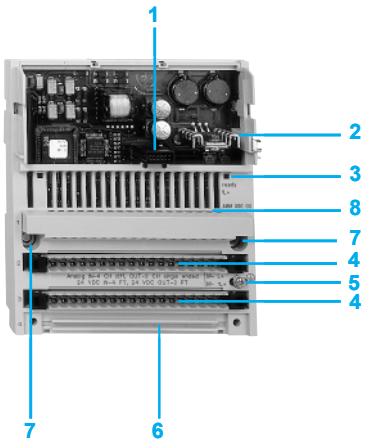
Modicon Momentum automation platform
Analog I/O bases



Presentation

The Momentum analog input bases enable acquisition of various analog values encountered in industrial applications, including:
- Standard high level (± 5 V, ±10 V, 1-5 V, 4-20 mA, ± 20 mA).
- Low level (± 25 mV, ± 100 mV).
- Thermocouples (B, E, J, ...).
- Temperature probes (Ni ..., Pt ...).

The analog output bases are used to control analog field devices such as various speed drives, proportional control valves, etc. The current or the voltage is proportional to the digital value defined by the user program. The outputs can be configured so that when the program stops the outputs either reset to zero or hold the last value received. This feature is useful during debugging since, if the outputs are set to “Hold”, the operation of the analog field devices is not disturbed every time the program stops.

In order to cover a wide range of applications, Momentum I/O bases offer the following functions in addition to A/D or D/A conversion:
- Choice of input/output ranges (voltage, current, thermocouple, temperature probes).
- Selection of number of channels used.
- Cold junction compensation for thermocouple modules.
- Broken wire detection (**170 AAI 030 00**, **170 AAI 140 00**, **170 AAI 520 40**).

Description

170 A●● analog I/O base units comprise on the front panel:
1. Internal interface connector for the communication module or processor module.
2. A locking and earth contact for the communication module or processor module.
3. LED status indicators (the number of indicators will depend on the number of channels).
4. Two connectors for the removable terminal blocks.
5. An earthing screw.
6. A slot for the power strip
7. Two screw holes for panel mounting.
8. A protective cover.

Connectors to be ordered separately:
- removable screw or spring terminal blocks **170 XTS 00● 00**.
- 1 to 3-row screw or spring bus bar **170 XTS 00● 01**.

Characteristics : pages 48238/3 to 48238/7
References : pages 48238/8 and 48238/9
Dimensions : page 48238/9
Connections : pages 48238/10 and 48238/11

Modicon Momentum automation platform
Analog I/O bases

Characteristics of analog input bases

Type of base units			170 AAI 030 00				
Number of inputs			1 x 8 differential imputs				
LEDs			Ready (green)				
Format of data			Full 16 bits signed (2's complement)				
Protection	Base and actuators		Polarity inversion				
Ranges			**± 10 VDC**	**± 5 VDC**	**4…20 mA**	**± 20 mA**	**1…5 VDC**
	Input impedance	kΩ	> .1000	> .1000	250	250	> .1000
	Error at 25 °C	%	0.27	0.21	0.27	0.32	0.13
	Error at 60 °C	%	0.32	0.26	0.38	0.41	0.19
	Resolution		14 bits + sign bipolar 15 bits unipolar				
Conversion times		**ms**	12 ms max. for 8 input channels (1.33 ms per input channel + 1.33 ms)				
Error indication			None				
Isolation	Channel to channel	**VDC**	± 200 for 1 minute				
	Field to ground	**VDC**	500 for 1 minute				
	Communication adapter to ground	**VAC**	500 for 1 minute				
Common mode rejection	Channel to ground		250 VAC @ 47…63 Hz or 100 VDC				
Crosstalk between channels		**dB**	⩾ 80				
External power requirement	Nominal	**VDC**	24				
	Limit values	**VDC**	20.4 to 28.8				
	Current	**mA**	< 382 @ 24 VDC				
EMC for industrial environment	Immunity		IEC 1131 surge on auxiliary power supply 2 kV				
	Emissions		EN 50081-2				
	Approvals		UL, CSA, CE				

References :
pages 48238/8 and 48238/9

Dimensions :
page 48238/9

Connections :
pages 48238/10 and 48238/11

Modicon Momentum automation platform
Analog I/O bases

Characteristics of analog input bases (continued)

Type of base units			170 AAI 140 00			170 AAI 520 40	
Number of inputs			1 x 16 single-ended input			1 x 4 differential inputs	
Format of data			Full 16 bits signed (2's complement)				
Protection	Base and actuators		Polarity inversion				
Error indication			None				
Ranges			**± 10 V**	**± 5 V**	**4…20 mA**	**± 25 mV**	**± 100 mV**
	Input impedance	**kΩ**	> 2200	> 2200	< 0.250	> 10000	> 10000
	Error at 25 °C		0.15 % FS	0.15 % FS	0.25 % FS	± 21 µV	± 27 µV
	Error at 60 °C		0.25 % FS	0.25 % FS	0.45 % FS	± 46 µV	± 94 µV
	Temperature drift (60 °C)	**‰**	30 PE / °C	30 PE / °C	60 PE / °C	–	
	PE (Full scale)		10 V	5 V	16 mA	–	
	Resolution		12 bits + sign	12 bits + sign	12 bits	15 bits + sign	
	Filtering		Low pass with cut-off frequency 10 kHz			–	
Current source	Pt100	**mA**	–			–	0.125
	Ni100	**mA**	–			–	0.125
	Pt1000	**mA**	–			0.125	–
	Ni1000	**mA**	–			0.125	–
Update time		**ms**	1 + 1.5 x n n = number of declared channels			500	
Error indication			None				
Potential isolation	Channel to channel	**VDC**	None			400	
	Base power supply and ground	**VDC**	500 for 1 minute			500 for 1 minute	
	Channels to ground	**VAC**	1780 for 1 minute			500 for 1 minute	
	Base power	**V**	± 30 (voltage or current output)			± 30 (voltage or current output)	
	Common mode Channel to ground	**V**	–			± 100 DC, 250 AC	
	Common mode Voltage between channels	**V**	–			200 DC, 115 AC single phase or 3-phase or 250 AC single phase	
Common mode rejection	Channel to ground		250 VAC at 47…63 Hz or 100 VDC			135 dB DC, 145 dB AC 50 Hz, 155 dB AC 60 Hz	
	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			Polarity inversion				
Operating voltage		**VDC**	24				
Internal current		**mA**	305 @ 24 VDC				
Power dissipation	Typical	**W**	4.95			3.5	
	Maximum	**W**	5.55			5.5	
Fusing	Internal		2 A slow-blow			2 A slow-blow	
	External		500 mA fast-blow			500 mA fast-blow	
Agency approvals			UL, CE, CSA, FM Class I, Div. II				

References :
pages 48238/8 and 48238/9

Dimensions :
page 48238/9

Connections :
pages 48238/10 and 48238/11

Characteristics of analog output bases

Type of base units			170 AAO 120 00		170 AAO 921 00	
Number of outputs			1 x 4			
Format of data			Full 16 bits signed (2's complement)			
Protection	Base and actuators		Polarity inversion			
Ranges			**± 10 V**	**0…20 mA**	**± 10 V**	**4…20 mA**
	Load impedance	**kΩ**	1 minimum	0.6 maximum	1 minimum	0.6 maximum
	Capacitive load	**µF**	< 1			
	Error at 25 °C	**%**	0.2 PE	0.3 PE	0.2 PE	0.4 PE
	Error at 60 °C	**%**	0.25 PE	0.4 PE	0.25 PE	0.5 PE
	Temperature drift (60 °C)	**‰**	10 PE / °C	30 PE / °C	10 PE / °C	30 PE / °C
	Resolution		12 bits + sign			
	Update time	**ms**	< 2			
Full scale			10 V in the range of ± 10V 2 mA in the range of 0…20 mA			
Fail State			Hold, reset to zero, reset to full scale			
Potential isolation	Channel to channel		None			
	Base power supply and ground	**VDC**	500 for 1 minute			
	Channels to ground	**VAC**	500 for 1 minute			
	Outprotections		Short-circuits in the voltage circuits, open in current polarity inversion			
	Base power	**V**	± 30 (voltage or current output)			
Common mode rejection		**VAC**	250 @ 47…63 Hz or 250 DC channel to ground			
Operating voltage		**VDC**	24			
Internal current	Base	**mA**	530 @ 24 VDC			
	Actuators	**mA**	150 @ 24 VDC			
Power dissipation	Typical	**W**	5.6			
	Maximum	**W**	8.5			
Internal fusing		**A**	2, slow-blow			
Agency approvals			UL, CE, CSA			

References :
pages 48238/8 and 48238/9

Dimensions :
page 48238/9

Connections :
pages 48238/10 and 48238/11

Modicon Momentum automation platform
Analog I/O bases

Characteristics of discrete and analog I/O bases

Type of base unit			170 AMM 090 00				170 AMM 090 01
Number of inputs and outputs			1 x 4 differential inputs 1 x 4 discrete inputs 1 x 2 analog outputs 1 x 2 discrete outputs				
Operating voltage		**VDC**	24				12
Internal current		**mA**	200 typical (at 24 VDC), 350 maximum (at 24 VDC)				700 maximum (at 12 VDC)
Differential inputs for 170 AMM 090 00/090 01	Conversion time		10 ms for all channels				
	Conversion error		**± 10 V**	**± 5 V**	**1…5 V**	**± 20 mA**	**4…20 mA**
	25 °C	**%**	0.08	0.16	0.16	0.16	0.16
	60 °C	**%**	0.15	0.3	0.3	0.3	0.3
	Resolution		14 bits	13 bits	12 bits	13 bits	12 bits
	Conversion consistency	**%**	± 0.02	± 0.04	± 0.04	± 0.04	± 0.04
	Common mode voltage		Input voltage starting at Ag ± 11 V				
	Common mode suppression	**dB**	> 54				80
	Overvoltage Voltage ranges	**V**	± 30 solid state if voltage is 24 V ± 50 dynamic max. 100 ms				± 30 solid state if voltage is 12 V ± 50 dynamic max. 100 ms
	Overvoltage current ranges	**mA**	–			> 48	
	Input resistance	Ω	1 M			250	
	Fail state		Hold or reset to zero				
Discrete inputs	Voltage	**VDC**	24 typical, 30 maximum				12 typical
	Signal Type		True high				
	On Voltage	**VDC**	+ 11…+ 30				+ 7.5…+ 15
	Off Voltage	**VDC**	- 3…+ 5				- 1.5…+ 2.5
	Input current	**mA**	2.5 minimum at state 1 (6 mA at operating voltage), 1.2 maximum at state 0				
	Input resistance	**kΩ**	4				2.1
	Response time	**ms**	2.2 from 0 to state 1 3.3 from 1 to state 0				
Analog outputs	Resolution		12 bits for single-phase measuring range 0…20 mA, 12 bits for 2-phase measuring range ± 10 V				
	Conversion time	**ms**	1 for all channels				
	Conversion error 25 °C		max. ± 0.35 % of upper measuring range value				
	Conversion error 60 °C		max. ± 0.70 % of upper measuring range value				
	Output load		≥ 3 kΩ for voltage output, ≤ 600 Ω for current output				
Discrete outputs	Voltage	**VDC**	24 typical, 30 maximum				
	Type		Semiconductor				
	Signal Type		True high				
	Current capacity		1 per channel, 2 per group, 2 per module				
	Leakage current	**mA**	< 1 @ 24 VDC				< 1 @ 12 VDC
	On State Voltage drop	**VDC**	< 0.5 @ 1 A				< 0.5 @ 0.5 A
	Response time Off to On	**ms**	< 0.1				
	Response time On to Off	**ms**	< 0.1				
	Output protection		The outputs are protected against overload and short-circuit-circuiting				
	Output indicator		1 red LED per “On” output in the event of an overload or short-circuit-circuiting				
	Error message		Message “I/O error” on bus adapter if module is defective				
	Max. Switching cycles		1000/hr (inductive load 1 A), 100/s (resistive load 1 A), 8/s (filament load 2.4 W)				
Potential isolation	Discrete input and output		None				
	Analog input to output		None				
	Analog input and output and to operating voltage	**VAC**	500 for 1 minute				
	Operating voltage and all inputs and outputs from ground	**VAC**	500 for 1 minute				
Power dissipation	Typical	**W**	4.0				
	Maximum	**W**	6.0				
Agency approvals			UL, CE, CSA, FM Class I, Div. II				UL, CE, CSA

References : pages 48238/8 and 48238/9
Dimensions : page 48238/9
Connections : pages 48238/10 and 48238/11

Modicon Momentum automation platform
Analog I/O bases

Characteristics of discrete and analog I/O bases (continued)

Type of base unit				170 ANR 120 90	170 ANR 120 91
Number of inputs and outputs				1 x 6 analog inputs 2 x 4 discrete inputs 1 x 4 analog outputs 1 x 8 discrete outputs	
Operating voltage			**VDC**	24, range 19.2...30	
Internal current			**mA**	400 @ 24 VDC	
Analog inputs	Resolution			14 bit	
	Input range		**VDC**	0...10	- 10...+ 10
	Input type			Single-ended	
	Conversion time			0.75 ms maximum for 6 input channels	
	Conversion error			0.2 % @ 25 °C for 0 - 10 VDC inputs	
	Max input signal		**VDC**	15 for voltage input	
	Max temperature drift		**VDC**	10 inputs	
	Input resistance		**MΩ**	>1 for voltage inputs	
Discrete inputs	Voltage		**VDC**	24	
	Configuration			2 groups of 4 inputs	
	Signal Type			True high	
	Minimum on voltage		**VDC**	> 11	
	Maximum off voltage		**VDC**	< 5	
	Input current	Minimum On	**mA**	6	
		Maximum Off	**mA**	2	
	Input voltage	Range	**VDC**	+ 3...+ 32	
		Surge	**VDC**	45 peak for 10 ms	
	Response time	Off to On	**ms**	1.2,	
		On to Off	**ms**	1.2	
Analog outputs	Resolution			14 bit	
	Output range		**VDC**	0...10	- 10...+ 10
	Conversion time		**ms**	1.20 for all four channels	
	Conversion error			max. + 0.4 % of upper measuring range value @ 25 °C	
	Output load			> 2 kΩ minimum @ 0...10 VDC	
	Fail state			Hold or reset to zero	
Discrete outputs	Voltage		**VDC**	10-30 operating, 50 for 1 ms maximum	
	Type			Solid State Switch	
	Signal type			True high	
	Current capacity		**A**	0.25 per point, 2 per group, 2 per module	
	Leakage current		**mA**	0.4 @ 30 VDC	
	Surge current		**A**	2.5 for 1 ms	
	On state voltage drop		**VDC**	< 0.4 @ 0.25 A current	
	Response time	Off to On	**ms**	1.2	
		On to Off	**ms**	1.05	
	Output protection			The Outputs are protected against overload and short-circuiting	
	Output indicator			1 LED per point	
Potential isolation	Discrete input to output			None	
	Analog input to output			None	
	Analog input and output to operating voltage		**VAC**	500 for 1 minute.	
	Operating voltage and all inputs and outputs from ground		**VAC**	500 for 1 minute	
Power dissipation	Typical		**W**	4.0	
	Maximum		**W**	6.0	
Agency approvals				UL, CE, CSA	

References :
pages 48238/8 and 48238/9

Dimensions :
page 48238/9

Connections :
pages 48238/10 and 48238/11

Modicon Momentum automation platform
Analog I/O bases


170 AAI ●●0 ●0


170 AAO ●2● 00


170 AAM 090 00

Analog input bases

Type of inputs	Number of channels	Ranges	Reference	Weight kg
12 bits + sign	16 single-ended	± 5 V, ± 10 V, 4-20 mA	**170 AAI 140 00**	0.215
15 bits + sign	4, differential	Pt 100, Pt 1000, Ni 100 thermocouples B, E, J, K, N, R, S, T	**170 AAI 520 40**	0.215
	8, differential	± 5 V, ± 10 V, 1-5V ± 20 mA, 4-20 mA	**170 AAI 030 00**	0.215

Analog output bases

Type of outputs	Number of channels	Ranges	Reference	Weight kg
12 bits + sign	4	± 10 V, 0-20 mA	**170 AAO 120 00**	0.215
		± 10 V, 4-20 mA	**170 AAO 921 00**	0.215

Discrete and analog I/O bases

Type		Ranges		Reference	Weight kg
Inputs	**Outputs**	**Inputs**	**Outputs**		
4 differential analog 13 bits + sign	**2 analogs** 12 bits	± 5 V, ± 10 V 1-5 V ± 20 mA 4-20 mA	0-20 mA ± 10 V	**170 AMM 090 00**	0.240
4 discretes	**2 discretes 0.5 A**	24 VDC	24 VDC		
4 differential analog 13 bits + sign	**2 analogs** 12 bits	± 5 V, ± 10 V 1-5 V ± 20 mA 4-20 mA	0-20 mA ± 10 V	**170 AMM 090 01**	0.240
4 discretes	**2 discretes 0.5 A**	12 VDC	12 VDC		
6 analog 14 bits	**4 analogs** 14 bits	0-10 V	0-10 V	**170 ANR 120 90**	0.240
2 x 4 discretes	**1 x 8 discretes 0.25 A**	24 VDC	24 VDC		
6 analog 14 bits	**4 analogs** 14 bits	± 10 V	± 10 V	**170 ANR 120 91**	0.240
2 x 4 discretes	**1 x 8 discretes 0.25 A**	24 VDC	24 VDC		

Characteristics : pages 48238/3 to 48238/7
Dimensions : page 48238/9
Connections : pages 48238/10 and 48238/11

Modicon Momentum automation platform
Analog I/O bases


170 XTS 001 00

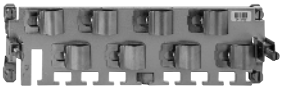

170 XTS 002 00


170 XTS 004 01


170 XTS 005 01


170 XTS 008 01


170 XTS 006 01


CER 001

Accessories

Description	Composition	Type of connection	Reference	Weight kg
Terminal blocks	Set of 3 connectors 1 row	Screw	**170 XTS 001 00**	–
		Spring	**170 XTS 002 00**	–
Bus Bar	3 rows	Screw	**170 XTS 004 01**	–
		Spring	**170 XTS 003 01**	–
	2 rows	Screw	**170 XTS 005 01**	–
		Spring	**170 XTS 008 01**	–
	1 rows	Screw	**170 XTS 006 01**	–
		Spring	**170 XTS 007 01**	–
Cable Grounding Rail	Used to connect the cable shielding		**CER 001**	–
High vibration environment clips	Used to prewire the I/O base units. Requires screw or spring connection terminals		**170 BDM 090 00**	–

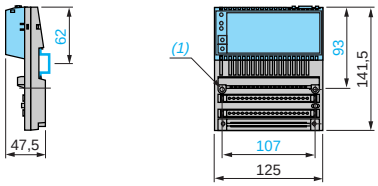
Replacement parts

Description	Use	Reference	Weight kg
Sheets of labels	10 front labels for Momentum modules	**170 XTS 100 00**	–
Set of codingand locating device	For screw or spring connection terminals	**170 XCP 200 00**	–

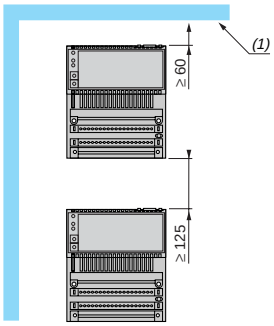
Dimensions, mounting

170 A●●

Rail or panel mounting



(1) 2 holes for M4 screws, for panel mounting.



(1) Equipment or enclosure.

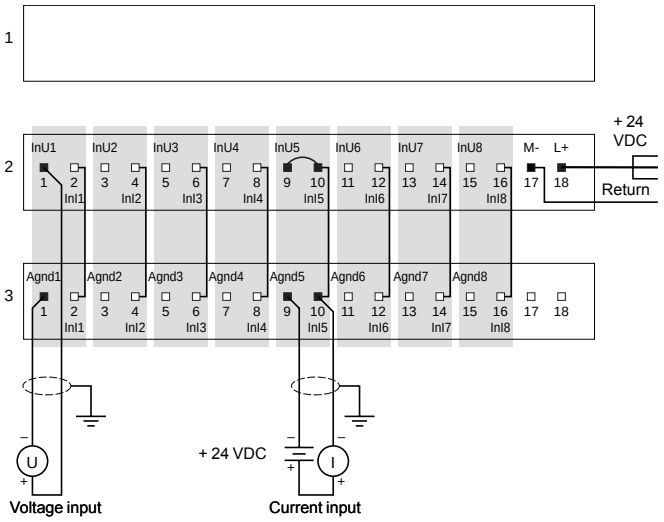
Characteristics : pages 48238/3 to 48238/7
Connections : pages 48238/10 and 48238/11

Modicon Momentum automation platform
Analog I/O bases

Connections of analog input bases and analog output bases

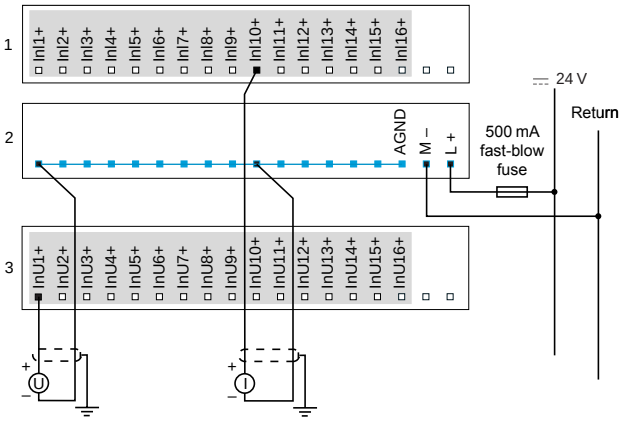
170 AAI 030 00

Example of external wiring of 2-wire sensor



170 AAI 140 00

Example of external wiring of 2-wire sensor

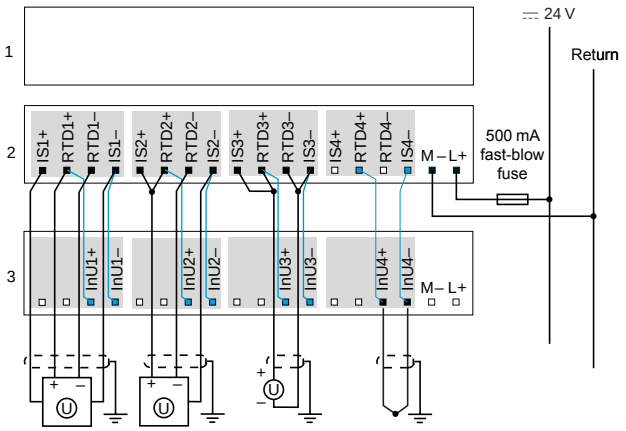


Group of channels

Internal wiring

170 AAI 520 40

Example of external wiring of sensor

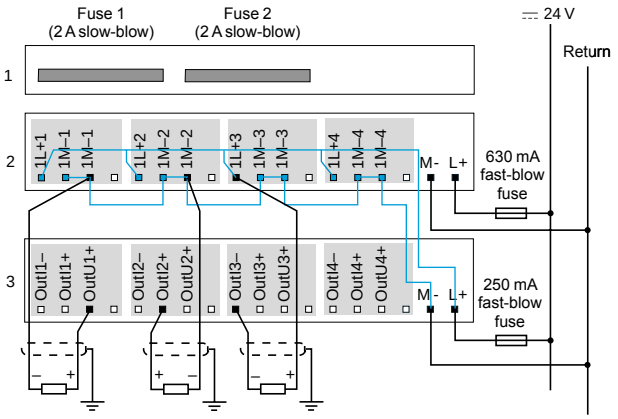


Group of channels

Internal wiring

170 AAO 120/921 00

Example of external wiring of 2-wire actuator



Group of channels

Internal wiring

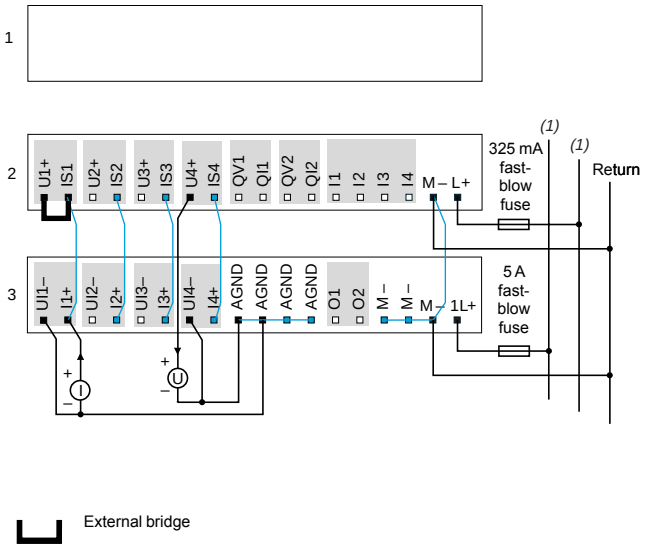
Telemecanique

Modicon Momentum automation platform
Analog I/O bases

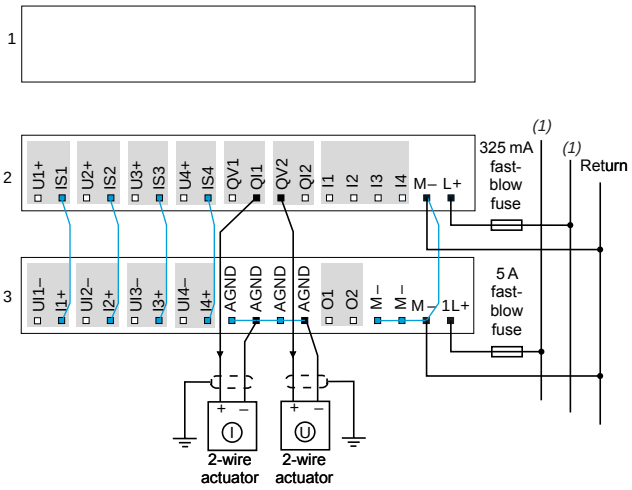
Connections of discrete and analog bases

170 AMM 090 00/AMM 090 01

Example of external wiring of 2-wire sensor



Example of external wiring of 2-wire actuator



External bridge

Group of channels

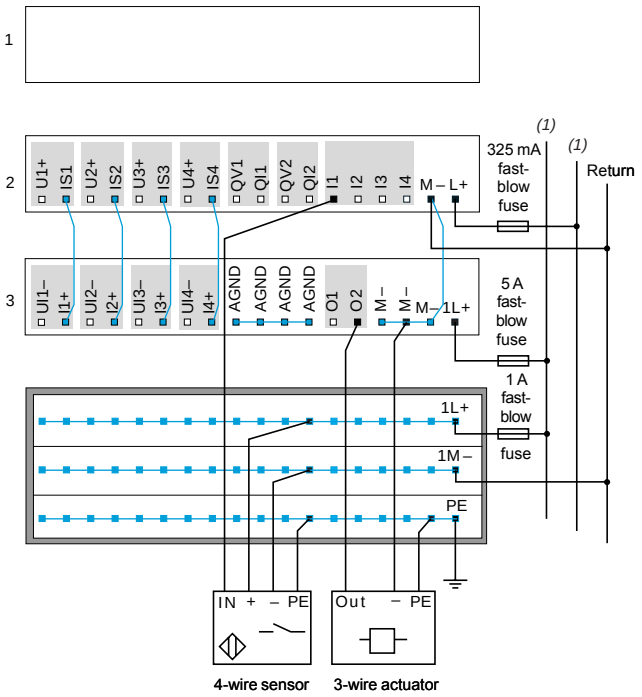
Internal wiring

Group of channels

Internal wiring

170 AMM 090 00/AMM 090 01 (continued)

Example of external wiring of digital sensor/actuator

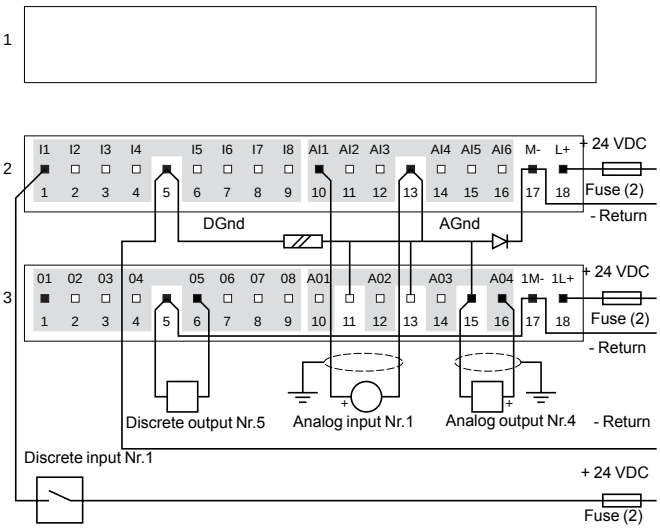


Group of channels

Internal wiring

170 ANR 120 90/91

Example of mixed discrete and analog I/O sensor/actuator field wiring



(1) ⎓ 24 V for 170 AMM 090 00, ⎓ 12 V for 170 AMM 090 01.
(2) Depending on application, max 5 A.