Chapter 33
170 AMM 090 00 Analog 4 Ch. In / 2 Ch. Out Module Base w/ 24 VDC I/O Pts

Overview

This chapter describes the 170 AMM 090 00 TSX Momentum I/O base. See also 170 AMM 090 01 *(see page 563)*.

What Is in This Chapter?

This chapter contains the following topics:

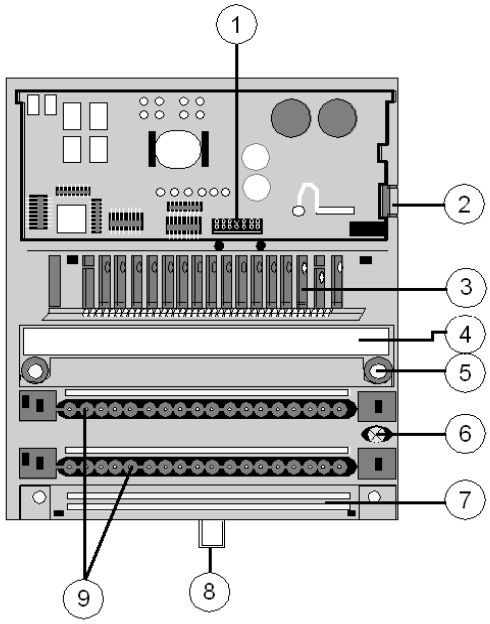
Front Panel Components

Overview

This section contains an illustration of the front panel of the 170 AMM 090 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.

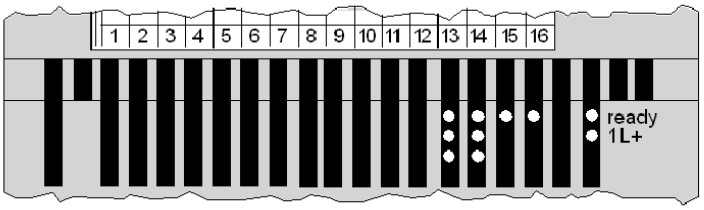


Components of the I/O module

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

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. 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 (an LED per output). Output point active, i.e. output carries "1" signal (logically "ON").
	Off	Discrete output status (an LED per output). Output point inactive, i.e. output carries "0" signal (logically "OFF").
Bottom row 13 , 14	Red	Discrete output overload (one LED per output). Output concerned short-circuited or overloaded.
	Off	Discrete outputs 1 ... 2 operating normally.

Specifications

Overview

This section contains specifications for the 170 AMM 090 00 I/O base.

General Specifications

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

Isolation

Discrete inputs from outputs	none
Analog inputs from outputs	none
Analog inputs and outputs from operating voltage	500 VDC, 1 min
Operating voltage and all inputs and outputs from ground	500 VDC, 1 min

Fuses

Internal	none
Operating voltage L+	1 A slow-blow (Bussmann GDC-1A 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

EMC

Immunity	IEC 1131-2 (500 V disturbance pulse in operating voltage)
Radiated noise	EN 50081-2
Agency approvals	UL, CSA, CE, FM Class 1, Div 2

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 159.5 mm (6.3 in) with two-row busbar 171.5 mm (6.75) with three-row busbar
Weight	240 g (0.55 lb)

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 Specific Data

Range	+/- 10 V	+/- 5 V	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	max. 0.16 % of upper measuring range value	max. 0.16 % of upper measuring range value
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	max. 0.3 % of upper measuring range value	max. 0.3 % of upper measuring range value
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	max. 0.04 % of upper measuring range value	max. 0.04 % of upper measuring range value
Resolution)	14 bits	13 bits	12 bits	13 bits	12 bits

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

Number of points	4
Number of groups	1
Points per group	4
Signal type	True High
IEC 1131 type	1+ (See Appendix *IEC 1131 Input Types, page 701* 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 24 VDC) 1.2 mA maximum OFF
Input voltage range	-3 ... +30 VDC
Input resistance	4 kOhm
Response time	2.2 ms OFF to ON 2.2 ms ON to OFF

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.

Output type	Semiconductor
Output voltage	External supply - .5 VDC
Number of points	2
Number of groups	1
Points per group	2
Current capacity	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 / 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.

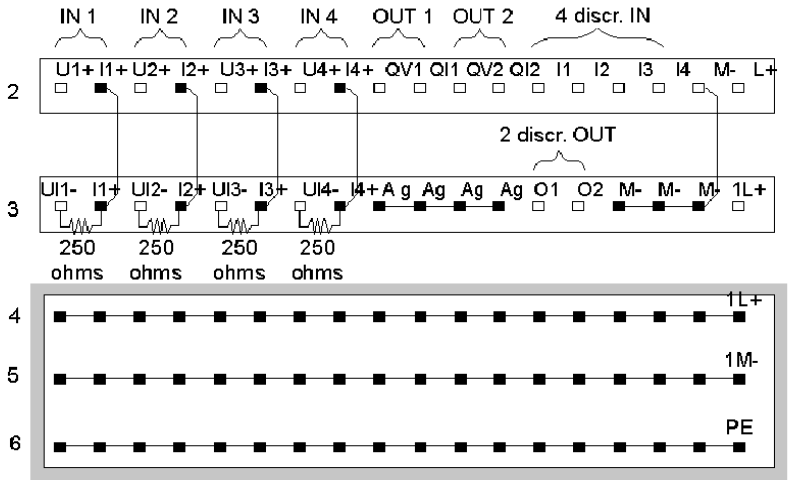
Internal Pin Connections

Overview

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

Illustration

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

To connect field devices to the I/O base, you need a field wiring terminal connector. Schneider Electric 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 Electric.

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

Mapping Terminal Blocks

⚠ 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 follow these instructions can result in injury or equipment damage.

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

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 prallel to the operating coil.

Wiring Diagrams

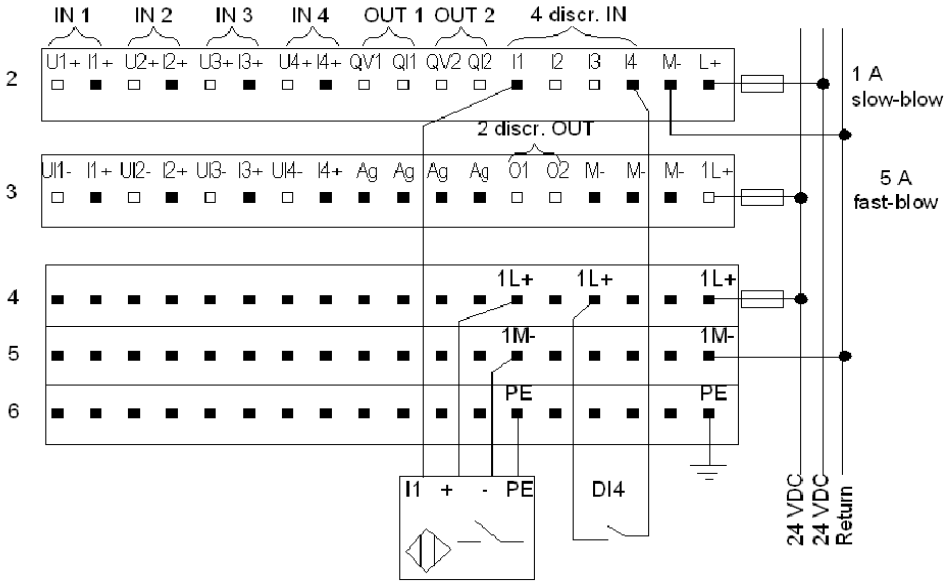
Overview

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

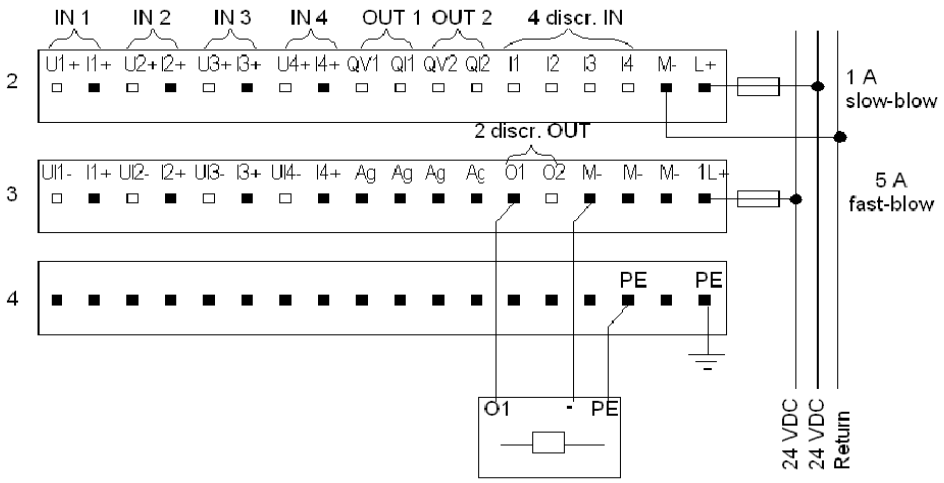
Discrete Inputs

The diagram below shows an example of wiring for discrete inputs:



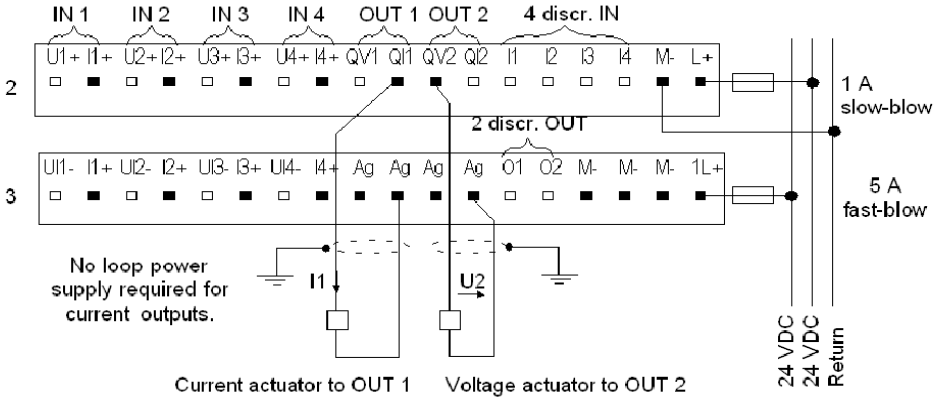
Discrete Outputs

The diagram below shows an example of wiring for discrete outputs:



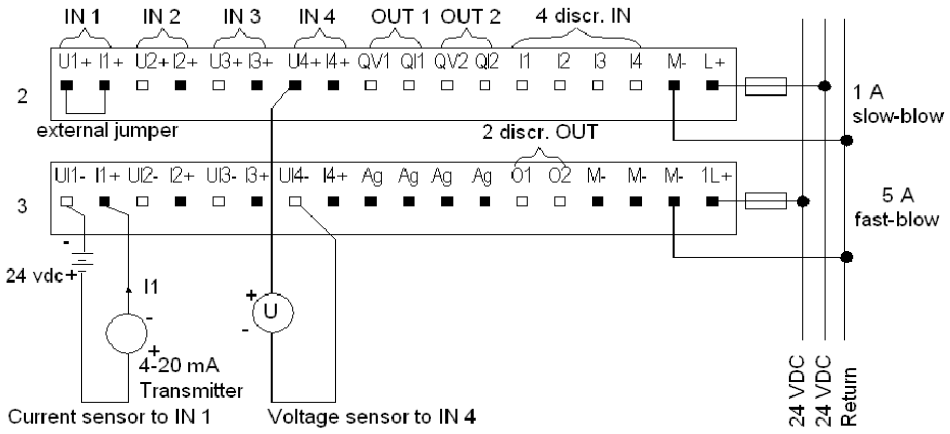
Analog Outputs

The diagram below shows an example of wiring for analog outputs:



Analog Inputs

The diagram below shows an example of wiring for analog inputs:



I/O Mapping

Overview

The 170 AMM 090 00 TSX Momentum I/O base supports 4 analog inputs, 2 analog outputs,4 discrete inputs and 2 discrete outputs. This section contains information about the mapping of the output words into the analog/discrete output values, the usage of output words for channel configuration and the mapping of analog/discrete input values into input words.

I/O Map

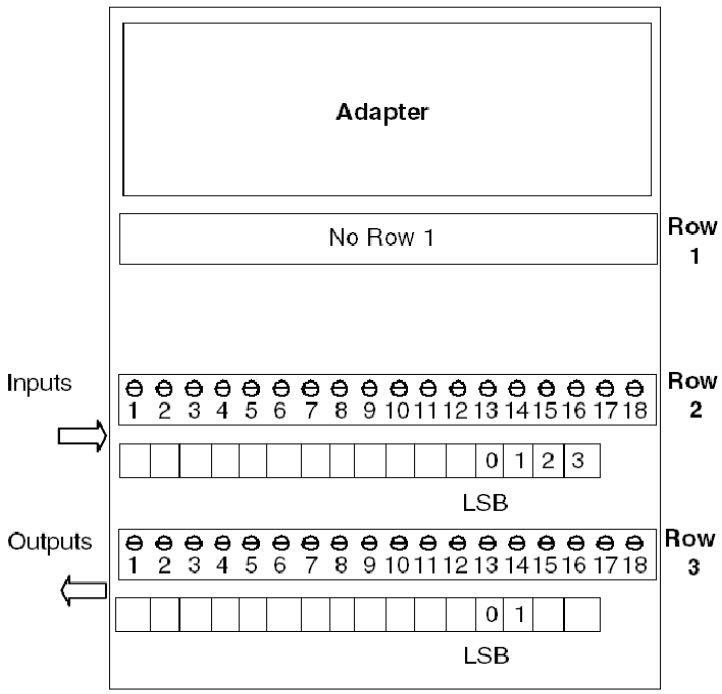
The I/O base may be mapped as five contiguous input words and five contiguous output words, as follows:

Word	Input Data	Output Data
1 = LSW	Value, input channel 1	Parameters for input channels 1 ... 4
2	Value, input channel 2	Parameters for output channels 1,2
3	Value, input channel 3	Value, output channel 1
4	Value, input channel 4	Value, output channel 2
5 = MSW	Discrete inputs	Discrete outputs

Discrete I/O Mapping

The figure below shows how data is mapped with an IEC Compliant adapter.

IEC and 984 Format



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 = LSW	Value, input channel 1	**Parameters for input channels 1 ... 4**
2	Value, input channel 2	**Parameters for output channels 1 ... 2**
3	Value, input channel 3	Not used
4	Value, input channel 4	Not used
5 = MSW	Value, input channel 5	Not used

Illustration

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			

Codes for Analog Input Parameters

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

Code (binary)	Code (hex)	Parameter
0100	4	Channel inactive
0010	2	+/-5V or +/-20mA input range
0011	3	+/-10V input range
1010	A	1 ... 5V or 4 ... 20 mA input range

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	4	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

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
1 = LSW	Value, input channel 1	Parameters for input channels 1 ... 4
2	Value, input channel 2	Parameters for output channels 1, 2
3	Value, input channel 3	**Value, output channel 1**
4	Value, input channel 4	**Value, output channel 2**
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 output 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 ... 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 output channels 1, 2
3	**Value, input channel 3**	Value, output channel 1
4	**Value, input channel 4**	Value, output channel 2
5 = MSW	Discrete inputs	Discrete outputs

Analog Input Values

Mapping of analog input values is shown below.

Intput Word 1															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sign	value input channel 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

The 170 AMM 090 00 TSX Momentum I/O base supports 4 discrete inputs and 2 discrete outputs. This section describes how to map I/O data between the I/O base and the CPU.

NOTE: You cannot commision the discrete I/O until parameters have been set for all six analog channels.
You must configure analog inputs and outputs, even if they are not being used, for the discrete inputs and outputs to operate.

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
1 = LSW	Value, input channel 1	Parameters for input channels 1 ... 4
2	Value, input channel 2	Parameters for output channels 1,2
3	Value, input channel 3	Value, output channel 1
4	Value, input channel 4	Value, output channel 2
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.

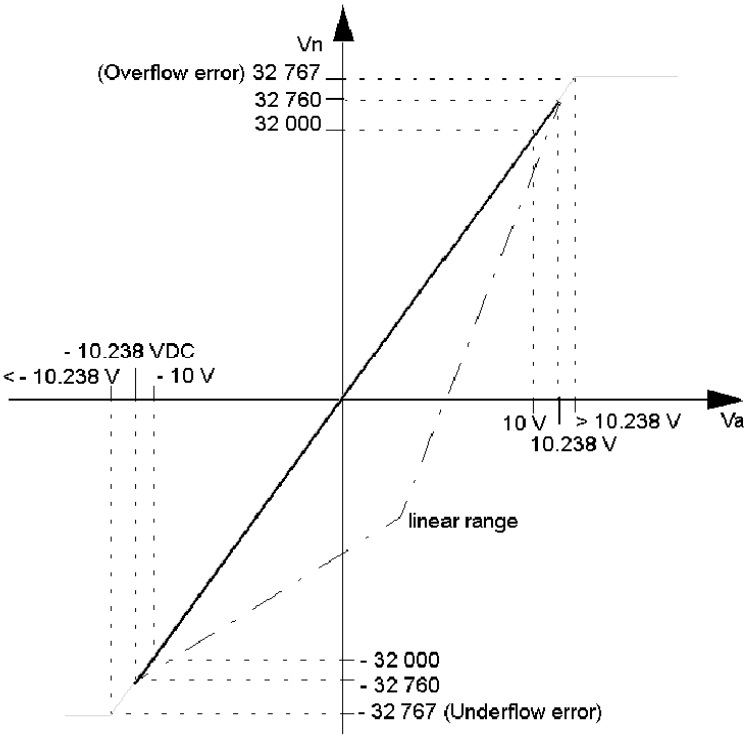
Input Measuring Ranges

Overview

This section contains illustrations explaining the analog/digital relation for the various input and output measuring ranges.

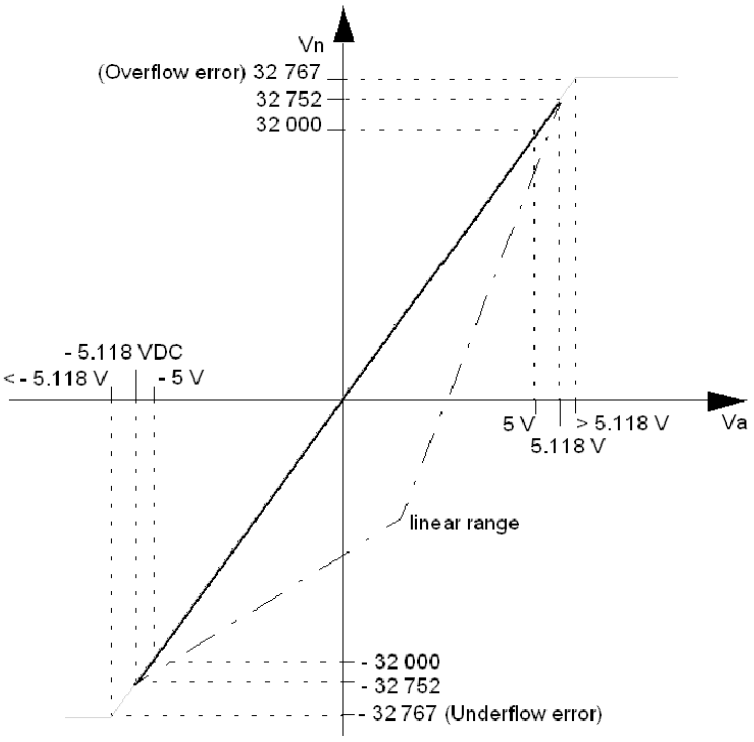
Input Range +/- 10 V

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: Vn = 3200 x Va (for the linear range):



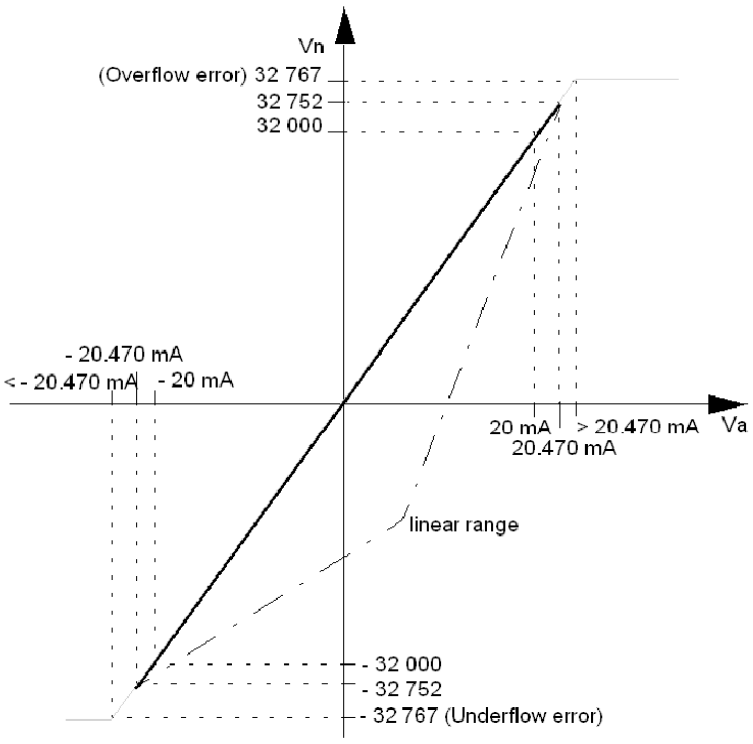
Input Range +/- 5 V

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: Vn = 6400 x Va (for the linear range):



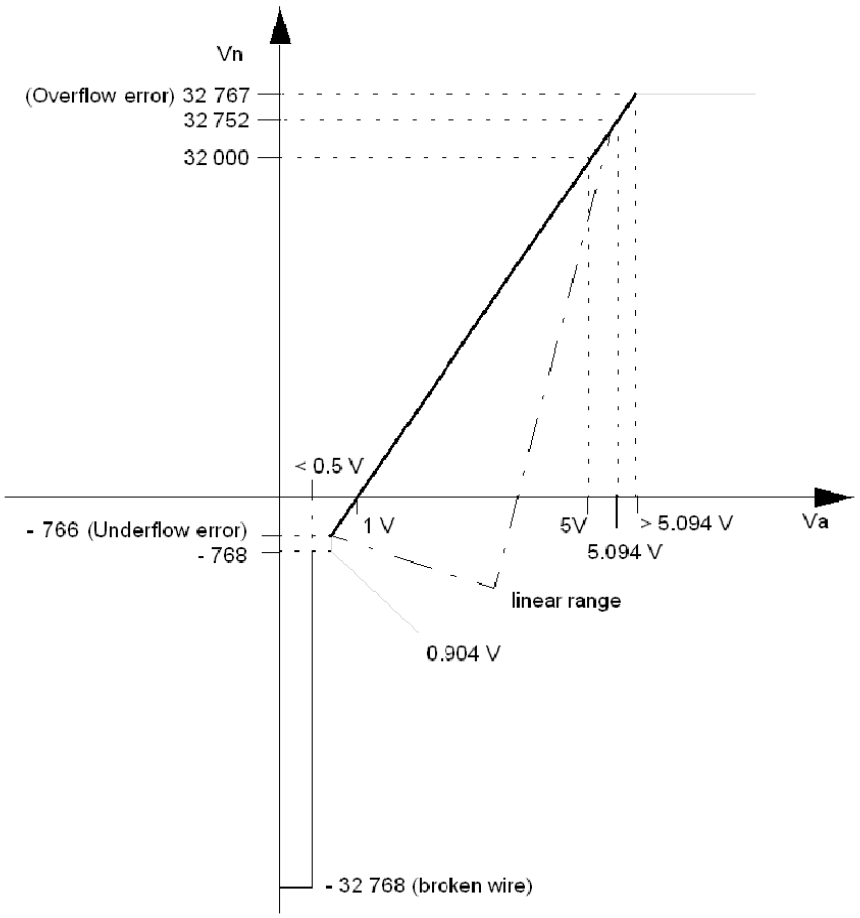
Input Range +/- 20 mA

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: Vn = 1600 x Ia (for the linear range):



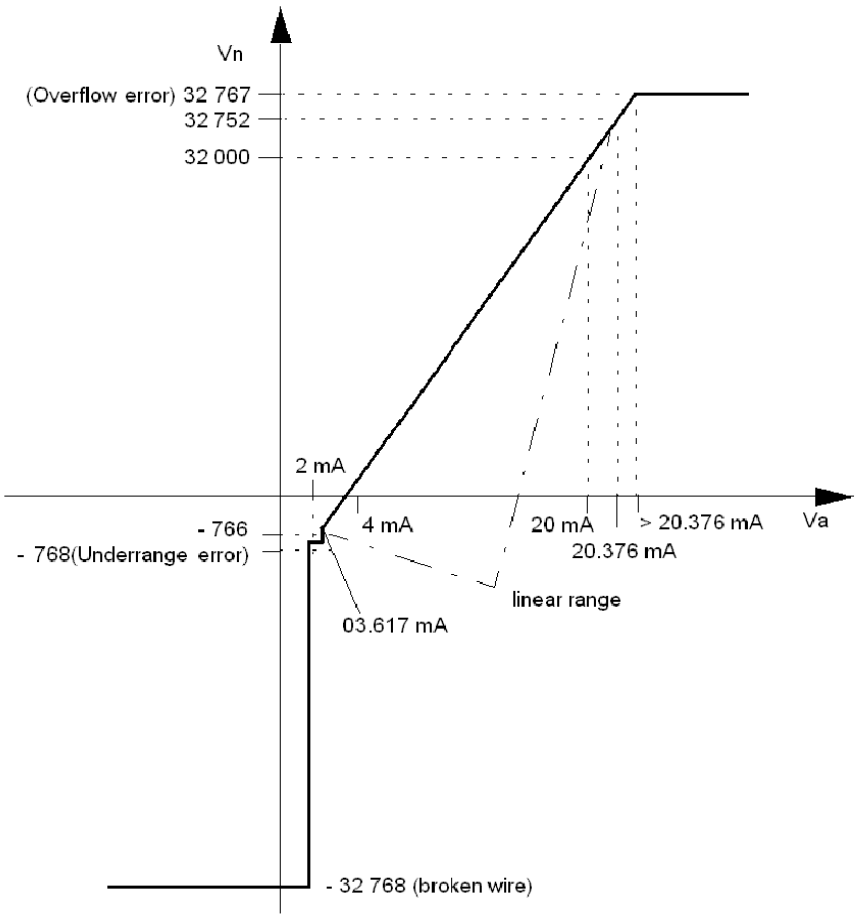
Input Range 1 ... 5 V

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: Vn = 8000 x Va - 8000 (for the linear range):



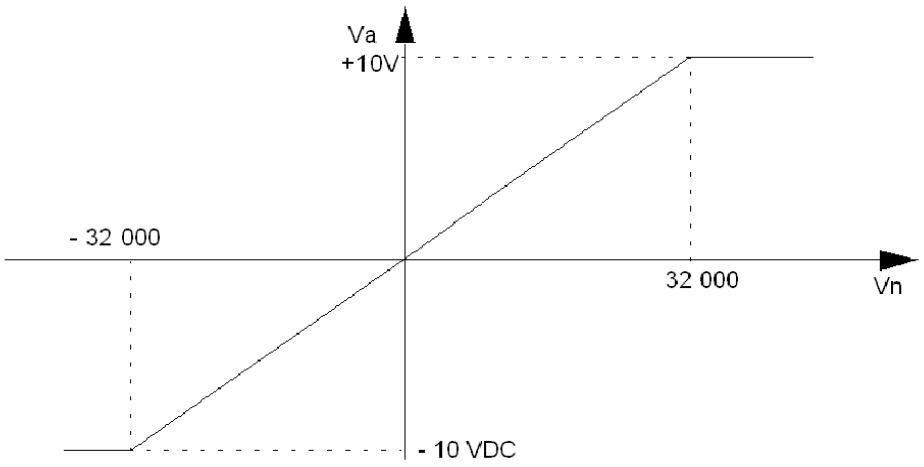
Input Range 4 ... 20 mA

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: Vn = 2000 x Ia - 8000 (for the linear range). Disabled channels deliver a value of 0.



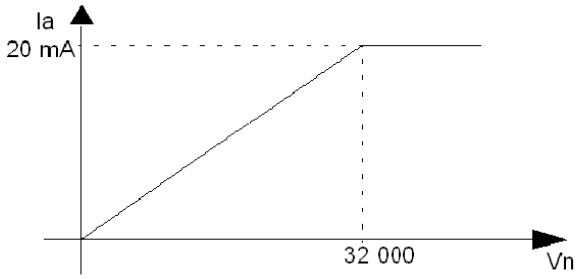
Output Range +/- 10 V

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:Va = 1/3200 x Vn.



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:Ia = 1/1600 x Vn.



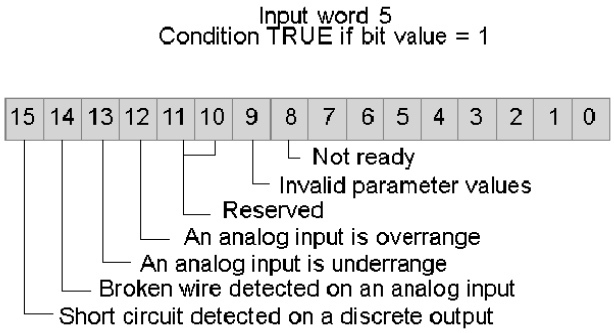
Error Messages

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.

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 on 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 sets to one, only if a resistor is wired in parallel to the input terminals. This resistor discharges 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 influene 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)

This error occurs when the I/O base detects a short circuit on a discrete output.