	586

Section 29.1

Module Overview

Introduction

Purpose This section describes the front panel components of the 170 CPS 111 00 TIO Power Supply module and provides specifications.

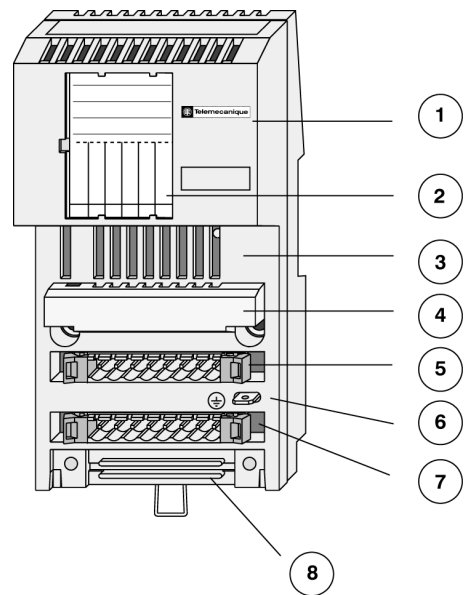
In This Section This section contains the following topics:

For This Topic...	See Page...
Front Panel Components	579
Specifications	581

Front Panel Components

Overview This section contains a illustration of the front panel of the 170 CPS 111 00 TIO Power Supply module and a description of the LEDs.

Front Panel Illustration The front panel of the power supply module is shown in the illustration below:

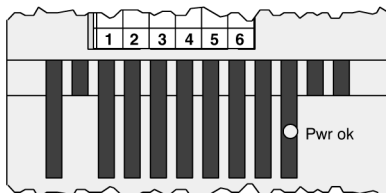


Label	Description
1	Module identifier
2	Identification label
3	LED status display
4	Protective cover
5	Input voltage (AC) terminal strip connector mounting slot
6	PE spade-lug connector
7	Output voltage (DC) terminal strip connector mounting slot
8	Grounding busbar connector mounting slot

Continued on next page

Front Panel Components, Continued

LED Illustration This module has one LED, which is shown in the illustration below:



LED Description The Pwr OK LED is described in the table below:

Indicator	Condition	Message
Pwr ok	Green	Power supply module is ready.
	Off	Power supply module is not ready.

Specifications

Overview

This section contains specifications for the 170 CPS 110 00 TIO Power Supply module.

General Specifications

The following table contains general specifications for the power supply module.

Nominal Input Voltage	230 VAC or 120 VAC (jumper selectable)
Nominal Output Voltage	24 VDC
Maximum Output Current (isolated)	0.7 A
Protective Circuitry	
Inputs	Self-restoring fuse
Outputs	Overvoltage protection: limited by a transzorb diode (type: SM6T30A)
	Overload protection: by thermal current limiting (should the thermal current limiting respond, the input voltage must be switched -- off/on for reactivation).
Frequency	
Input voltage	50/60 Hz + 5%
Internal chopper frequency	90 ... 110 kHz
Power	
Efficiency	Typically 0.76 for $I_A = 0.7$ A
Apparent power	Typically 32 VA for $I_A = 0.7$ A
Effective power	Typically 21 W for $I_A = 0.7$ A
Isolation	
Input/output voltage	L, N, PE isolated from UB, M
Fusing	
Input	Internal self-restoring fuse
	Min external F1: for 230 VAC, 0.315 A, slow-blow
	Min external F1: for 120 VAC, 0.63 A, slow-blow

Continued on next page

Specifications, Continued

General Specifications, Continued

Fault Information	
Inputs	None
Outputs	Green status LED for output voltage ok
Environmental Conditions	
Regulations	VDE 0160, UL 508
Permissible operating and ambient temperatures	GUF (-40 ... +60 deg. C) adhering to DIN 40040, refer to the derating curve for uninhibited convection, operation orientation is vertical
Permissible storage temperature	-40 ... +85 deg. C
Internal power dissipation	Roughly $1.2 + 5 \times I_A$ (in W, I_A in A)
Noise immunity	EN 55011 (DIN VDE 0875) class A
Safety classification	Class 1 (VDE 0160, IEC 1131)

Continued on next page

Specifications, Continued

AC Input Voltage This section contains specifications for AC input voltage, selectable by jumper.

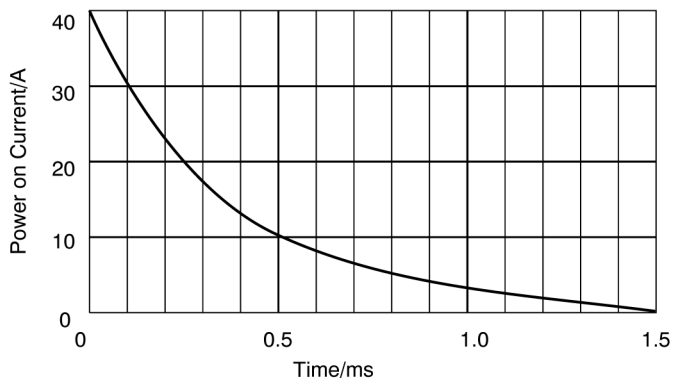
Input Voltage	
EX - EY not jumpered	L/N = 230 VAC
EX - EY jumpered	L/N = 120 VAC
Limiting Values	
With jumper	100 Veff -15% to 120 Veff +10%
Without jumper	230 Veff -15% to 240 Veff +10%
Power Failure	
Half wave loss at	100 Veff -15%
Min. of a half wave at	≥ 100 Veff
Min. of a half wave at	230 Veff -15%
Input Current	
For 85 Veff	Typically 0.366 Aeff, IA = 0.7 A
For 170 Veff	Typically 0.188 Aeff, IA = 0.7 A
For 230 Veff	Typically 0.188 Aeff, IA = 0.7 A
Power on Current	
I²T	0.3 A ² s
IT	0.02 As

Continued on next page

Specifications, Continued

Power on Surge Current Curve

The following chart shows power on surge current for 120 VAC + 10% or 240 VAC + 10%.



DC Output Voltage

This section contains specifications for DC output voltage:

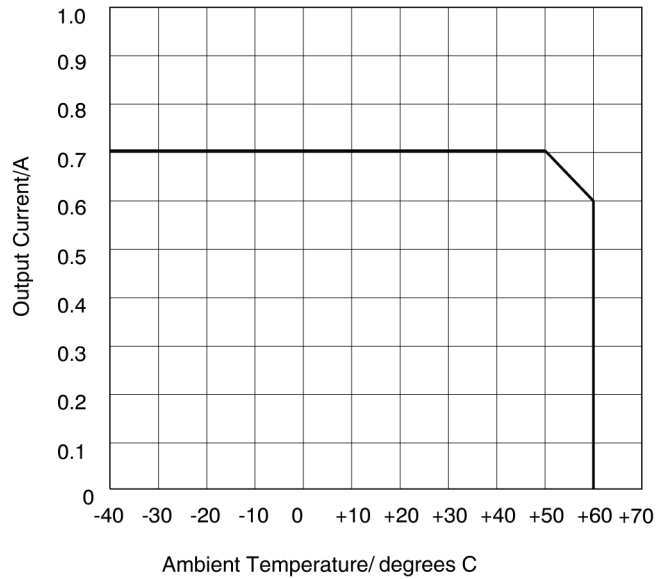
Number	1 x UB = 24 VDC, max. 0.7 A, isolated
Limiting Values	
UBmin	21 VDC
UBmax	30 VDC
Output Current	
IA	0 ... 0.7 A
Output Ripple	
Typical	150 mV/p-p (max. 20 MHz)
Max.	250 mV/p-p (max. 20 MHz) - measured with a 0.1 microF capacitor
Voltage Regulation	Typically +500 mV for 0.7A after 0.35 A Typically -500 mV for 0.35A after 0.7 A

Continued on next page

Specifications, Continued

Output Current Chart

The following chart shows output current (derating) for uninhibited vertical convection:



Section 29.2

Wiring

Overview

Purpose

This section describes the types of terminal connectors available, how to code terminal connectors and how to mount them. It also describes external operating voltage connections.

In This Section

This section contains the following topics:

Topics
Choosing a Terminal Connector
Terminal Connector Coding
Mounting the Terminal Connectors
External Operating Voltage Connections

Choosing a Terminal Connector

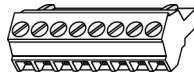
Introduction

Power is supplied to the module through an 8-pole terminal connector. Two types of terminal connectors are available:

- screw-in
 - spring-clip
-

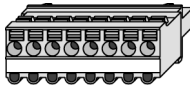
Screw-In Version

Screw-in terminals can be used with cable with a diameter of up to 12 AWG (2.5 mm²). They come in sets of three. The part number is 170 XTS 011 00.



Spring-Clip Version

Spring-clip terminals can be used with cable with a diameter of up to 14 AWG (1.5 mm²). They come in sets of three. The part number is 170 XTS 012 00.



Terminal Connector Coding

Safety Requirement

This module is used in hazardous and harmless voltage ranges. For safety, code the terminal connectors and the power supply module to prevent inadvertent exchanges of terminal blocks.

Coding Set

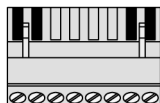
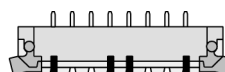
To complete the coding described below, order the 170 XCP 200 00 coding set. This set contains coding keys and combs.

Coding Illustration

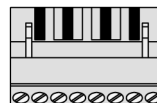
Install coding keys in the positions shown in the following illustration:



Install coding keys in the positions shown



Coding for the harmless range (row 3)



Coding for the hazardous range (row 2)

Mounting the Terminal Connectors

Introduction

This section describes how to mount terminal connectors and how to remove them, including safety considerations.



CAUTION

ELECTRICAL HAZARD

Only mount and remove terminal connectors when the module is not under power.

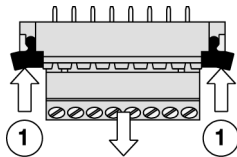
Failure to observe this precaution can result in injury or equipment damage.

Mounting

To mount a terminal connector, press it into the module's pin connector.

Removal

To remove a terminal connector, press both extractors, as shown in the illustration below:



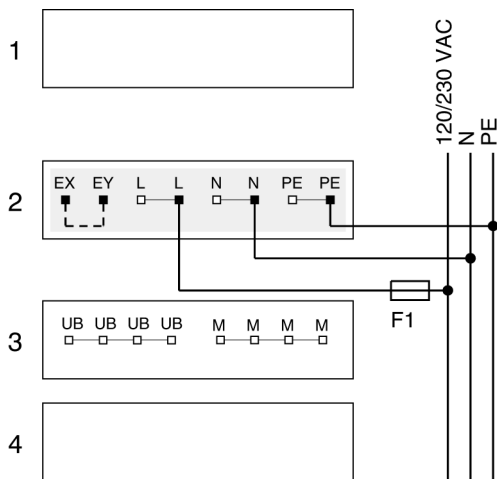
External Operating Voltage Connections

Overview

This section contains a illustration of the external operating voltage connections and explanatory notes.

Illustration

The following illustration shows the external operating voltage connections for the 170 CPS 11 00 TIO Power Supply module:



Row	Terminal	Connection	Function
2	1	EX	Jumper connection
2	2	EY	Jumper connection
2	3, 4	L	AC input voltage, line
2	5, 6	N	AC input voltage, neutral
2	7, 8	PE	Earth ground
3	1, 2, 3, 4	UB	DC output voltage
3	5, 6, 7, 8	M	DC output voltage return

Continued on next page

External Operating Voltage Connections, Continued

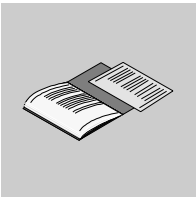
Grounding The spade-lug connector on the front of the module provides a short, secure PE grounding surface.

Electrical safety Power supply modules may not be operated in parallel. Physically separate input cabling from output cabling.

Fusing Dimension the F1 fuse to match the operative load, observing the minimum values in the following table:

Voltage	Jumper Placement	External Fusing (min. F1)
120 VAC	Mounted	0.63 A slow-blow
230 VAC	Removed	0.315 A slow-blow

Appendices



At a Glance

Purpose The appendices present supplementary information about the TSX Momentum I/O bases.

In This Part This part contains the following chapters:

For Information On ...	See Appendix...	On Page...
System Specifications	A	595
Voltage Surge Precautions and Interference Suppression	B	601
IEC 1131 Input Types	C	607
Field Wire Length	D	609
IEC Symbols	E	611

System Specifications

A

At a Glance

Purpose This appendix provides system specifications for all TSX Momentum I/O bases.

In This Appendix This appendix contains the following topics:

For This Topic...	See Page...
Power Supply Specifications	596
Field Device Interfaces	597
Environmental Specifications	599

Power Supply Specifications

Overview

This section contains power supply specifications for the following types of TSX Momentum I/O bases:

- 24 VDC
 - AC voltages
-

24 VDC

Power supply specifications for 24 VDC modules are contained in the table below.

Operating voltage (internal logic)	20 ... 24 ... 30 VDC
Input voltage (discrete inputs)	20 ... 24 ... 30 VDC
Output voltage for electronic outputs	20 ... 24 ... 30 VDC
Output voltage for relay outputs	24 ... 115 VDC
Ripple	max. 5 % effective, corresp. to relat. total oscillation amplitude per DIN 40 110 (unfiltered three-phase bridge permissible)
Periodic peak values (including ripple)	18 ... 33 VDC
Nonperiodic peak values	max. 35 V at t < 500 ms max. 45 V at t < 10 ms
Line power dropout	max. 1 ms, repetition rate 1 s

AC Voltages

Power supply specifications for AC voltage modules are contained in the table below.

Operating voltage (internal logic)	100 ... 115 ... 132 VAC, 47 ... 63 Hz
Input voltage (discrete inputs)	85 ... 115 ... 132 VAC, 47 ... 63 Hz
Output voltage for electronic outputs	20 ... 115 ... 132 VAC, 47 ... 63 Hz
Output voltage for relay outputs	24 ... 230 VAC
Line power dropout	max. 10 ms or 1 half-wave, repetition rate 1 s

Field Device Interfaces

Overview

This section contains specifications for:

- Operating thresholds, input current
- Discrete outputs
- Relay outputs

Operating Thresholds, Input Current

The table below contains specifications for operating thresholds, input current.

Rated voltage	24 VDC	115 VAC
Signal level of "1"-signal	+11 ... +30 VDC	74 ... 132 VAC
Signal level of "0"-signal	-3 ... +5 VDC	0 ... 20 VAC
Minimum ON-voltage	min. 2.5 mA, 6 mA at 24 VDC	min. 6 mA
Maximum OFF-voltage	max. 1.2 mA	max. 2.6 mA
Input delay	0 -> 1: 2.2 ms 1 -> 0: 3.3 ms	< 1 half-wave

Discrete Outputs

The table below contains specifications for discrete outputs.

Rated voltage	24 VDC	115 VAC	230 VAC
Voltage drop on "1"-Signal	max. 0.5 V	max. 1.5 V	max. 1.5 V
Leakage current on "0"-Signal	max. 1 mA	max. 1.3 mA	
Load current per output	max. 500 mA 2 A at ADM 370 10	30 ... 500 mA	
Simultaneity factor	100 %	100 %	100 %
Operating delay	3 ms	< 1 half-wave	

Continued on next page

Field Device Interfaces, Continued

Relay Outputs

The table below contains specifications for relay outputs.

Rated voltage	24 ... 230 VAC 20 ... 115 VDC
Relay type	Normally open (NO) contact
Rated current per output	0.5 ... 2 A, depending on operating voltage and power factor

Environmental Specifications

Overview

All Momentum I/O bases share the following environmental specifications.

General

The table below contains general environmental specifications:

Safety Class	Class 1, IEC 536
Safety Type	IEC 529: IP20
Temperature range (operating)	0 ... +60 °C air intake temperature (without forced ventilation). Under more difficult ventilation conditions, power dissipation must be taken into account (refer to the module descriptions).
Temperature range (storage)	-40 ... +85 °C (without battery) -40 ... +70 °C (with battery)
Relative humidity	95 % continuous for 30 days 75 % annual average, noncondensing
Atmospheric pressure (operating)	>=700 hPa (700 mbar)
Atmospheric pressure (transport)	>=230 hPa (230 mbar)
Pollutants	Maximum at 60% relative humidity, noncondensing SO ₂ <= 0.5 ml/m ³ H ₂ S <= 0.1 ml/m ³
Shock	15 g at 147 m/s ² for 11 ms Three shocks/axis per IEC 68.2-6EC
Vibration	10...57 Hz @ 0.075mm d.a.57...150Hz @ 1 g per IEC 68.2-27EA
Dielectric strength	Conforms to IEC 664
Norms and Standards	CE, UL, CULFM pending
Equipment definition	Open equipment (IEC 1131-2)

Continued on next page

Environmental Specifications, Continued

Noise Immunity

The tables below contain specifications for noise immunity to line-conducted phenomena.

Circuits	Rated Voltage	Fast transients / Burst per IEC61000-4-4
Power mains	24 VDC / 230 VAC	+/-2 kV
Binary/Discrete inputs	24 VDC 230 VAC	+/-1 kV +/-2 kV
Analog inputs	-	+/-1 kV
Discrete outputs (electronic)	24 VDC	+/-1 kV
Analog outputs	-	+/-1 kV
Relay outputs	24 VDC / 230 VAC	+/-1 kV
Shielded cables	-	+/-1 kV

Noise immunity to electrostatic discharge	+/-4 kV for indirect contact discharge
Noise immunity to electromagnetic fields	10 V/m
RFI suppression	Limit curve A

Voltage Surge Precautions and Interference Suppression

B

At a Glance

Purpose This appendix contains information about voltage surge precautions and interference suppression.

In This Appendix This appendix contains the following topics:

For This Topic...	See Page...
Voltage Surge Precautions	602
Interference Suppression	605

Voltage Surge Precautions

Overview

If your supply voltage is outside the specified tolerances, a surge protector (suppressor diode) should be used to protect the electronic inputs and outputs of the I/O bases from voltage surges.

This section describes and illustrates how to install a surge protector.

Mounting Options

Suppressor diodes come in two models:

- For DIN rail mounting, use overvoltage protection OVP 001.
 - For wall mounting, use overvoltage protection OVP 2480.
-

Positioning

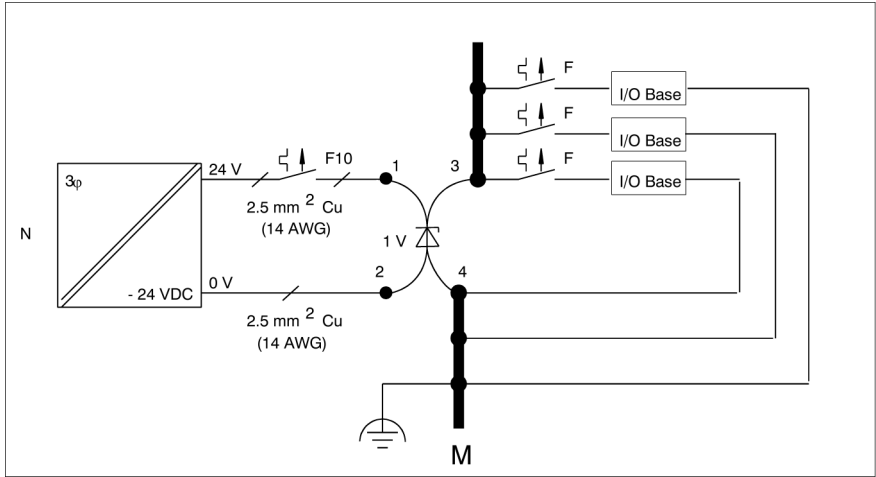
Install the surge protector at the point of entry of the fuse-protected supply voltage (V1 in the diagram below). The suppressor diodes are to be wired as quadripoles and, with a low-resistance reference conductor, positioned close to the power supply unit.

Continued on next page

Voltage Surge Precautions, Continued

Configuration of Power Supply Units

The diagram below shows how to configure power supply units:



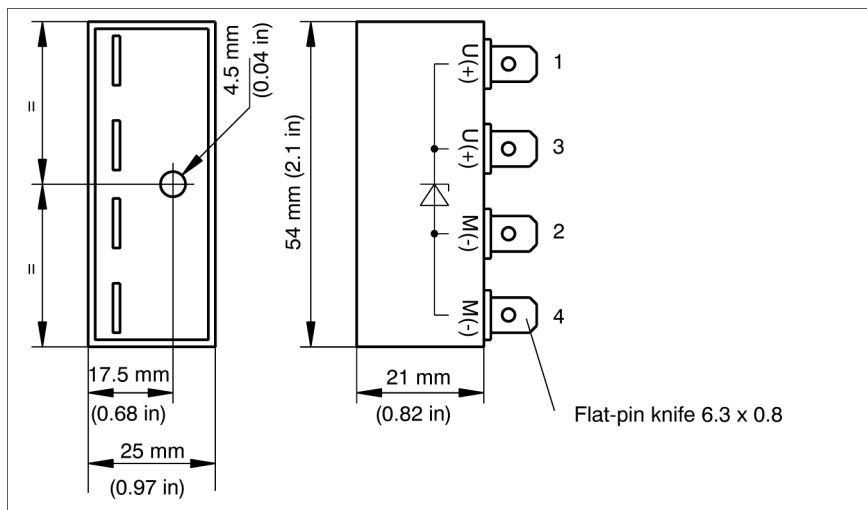
Label	Meaning
F	Automatic circuit breaker or fuse
F10	Safety circuit breaker 10 A or 25 A
N	Power supply unit 24 VDC, max. 25 A
1 V	Commercially available voltage surge protector, such as OVP 001 (10A) or OVP 2480 (25 A)
1, 2, 3, 4	Connecting points of the surge protector V1. You will find the same reference numerals in the surge-protector installation diagrams which follow, assuring correct connection.

Continued on next page

Voltage Surge Precautions, Continued

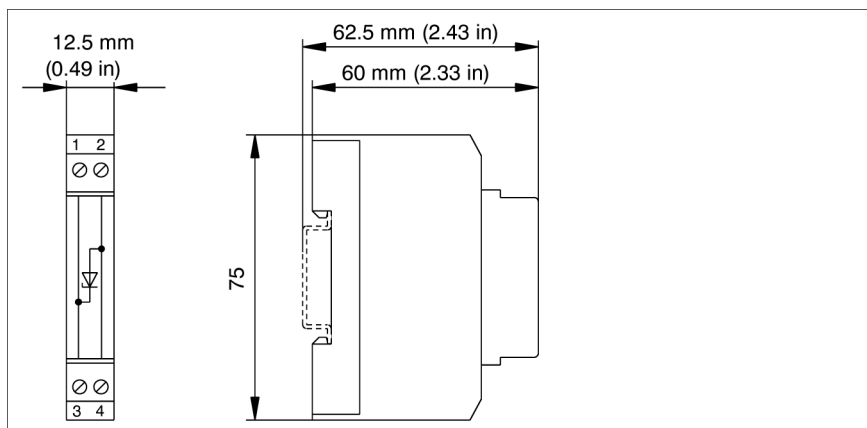
DIN Rail Mount

The diagram below illustrates how to position a DIN rail-mounted overvoltage protection device (OVP 001).



Wall Mount

The diagram below illustrates how to position a wall-mounted overvoltage protection device (OVP 2480).



Interference Suppression

Overview

This section explains the interference suppression properties of TSX Momentum components, guidelines for interference suppression of your system, and recommendations for obtaining permits.

TSX Momentum Components

Under the RF Equipment Act, individual components and individually nonoperational subassemblies are not subject to the mandatory PT&T classification or registration rules.

The components of the TSX Momentum are interference-suppressed to within EN 55011 Limit Curve A.

Your System

Assuming adherence to the configuration guidelines, even a total system constructed from TSX Momentum components typically meets this requirement, if:

- All third-party add-on equipment and components are equally RFI-suppressed,
 - The operating instructions regarding RF suppression are adhered to, e.g.:
 - Filtering the line voltage using RFI filters
 - Noise filtering using anti-interference capacitors
 - Equipping inductive consumers with clamping diodes (suppressor diodes) to prevent the injection of RF noise potentials into neighboring lines
-

Permits

In some cases, so-called operating permits may be required. Obtaining the operating permit for the total system from the local RFI control agency is the responsibility of the user. It usually applies to systems operated in residential and mixed-zoning areas, government offices, hospitals and airports, but not within industrial zones.

In the event of any problems with the operating permit or license, consult the system supplier first. In case of doubt, the latter can direct questions to the local distributor.

IEC 1131 Input Types



Input Voltage and Current Thresholds

Overview This section describes the voltage and current thresholds for three types of input, as defined by IEC 1131.

Thresholds The following table shows the voltage and current thresholds for three input types at 24 VDC, as defined by IEC 1131.

Input Type	On Voltage	On Current	Off Voltage	Off Current
Type 1	+15 ... +30 V	2 ... 15 mA	-3 ... +5 V	... 15 mA
Type 1+	+11 ... +30 V	2.5 ... 10 mA	-3 ... +5 V	... 10 mA
Type 2	+11 ... +30 V	6 ... 30 mA	-3 ... +5 V	... 30 mA

Type 1+ This type is often used for active sensors and relays because the minimum on and maximum off current thresholds are higher.

Field Wire Length

D

Calculating Field Wire Length for AC and DC Devices

Introduction This section describes some considerations in calculating field wire length.

Effect of IR Drop The IR drop is the product of the resistance of the wire (depends on wire gauge size) and the current drawn by the load. ($IR = \text{volts}$) After calculating the IR drop of the field wire, what you have left is available at the module input.

Example The following example shows how to calculate the IR drop to see if enough is left over to turn on an I/O base's input point.

1. Assume an I/O base needs 80 VAC minimum to turn on voltage and assume a field source of 120 VAC.
2. Assume the current drawn by the I/O base is 6 mA.
3. Consult the vendor of the wire to get the resistance of the wire (usually given in Ohms per 1000 feet, this depends on the gauge and length of the wire). For this example, assume the total resistance of the wire length is 1000 Ohms.
4. Calculate $.006 \text{ A} \times 1000 \text{ Ohms} = 6 \text{ VAC}$. This is the IR drop.
5. Calculate $120 \text{ VAC} - 6 \text{ VAC} = 114 \text{ VAC}$. This is plenty to turn on the inputs, as the minimum required is 80 VAC.

Continued on next page

Calculating Field Wire Length for AC and DC Devices, Continued

Empirical Testing Required

The IR drop calculation can only be a rough estimate. Empirical testing is required to fine-tune the wiring length. The result will depend on the following variables:

- shielded vs. unshielded wire
 - single vs. wiring pairs
 - wire impedance
 - electrical noise
 - routing of wiring, such as running in parallel with high voltage that can induce capacitive and inductive coupling of noise spikes
-

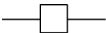
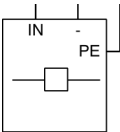

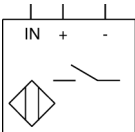
IEC Symbols

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Glossary of Symbols

Overview This appendix contains illustrations and definitions of common IEC symbols used in describing TSX Momentum components.

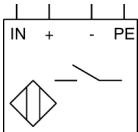
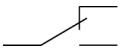


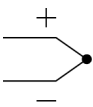
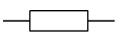
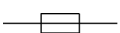


Symbols Common IEC symbols are illustrated and defined in the table below:

Symbol	Definition
	Actuator/output, e.g. contactor, lamp, valve, heating, etc.
	3-wire actuator
	Digital sensor/input, e.g. contact, switch, initiator, light barrier, etc.
	3-wire sensor

Continued on next page

Glossary of Symbols, Continued

Symbols, Continued

	4-wire sensor
	Change-over break
	Analog sensor (voltage)
	Analog sensor (current)
	Thermocouple Element
	Resistor, general symbol
	Fuse
	Electrolytic Capacitor
	Earth Ground

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