



Main

Range of product	Modicon M238 logic controller
Product or component type	Compact base
Product specific application	-
Discrete I/O number	24
Discrete input number	6 input conforming to EN/IEC 61131-2 type 1 8 fast input conforming to EN/IEC 61131-2 type 1
Discrete input voltage	24 V
Discrete input voltage type	DC
Discrete output number	4 fast output 6 output
Discrete output voltage	24 V DC
Number of I/O expansion module	7
[Us] rated supply voltage	24 V DC
Memory description	Internal RAM 1000 kB
Data backed up	Variables of type retain and retain persistent internal battery 3 days 22 hrs 10 yr Variables of type retain and retain persistent optional battery lithium thionyl chloride (TSXPLP01) 1 year
Mounting support	35 mm symmetrical DIN rail Panel

Complementary

Discrete input logic	Positive logic (sink) fast input Sink or source (positive/negative) input
Number of common point	1 fast output 1 input 2 output 4 fast input
Sensor power supply	19.2...30 V DC
Voltage state1 guaranteed	>= 15 V input/fast input
Current state 1 guaranteed	>= 2 mA input/fast input
Voltage state 0 guaranteed	<= 5 V input/fast input
Current state 0 guaranteed	<= 1.5 mA input/fast input
Discrete input current	10.4 mA input 8 mA fast input
Input impedance	2.3 kOhm input 3 kOhm fast input
Response time	< 1 ms output 0.25 ms fast output 3 ms input 300 ns fast input
Configurable filtering time	0.004 ms fast input 0.4 ms fast input 1 ms fast input 2 ms fast input 4 ms fast input
Anti bounce filtering	0 ms configurable input/fast input 1.5 ms configurable input/fast input 12 ms configurable input/fast input 4 ms configurable input/fast input

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric Industries SAS nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein.

Input frequency	<= 100 kHz fast input (counter mode) <= 100 kHz fast input (normal mode) <= 100 kHz input
Cable length	<= 10 m fast output (PWM or PTO mode) <= 10 m shielded cable fast input (counter mode) <= 30 m fast input (normal mode) <= 30 m input <= 30 m output <= 30 m shielded cable fast output (normal mode)
Isolation between channels and internal logic	500 V DC
Isolation between channels	500 V for group of 2 fast inputs 500 V for output and fast output None input
Discrete output logic	+ lgc (source)/ngtv lgc (sink)
Output voltage limits	19.2...30 V
Discrete output current	<= 100 mA fast output (PTO mode) <= 100 mA fast output (PWM mode) <= 500 mA fast output (normal mode) 20...500 mA output
Output frequency	<= 100 kHz fast output (PTO mode) <= 100 kHz output <= 20 kHz fast output (PWM mode)
Absolute accuracy error	1 % of full scale cyclic ratio 20...80% fast output (PWM mode) 1 % of full scale fast output (PTO mode)
Leakage current	<= 2 mA fast output 0.05 mA output
[Ures] residual voltage	<= 2 V output and fast output
Tungsten load	<= 3 W output and fast output
Short-circuit protection	With output and fast output
Overvoltage protection	With output and fast output
Overload protection	With output and fast output
Input/Output number	<= 136 removable screw terminal block with I/O expansion module <= 192 spring terminal block with I/O expansion module <= 248 HE-10 connector with I/O expansion module
Supply voltage limits	19.2...28.8 V
Inrush current	<= 35 A
Power consumption in W	<= 17.2 W
Insulation resistance	> 10 MOhm at 500 V, between I/O and earth terminals > 10 MOhm at 500 V, between supply and earth terminals
Exact time for 1 Kinstruction	0.3 ms 70 % Boolean + 30 % fixed arithmetic
Execution time per instruction	0.42 µs arithmetic INT word LD and ST 0.439 µs arithmetic INT word +, -, x operations 0.459 µs arithmetic DINT double-word LD and ST 0.506 µs arithmetic DINT double-word +, -, x operations 0.648 µs arithmetic REAL floating LD and ST 0.971 µs Boolean 5111 µs arithmetic REAL floating +, -, x operations 7.25 µs arithmetic REAL floating by operation
Exct time for event task	<= 1.75 ms arithmetic REAL floating >= 0.75 ms arithmetic INT word 0.95 ms arithmetic DINT double-word
System overhead	0.15 ms master task (PWM, frequency meter) 0.15 ms master task (simple counting) 0.2 ms master task (PTO) 0.35 ms master task (advanced counting) 0.9 ms master task (I/O)
Input output assignment	Reading/Writing I/O on base Reading/Writing I/O on CANopen bus Reading/Writing I/O on extension modules
Application structure	1 configurable freewheeling/cyclic master task 2 configurable freewheeling/cyclic/event auxiliary tasks 32 levels of priority between tasks 4 interrupt tasks
Realtime clock	With 10 s/month at 25 °C

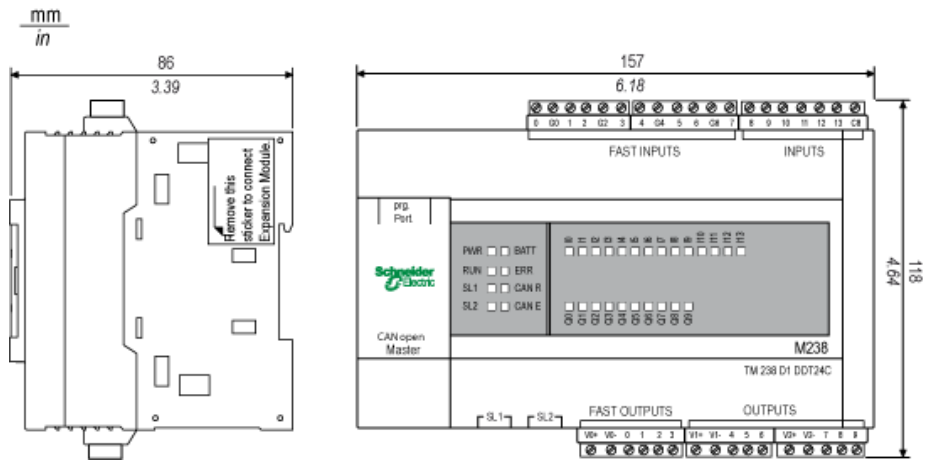
Integrated connection type	1 isolated serial link female RJ45 Modbus master/slave RTU/ASCII or SoMachine-Network RS485 1.2...115.2 kbit/s (115.2 kbit/s by default) 1 isolated serial link female RJ45 Modbus master/slave RTU/ASCII, character mode or SoMachine-Network RS232/RS485 1.2...38.4 kbit/s (19.2 kbit/s by default) CANopen removable screw terminal block CANopen
Supply	Serial link supply 5 V 200 mA
CANopen feature profile	DR 303-1 DS 301 V4.02
Transmission rate	1000 kbit/s 20 m CANopen 125 kbit/s 500 m CANopen 250 kbit/s 250 m CANopen 425 kbit/s 125 m CANopen 50 kbit/s 1000 m CANopen 500 kbit/s 100 m CANopen 800 kbit/s 50 m CANopen
Positioning functions	PWM/PTO 2 100 kHz
Counting input number	8 100 kHz 32 bits
Complementary function	Event processing PID
Marking	CE
Local signalling	1 LED RUN 1 LED Batt 1 LED CAN ERR 1 LED CAN RUN 1 LED module error (ERR) 1 LED per channel I/O state 1 LED PWR 1 LED SL1 1 LED SL2
Electrical connection	1 connector mini B USB 2.0 for a programming terminal 1 removable screw terminal block (10 terminals) for connecting the 4 preactuators (fast output) 1 removable screw terminal block (12 terminals) for connecting the sensors (fast inputs) 1 removable screw terminal block (5 terminals) for connection to the CANopen bus 1 removable screw terminal block (6 terminals) for connecting the 6 preactuators (output) 1 removable screw terminal block (7 terminals) for connecting the sensors (inputs) 1 removable screw terminal block for connecting the 24 V DC power supply
Product weight	0.595 kg

Environment

Immunity to microbreaks	10 ms
Dielectric strength	500 V for 1 minute, between I/O and earth terminals 500 V for 1 minute, between supply and earth terminals
Class	Class M20 <= 16 CANopen
Product certifications	CSA CTick GOST UL
Ambient air temperature for operation	-10...55 °C
Ambient air temperature for storage	-40...70 °C
Relative humidity	95 % without condensation
IP degree of protection	IP20
Pollution degree	<= 2
Operating altitude	0...2000 m
Storage altitude	0...3000 m
Vibration resistance	1 gn 3.5 mm (f= 5...150 Hz)
Shock resistance	15 gn for 11 ms

Modicon M238 Logic Controller

Dimensions



mounting positions Mounting Positions

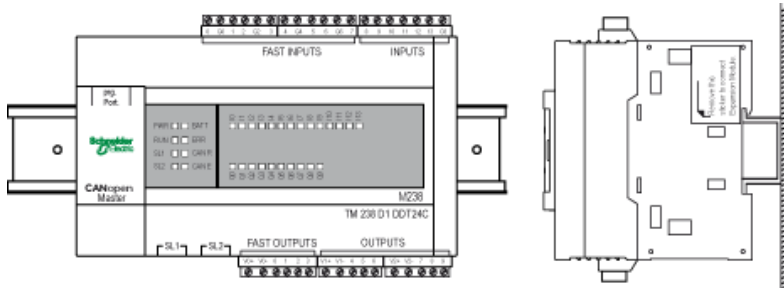
Introduction

This section describes the correct mounting positions for the Modicon M238 Logic Controller.

Keep adequate spacing for proper ventilation and to maintain an ambient temperature between -10°C (14°F) and 55°C (131°F).

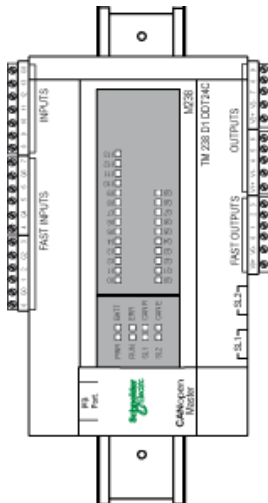
Correct Mounting Position

Whenever possible, the Modicon M238 Logic Controller should be mounted horizontally on a vertical plane as shown in the figure below:



Acceptable Mounting Positions

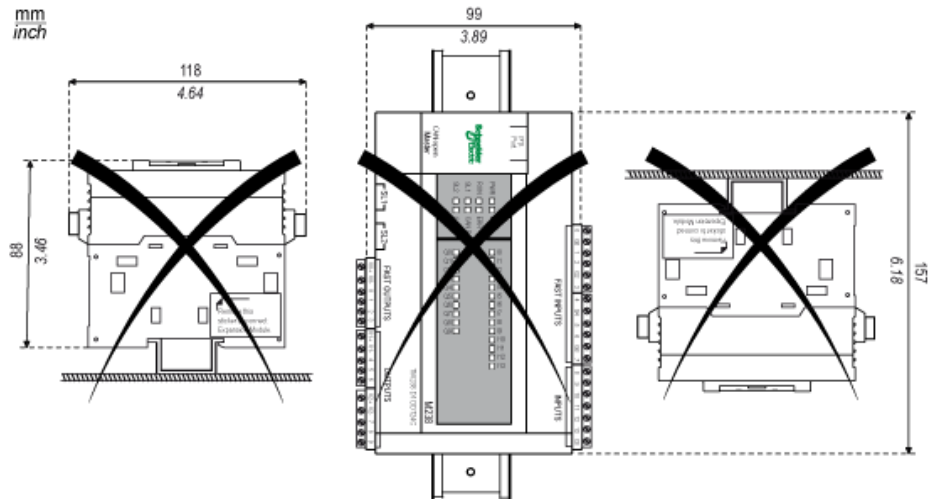
The Modicon M238 Logic Controller can also be mounted sideways on a vertical plane as shown below.



Expansion modules must be on top.

Incorrect Mounting Position

The Modicon M238 Logic Controller should only be positioned as shown in Correct Mounting Position figure. The figures below show the incorrect mounting positions.



clearance, minimum cooling clearance, minimum Minimum Clearances

Minimum Clearances



UNINTENDED EQUIPMENT OPERATION

- Place devices dissipating the most heat at the top of the cabinet and ensure adequate ventilation.
- Avoid placing this equipment next to or above devices that might cause overheating.
- Install the equipment in a location providing the minimum clearances from all adjacent structures and equipment as directed in this document.
- Install all equipment according to the drawings specified in the related documentation.

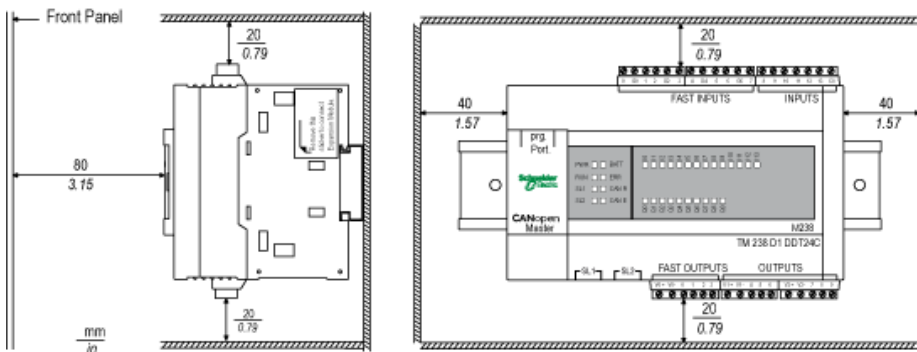
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Keep adequate spacing for proper ventilation and to maintain an ambient temperature between -10°C (14°F) and 55°C (131°F).

The Modicon M238 Logic Controller has been designed as an IP20 product and must be installed in an enclosure. Clearances must be respected when installing the product.

There are 3 types of clearances between:

- The Modicon M238 Logic Controller and all sides of the cabinet (including the panel door). This type of clearance allows proper circulation of air around the controller, and therefore keeps the sides of cabinet at the ambient temperature.
- The Modicon M238 Logic Controller terminal blocks and the wiring ducts. This distance avoids electromagnetic impulse between the controller and the wiring ducts.
- The Modicon M238 Logic Controller and other heat generating devices installed in the same cabinet.



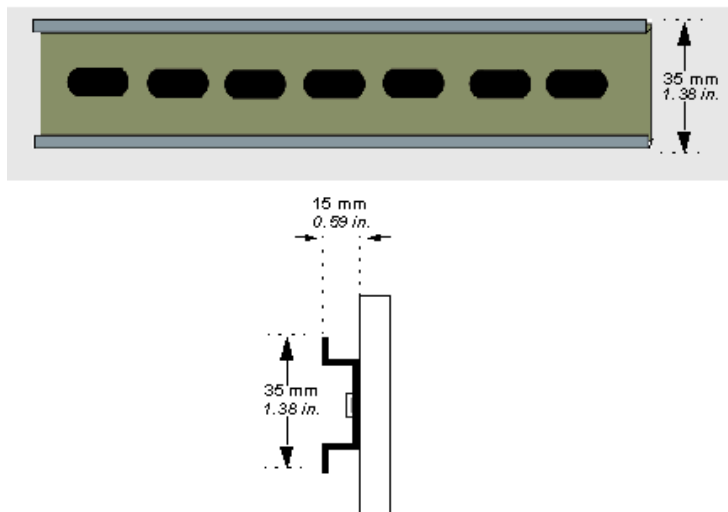
DIN rail The DIN Rail

Introduction

You can mount the M238 and its expansions on a DIN rail. A DIN rail can be attached to a smooth mounting surface or suspended from a EIA rack or in a NEMA cabinet.

Dimensions of the DIN Rail

The DIN rail measures 35 mm (1.38 in.) high and 15 mm (0.59 in.) deep, as shown below.



Recommended Equipment

Rail depth	Catalogue part number
15 mm (0.59 in.)	AM1DE200

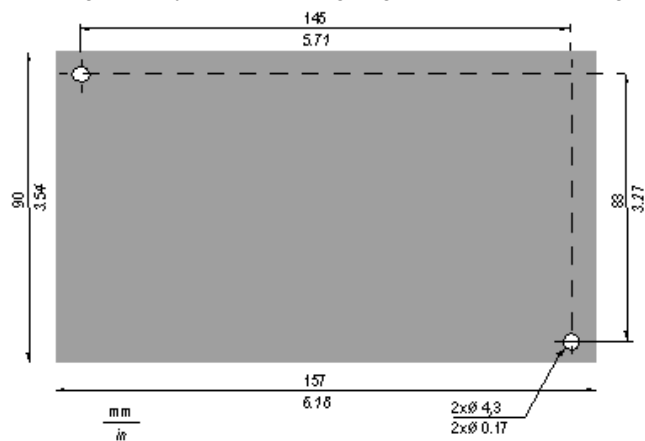
installing on a metallic panel mounting procedure on a metallic panel Mounting on a Metallic Panel

Introduction

This section provides information on how to mount the Modicon M238 Logic Controller on a metallic panel.

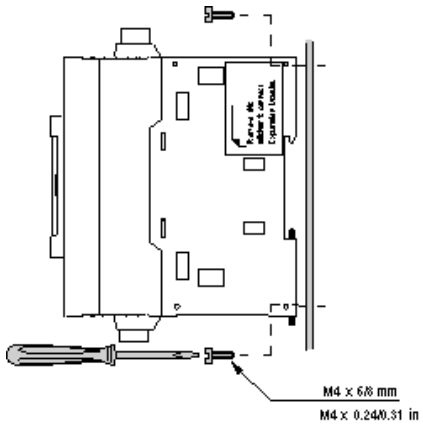
Mounting Holes

mounting holes layout The following diagram shows the mounting holes for the Modicon M238 Logic Controller:



Mounting the Modicon M238 Logic Controller on a Metallic Panel

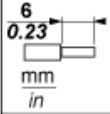












CAUTION
<p>INOPERABLE EQUIPMENT</p> <p>Do not tighten screw terminals beyond the specified maximum torque (Nm / lb-in.).</p> <p>Failure to follow these instructions can result in equipment damage.</p>

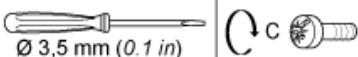


safety guidelines wiring wiring rules Wiring Requirements

Rules for Removable Screw Terminal Block

The following table shows the cable types and wire sizes for a removable screw terminal block (I/Os and Power Supply):

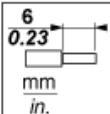








						
						
mm ²	0,2...1,5	0,25...1,5	0,2...1	0,2...1,5	0,25...1	0,5...1,5
AWG	24...14	24...14	26...16	24...14	24...16	20...14

	N.m	0,6
	lb-in	5,3

Use copper conductors only.

Rules for Removable Spring Terminal Block

The following table shows the cable types and wire sizes for a removable spring terminal block (I/Os and Power Supply):

				
				
mm ²	0,2...1,5	0,25...1,5	0,25...1	0,5...1,5
AWG	24...14	24...14	24...16	20...14

Use copper conductors only.

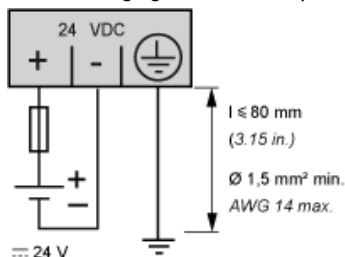
connect a DC power supply DC Power Supply Wiring

Power Supply Wiring Diagram, 24 Vdc

The power supply of this equipment does not have built-in reverse polarity protection. Incorrectly connecting polarity can permanently damage the output circuits and the internal backup battery or otherwise result in unintended operation of the equipment.

CAUTION
<p>INOPERABLE EQUIPMENT</p> <p>Verify the wiring conforms to the polarity markings on the connections of this equipment and as described in the related documentation. Failure to follow these instructions can result in equipment damage.</p>

The following figure shows the power supply wiring diagram:

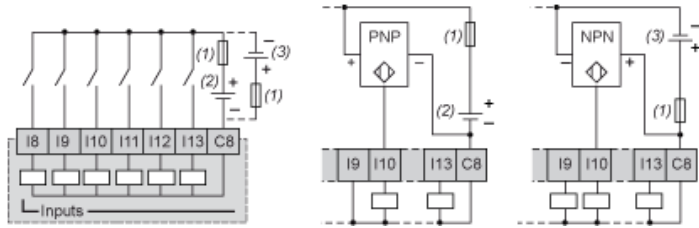


Use an external fast-blow fuse 2 A type F (UL recognized and CSA approved).

connect regular input Regular Input Wiring

Regular Input Wiring Diagram

inputs wiring diagram regular regular inputs wiring diagram wiring diagrams regular inputs The following figure shows the regular input wiring diagram:

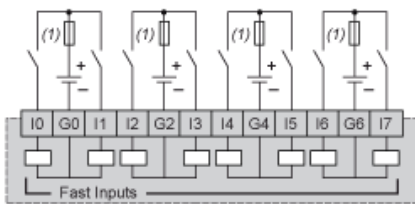


- (1) Fast-blow fuse 0.5 A
- (2) Sink input (positive logic)
- (3) Source input (negative logic)

connect fast input Fast Input Wiring

Fast Input Wiring Diagram

inputs wiring diagram fast fast inputs wiring diagram wiring diagrams fast inputs The following figure shows the fast inputs wiring diagram:



- (1) Fast-blow fuse 0.5 A

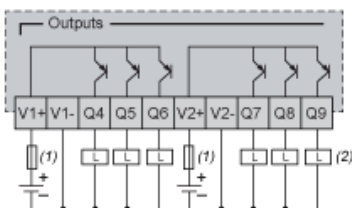
connect regular output Regular Output Wiring for DC Controllers

Regular Output Wiring Diagram

The outputs of this equipment do not have built-in reverse polarity protection. Incorrectly connecting polarity can permanently damage the output circuits or otherwise result in unintended operation of the equipment.

CAUTION
DAMAGED OUTPUT CIRCUITS
Verify the wiring conforms to the polarity markings on the output connections of this equipment and as described in the related documentation.
Failure to follow these instructions can result in equipment damage.

output wiring diagram regular regular output wiring diagram wiring diagrams regular output The following figure shows the regular outputs wiring diagram:



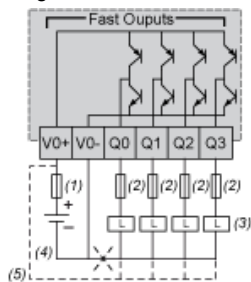
- (1) Fast-blow fuse 2 A
- (2) Protection for inductive load

In the case of a short-circuit or current overload, the common group of outputs automatically enter into thermal protection mode (all outputs set to 0), and are then periodically rearmed (each second) to test the connection state. However, you must be aware of the effect of this rearming on the machine or process being controlled.

connect fast output Fast Output Wiring for DC Controller

Fast Output Wiring Diagram

fast output wiring diagram output wiring diagram fast wiring diagrams fast output The following figure shows the fast outputs source wiring diagram:

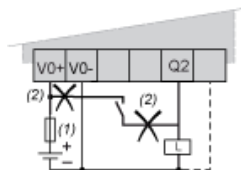


- (1) 2 A fast-blow fuse
- (2) Fast-blow fuse:
0.5 A in standard use
0.1 A in PTO use
- (3) Protection for inductive load
- (4) Positive logic output wiring
- (5) Negative logic output wiring

The outputs of this equipment do not have built-in reverse polarity protection. Incorrectly connecting polarity can permanently damage the output circuits or otherwise result in unintended operation of the equipment.

CAUTION
<p>DAMAGE TO FAST OUTPUTS</p> <ul style="list-style-type: none"> • Ensure adequate protection against short-circuits on the power supply to the fast outputs. • Do not connect positive voltage to any of the DC fast outputs terminals (Q0, Q1, Q2, Q3). • Comply with the wiring diagrams in this documentation. <p>Failure to follow these instructions can result in equipment damage.</p>

Example of an incorrect wiring on Q2:



- (1) 2 A fast-blow fuse
- (2) Incorrect wiring

In the case of a short-circuit or current overload, the common group of outputs automatically enter into thermal protection mode (all outputs set to 0), and are then periodically rearmed (each second) to test the connection state. However, you must be aware of the effect of this rearming on the machine or process being controlled.

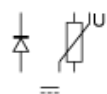
WARNING
<p>UNINTENDED MACHINE STARTUP</p> <p>Inhibit the automatic rearming of outputs if this feature is an undesirable behavior for your machine or process.</p> <p>Failure to follow these instructions can result in death, serious injury, or equipment damage.</p>

The automatic rearming feature can be inhibited. For this controller, use the GetShortcutStatus function to force the group of fast outputs to remain at 0 (OFF).

Depending on the load, a protection circuit may be needed for the outputs on the controllers and certain modules. Inductive loads using DC voltages may create voltage reflections resulting in overshoot that will damage or shorten the life of output devices.

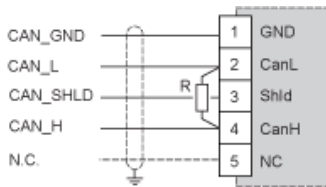
CAUTION
<p>OUTPUT CIRCUIT DAMAGE DUE TO INDUCTIVE LOADS</p> <p>Use an appropriate external protective circuit or device to reduce the risk of inductive direct current load damage.</p> <p>Failure to follow these instructions can result in injury or equipment damage.</p>

Choose a protection circuit from the following diagrams according to the power supply used. Connect the protection circuit to the outside of the controller or relay output module.



For more information about protecting outputs from inductive load damage see the user guide.

CANopen Wiring Diagram



R Line termination resistor (120 Ω)

Pin	Signal	Description	Marking	Color of Cable
1	CAN_GND	CAN Ground	GND	black
2	CAN_L	CAN_L bus line (dominant low)	CanL	blue
3	CAN_SHLD	Optional CAN shield	Shld	-
4	CAN_H	CAN_H bus line (dominant high)	CanH	white
5	Not used	Reserved	N.C.	red

CAUTION

INOPERABLE EQUIPMENT

Do not tighten screw terminals beyond the specified maximum torque (Nm / lb-in.).
 Failure to follow these instructions can result in equipment damage.

Cable Length

Transmission speed is limited by the bus length and the type of cable used.

Maximum transmission baud rate	Bus length
1000 Kbps	20 m (65 ft)
800 Kbps	40 m (131 ft)
500 Kbps	100 m (328 ft)
250 Kbps	250 m (820 ft)
125 Kbps	500 m (1,640 ft)
50 Kbps	1000 m (3280 ft)
20 Kbps	2500 m (16,400 ft)

CANopen Wiring

The CANopen network cable is a shielded twisted double-pair cable that complies with the CANopen standard CiA DR-303-1.

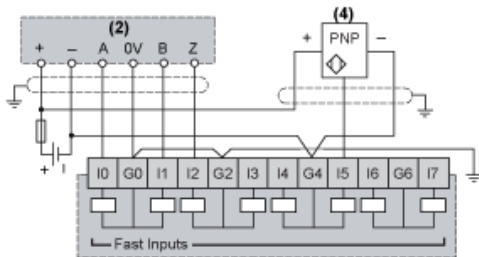
The CANopen network cable must be properly grounded to the Modicon M238 Logic Controller Shield Ground (Shld), or CANopen communications may be interrupted or operate improperly.

Wiring Diagram Examples for 1 Encoder on Fast Inputs

Introduction

This section provides wiring diagram examples for 1 encoder on fast inputs.

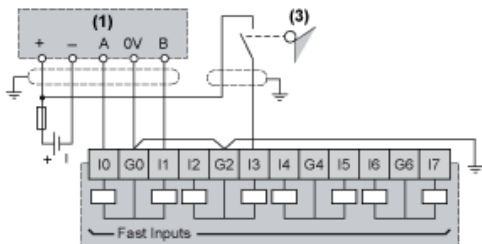
Incremental Encoder with Phase-Shifted Signals with TDC and 3-Wire PNP Detector



- (2) Dual-phase encoder with index
- (4) PNP sensor

- Use a specific auxiliary power supply for the encoders and sensors connected to the fast inputs and used in fast counter mode.
- Use cordsets with mandatory shielding to connect to the metal support for mounting the Modicon M238 Logic Controller. 10 m (32.8 ft) max.
- Use a 0.5 A fast-blow fuse.

Incremental Encoder with Phase-Shifted Signals without TDC and Electromechanical Sensor



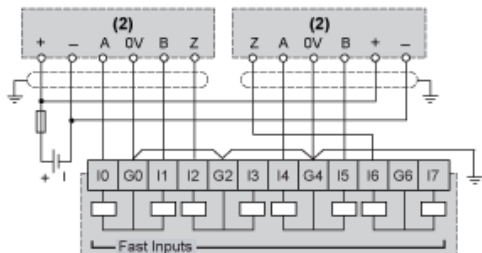
- (1) Dual-phase encoder without index
 (3) Limit switch
- Use a specific auxiliary power supply for the encoders and sensors connected to the fast inputs and used in fast counter mode.
 - Use cordsets with mandatory shielding to connect to the metal support for mounting the Modicon M238 Logic Controller. 10 m (32.8 ft) max.
 - Use a 0.5 A fast-blow fuse.

Wiring Diagram Examples for 2 Encoders on Fast Inputs

Introduction

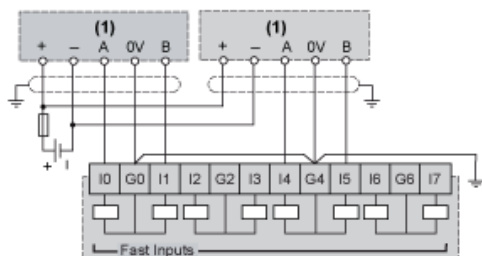
This section provides wiring diagram examples for 2 encoders on fast inputs. The hardware limitation is 2 incremental encoders with phase-shifted signals.

Incremental Encoders with Phase-Shifted Signals with TDC



- (2) Dual-phase encoder with index
- Use a specific auxiliary power supply for the encoders and sensors connected to the fast inputs and used in the fast counter mode.
 - Use cordsets with mandatory shielding to connect to the metal support for mounting the Modicon M238 Logic Controller. 10 m (32.8 ft) max.
 - Use a 0.5 A fast-blow fuse.

Incremental Encoders with Phase-Shifted Signals without TDC



- (1) Dual-phase encoder without index
- Use a specific auxiliary power supply for the encoders and sensors connected to the fast inputs and used in the fast counter mode.
 - Use cordsets with mandatory shielding to connect to the metal support for mounting the Modicon M238 Logic Controller. 10 m (32.8 ft) max.
 - Use a 0.5 A fast-blow fuse.