

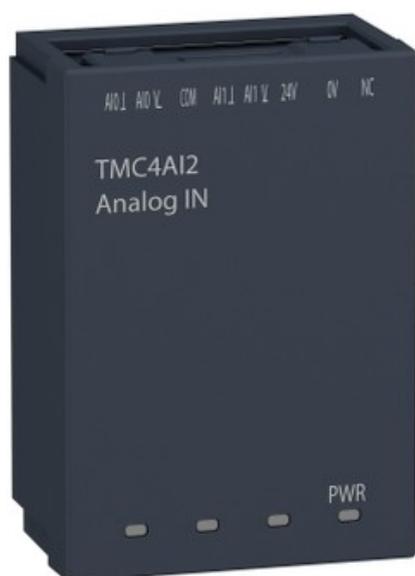
Modicon TMC4

Cartridges

Hardware Guide

Original instructions

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This document is not intended as a substitute for a detailed study or operational and site-specific development or schematic plan. It is not to be used for determining suitability or reliability of the products/solutions for specific user applications. It is the duty of any such user to perform or have any professional expert of its choice (integrator, specifier or the like) perform the appropriate and comprehensive risk analysis, evaluation and testing of the products/solutions with respect to the relevant specific application or use thereof.

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Safety Information

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Qualification of Personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product.

The qualified person must be able to detect possible hazards that may arise from parameterization, modifying parameter values and generally from mechanical, electrical, or electronic equipment. The qualified person must be familiar with the

standards, provisions, and regulations for the prevention of industrial accidents, which they must observe when designing and implementing the system.

Intended Use

The products described or affected by this document, together with software, accessories, and options, are cartridges, intended for industrial use according to the instructions, directions, examples, and safety information contained in the present document and other supporting documentation.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements, and the technical data.

Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety-related measures must be implemented.

Since the product is used as a component in an overall machine or process, you must ensure the safety of persons by means of the design of this overall system.

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts.

Any use other than the use explicitly permitted is prohibited and can result in unanticipated hazards.

About the Book

Document Scope

This guide describes the hardware implementation of TMC4 cartridges. It provides the parts description, characteristics, wiring diagrams, and installation details for TMC4 cartridges.

Validity Note

For more information on the validity of the present document, see the online help for the product.

For product compliance and environmental information (RoHS, REACH, PEP, EOL, etc.), go to www.se.com/ww/en/work/support/green-premium/.

The characteristics of the products described in this document are intended to match the characteristics that are available on www.se.com. As part of our corporate strategy for constant improvement, we may revise the content over time to enhance clarity and accuracy. If you see a difference between the characteristics in this document and the characteristics on www.se.com, consider www.se.com to contain the latest information.

Available Languages of this Document

This document is available in these languages:

- English (EIO0000003113)
- French (EIO0000003114)
- German (EIO0000003115)
- Spanish (EIO0000003116)
- Italian (EIO0000003117)
- Chinese (EIO0000003118)

Related Documents

Title of Documentation	Reference Number
Modicon TMC4 Cartridges - Programming Guide	EIO0000003107 (ENG)
	EIO0000003108 (FRE)
	EIO0000003109 (GER)
	EIO0000003110 (SPA)
	EIO0000003111 (ITA)
	EIO0000003112 (CHS)
Modicon M241 Logic Controller - Hardware Guide	EIO0000003083 (ENG)
	EIO0000003084 (FRE)
	EIO0000003085 (GER)
	EIO0000003086 (SPA)
	EIO0000003087 (ITA)
	EIO0000003088 (CHS)
Modicon TMC4 Cartridges - Instruction sheet	EAV47885

To find documents online, visit the Schneider Electric download center (www.se.com/ww/en/download/).

Product Related Information

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

DANGER

POTENTIAL FOR EXPLOSION

- Only use this equipment in non-hazardous locations, or in locations that comply with Class I, Division 2, Groups A, B, C and D.
- Do not substitute components which would impair compliance to Class I, Division 2.
- Do not connect or disconnect equipment unless power has been removed or the location is known to be non-hazardous.
- Do not use the USB port(s), if so equipped, unless the location is known to be non-hazardous.

Failure to follow these instructions will result in death or serious injury.

▲ WARNING
<p>LOSS OF CONTROL</p> <ul style="list-style-type: none"> • Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation. • Provide a fallback state for undesired control events or sequences. • Provide separate or redundant control paths wherever required. • Supply appropriate parameters, particularly for limits. • Review the implications of transmission delays and take actions to mitigate them. • Review the implications of communication link interruptions and take actions to mitigate them. • Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations. • Apply local accident prevention and safety regulations and guidelines.¹ • Test each implementation of a system for proper operation before placing it into service. <p>Failure to follow these instructions can result in death, serious injury, or equipment damage.</p>

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

▲ WARNING
<p>UNINTENDED EQUIPMENT OPERATION</p> <ul style="list-style-type: none"> • Only use software approved by Schneider Electric for use with this equipment. • Update your application program every time you change the physical hardware configuration. <p>Failure to follow these instructions can result in death, serious injury, or equipment damage.</p>

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in the information contained herein, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives and general automation, this may include, but is not limited to, terms such as *safety, safety function, safe state, fault, fault reset, malfunction, failure, error, error message, dangerous, etc.*

Among others, these standards include:

Standard	Description
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2023	Safety of machinery: Safety related parts of control systems. General principles for design.

Standard	Description
EN 61496-1:2020	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
IEC 62061:2021	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2021	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

In addition, terms used in the present document may tangentially be used as they are derived from other standards such as:

Standard	Description
IEC 60034 series	Rotating electrical machines
IEC 61800 series	Adjustable speed electrical power drive systems
IEC 61158 series	Digital data communications for measurement and control – Fieldbus for use in industrial control systems

Finally, the term *zone of operation* may be used in conjunction with the description of specific hazards, and is defined as it is for a *hazard zone* or *danger zone* in the *Machinery Directive (2006/42/EC)* and *ISO 12100:2010*.

NOTE: The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.

Information on Non-Inclusive or Insensitive Terminology

As a responsible, inclusive company, Schneider Electric is constantly updating its communications and products that contain non-inclusive or insensitive terminology. However, despite these efforts, our content may still contain terms that are deemed inappropriate by some customers.

TMC4 Cartridges General Overview

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TMC4 Cartridges Description

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General Description..... 12

General Description

Introduction

The cartridges are designed to be connected to the Modicon M241 Logic Controller range.

Cartridges Features

The following table describes the TMC4 cartridges features:

Reference	Description
TMC4AI2, page 30	TMC4 cartridge with 2 analog voltage or current inputs (0...10 V, 0...20 mA, 4...20 mA), 12 bits
TMC4TI2, page 35	TMC4 cartridge with 2 analog temperature inputs (thermocouple, RTD), 14 bits
TMC4AQ2, page 42	TMC4 cartridge with 2 analog voltage or current outputs (0...10 V, 4...20 mA), 16 bits
TMC4HOIS01, page 48	TMC4 application cartridge with 2 analog voltage or current inputs for hoisting load cells
TMC4PACK01, page 53	TMC4 application cartridge with 2 analog voltage or current inputs for packaging

Logic Controller Compatibility

The following table describes the number of TMC4 cartridges that can be installed in a Modicon M241 Logic Controller:

Reference	Cartridge Slots
TM241C24R	1
TM241CE24R	1
TM241CEC24R	1
TM241C24T	1
TM241CE24T	1
TM241CEC24T	1
TM241C24U	1
TM241CE24U	1
TM241CEC24U	1
TM241C40R	2
TM241CE40R	2
TM241C40T	2
TM241CE40T	2
TM241C40U	2
TM241CE40U	2

NOTE: For more information on cartridge compatibility with specific controllers, refer to your controller-specific hardware guide.

NOTICE

ELECTROSTATIC DISCHARGE

- Verify that empty cartridge slots have their covers in place before applying power to the controller.
- Do not touch the contacts of the cartridge.
- Only handle the cartridge on the housing.
- Take the necessary protective measures against electrostatic discharges.

Failure to follow these instructions can result in equipment damage.

TMC4 Cartridges Installation

What's in This Chapter

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TMC4 Cartridges General Rules for Implementing

Environmental Characteristics

Enclosure Requirements

M241 Logic Controller system components are designed as Zone B, Class A industrial equipment according to IEC/CISPR Publication 11. If they are used in environments other than those described in the standard, or in environments that do not meet the specifications in this manual, the ability to meet electromagnetic compatibility requirements in the presence of conducted and/or radiated interference may be reduced.

All M241 Logic Controller system components meet European Community (CE) requirements for open equipment as defined by IEC/EN 61131-2. You must install them in an enclosure designed for the specific environmental conditions and to minimize the possibility of unintended contact with hazardous voltages. Use metal enclosures to improve the electromagnetic immunity of your M241 Logic Controller system. Use enclosures with a keyed locking mechanism to minimize unauthorized access.

Environmental Characteristics

All the M241 Logic Controller module components are electrically isolated between the internal electronic circuit and the input/output channels within the limits set forth and described by these environmental characteristics. For more information on electrical isolation, see the technical specifications found later in the present document. This equipment meets CE requirements as indicated in the table below. This equipment is intended for use in a Pollution Degree 2 industrial environment.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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

The following table shows the general environmental characteristics:

Characteristic	Minimum Specification	Tested Range	
Standard compliance	IEC/EN 61131-2 IEC/EN 61010-2-201	–	
Ambient operating temperature	–	Horizontal installation	–10...55 °C (14...131 °F)
	–	Vertical installation	–10...50 °C (14...122 °F)
Storage temperature	–	–25...70 °C (- 13...158 °F)	
Relative humidity	–	Transport and storage	10...95 % (non-condensing)
		Operation	10...95 % (non-condensing)
Degree of pollution	IEC/EN 60664-1	2	
Degree of protection	IEC/EN 61131-2	IP20 with protective covers in place	
Corrosion immunity	–	Atmosphere free from corrosive gases	
Operating altitude	–	0...2000 m (0...6560 ft)	
Storage altitude	–	0...3000 m (0...9843 ft)	
Vibration resistance	IEC/EN 61131-2	Panel mounting or mounted on a top hat section rail (DIN rail)	3.5 mm (0.13 in) fixed amplitude from 5...8.4 Hz 9.8 m/s ² (32.15 ft/s ²) (1 g _n) fixed acceleration from 8.4...150 Hz 10 mm (0.39 in) fixed amplitude from 5...8.7 Hz 29.4 m/s ² (96.45 ft/s ²) (3 g _n) fixed acceleration from 8.7...150 Hz
Mechanical shock resistance	–	147 m/s ² or 482.28 ft/s ² (15 g _n) for a duration of 11 ms	
<p>NOTE: The tested ranges may indicate values beyond that of the IEC Standard. However, our internal standards define what is necessary for industrial environments. In all cases, we uphold the minimum specification if indicated.</p>			

Electromagnetic Susceptibility

The M241 Logic Controller system meets electromagnetic susceptibility specifications as indicated in the following table:

Characteristic	Minimum Specification	Tested Range		
Electrostatic discharge	IEC/EN 61000-4-2	8 kV (air discharge)		
	IEC/EN 61131-2	4 kV (contact discharge)		
Radiated electromagnetic field	IEC/EN 61000-4-3	10 V/m (80...1000 MHz)		
	IEC/EN 61131-2	3 V/m (1.4...2 GHz)		
		1 V/m (2...3 GHz)		
Fast transients burst	IEC/EN 61000-4-4 IEC/EN 61131-2	24 Vdc main power lines	2 kV (CM ¹ and DM ²)	
		24 Vdc I/Os	2 kV (clamp)	
		Relay output	1 kV (clamp)	
		Digital I/Os	1 kV (clamp)	
		Communication line	1 kV (clamp)	
Surge immunity	IEC/EN 61000-4-5 IEC/EN 61131-2	–	CM ¹	DM ²
		DC Power lines	0.5 kV	0.5 kV
		Relay Outputs	–	–
		24 Vdc I/Os	–	–
		Shielded cable (between shield and ground)	1 kV	–
Induced electromagnetic field	IEC/EN 61000-4-6 IEC/EN 61131-2	10 Vrms (0.15...80 MHz)		
Conducted emission	IEC 61000-6-4 IEC/EN 61131-2	• 10...150 kHz: 120...69 dB μ V/m QP		
		• 150...1500 kHz: 79...63 dB μ V/m QP		
		• 1.5...30 MHz: 63 dB μ V/m QP		
Radiated emission	IEC 61000-6-4	30...230 MHz: 40 dB μ V/m QP		
	IEC/EN 61131-2	230...1000 MHz: 47 dB μ V/m QP		
1 Common Mode 2 Differential Mode NOTE: The tested ranges may indicate values beyond that of the IEC Standard. However, our internal standards define what is necessary for industrial environments. In all cases, we uphold the minimum specification if indicated.				

Certifications and Standards

Introduction

For information on certifications and conformance to standards, go to www.se.com.

For product compliance and environmental information (RoHS, REACH, PEP, EOLi, etc.), go to www.se.com/green-premium.

TMC4 Cartridges Installation

Installation and Maintenance Requirements

Before Starting

Read and understand this chapter before beginning the installation of your system.

The use and application of the information contained herein require expertise in the design and programming of automated control systems. Only you, the user, machine builder or integrator, can be aware of all the conditions and factors present during installation and setup, operation, and maintenance of the machine or process, and can therefore determine the automation and associated equipment and the related safeties and interlocks which can be effectively and properly used. When selecting automation and control equipment, and any other related equipment or software, for a particular application, you must also consider any applicable local, regional or national standards and/or regulations.

Pay particular attention in conforming to any safety information, different electrical requirements, and normative standards that would apply to your machine or process in the use of this equipment.

Disconnecting Power

All options and modules should be assembled and installed before installing the control system on a mounting rail, onto a mounting plate or in a panel. Remove the control system from its mounting rail, mounting plate or panel before disassembling the equipment.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

Programming Considerations

WARNING

UNINTENDED EQUIPMENT OPERATION

- Only use software approved by Schneider Electric for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

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

Operating Environment

In addition to the Environmental Characteristics, page 14, refer to Product Related Information, page 8 at the beginning of the present document for important information regarding installation in hazardous locations for this specific equipment.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Install and operate this equipment according to the conditions described in the Environmental Characteristics.

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

Installation Considerations

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use appropriate safety interlocks where personnel and/or equipment hazards exist.
- Install and operate this equipment in an enclosure appropriately rated for its intended environment and secured by a keyed or tooled locking mechanism.
- Use the sensor and actuator power supplies only for supplying power to the sensors or actuators connected to the module.
- Power line and output circuits must be wired and fused in compliance with local and national regulatory requirements for the rated current and voltage of the particular equipment.
- Do not use this equipment in safety-critical machine functions unless the equipment is otherwise designated as functional safety equipment and conforming to applicable regulations and standards.
- Do not disassemble, repair, or modify this equipment.
- Do not connect any wiring to reserved, unused connections, or to connections designated as No Connection (N.C.).

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

NOTE: JDYX2 or JDYX8 fuse types are cULus-recognized.

TMC4 Cartridges Installation

Installation Considerations

The TMC4 cartridge is designed to operate within the same temperature range as the controllers, including the controller derating for extended temperature operation, and temperature restrictions associated with the mounting positions. Refer to the controller mounting position and clearance (see Modicon M241 Logic Controller, Hardware Guide) for more information.

Installation

DANGER

ELECTRIC SHOCK OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Use protective gloves when installing or removing the cartridges.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

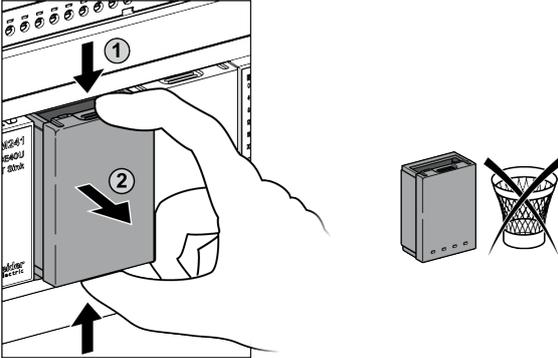
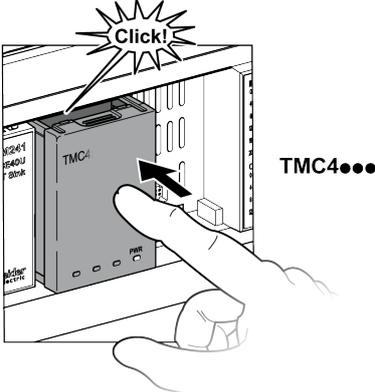
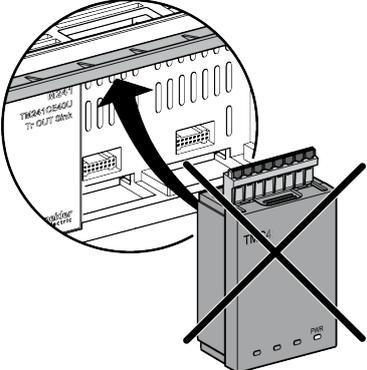
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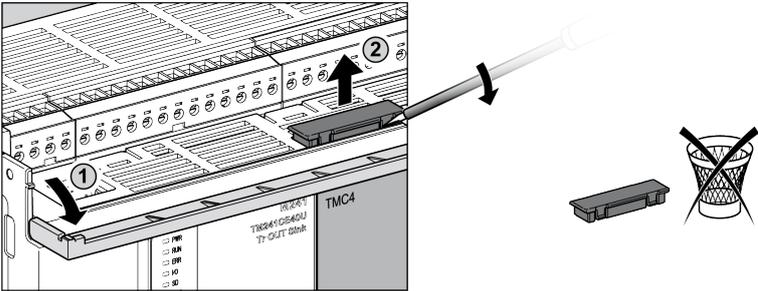
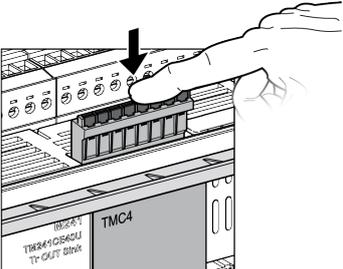
ELECTROSTATIC DISCHARGE

- Verify that empty cartridge slots have their covers in place before applying power to the controller.
- Do not touch the contacts of the cartridge.
- Only handle the cartridge on the housing.
- Take the necessary protective measures against electrostatic discharges.

Failure to follow these instructions can result in equipment damage.

The following table describes the different steps to install a TMC4 cartridge on the controller:

Step	Action
1	Disconnect all power from all equipment prior to removing any covers or installing a cartridge.
2	Remove the cartridge from the packaging.
3	<p>Press the locking clips on the top and bottom of the cover with your fingers and pull up the cartridge slot cover gently.</p> <p>Remove by hand the cartridge slot cover from the controller.</p> <p>NOTE: Keep the cover to reuse it for the de-installation.</p> 
4	<p>Place the cartridge in the slot on the controller.</p> <p>Push the cartridge into the slot until it clicks.</p>  <p>NOTE: Do not insert the cartridge with its removable spring terminal block connected.</p> 

Step	Action
5	<p>Rotate the controller top connections cover to have more clearance to insert the cartridge removable spring terminal block.</p> <p>Press the locking clip on the side of the terminal block cover with an insulated screwdriver and pull up the cover gently. Remove the slot cover from the controller.</p> <p>NOTE: Keep the cover to reuse it for the de-installation.</p> 
6	<p>Insert the removable spring terminal block in the cartridge until it clicks.</p> 

De-installation

⚠️⚠️ DANGER

ELECTRIC SHOCK OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Use protective gloves when installing or removing the cartridges.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

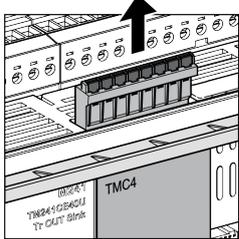
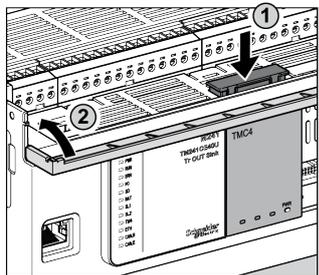
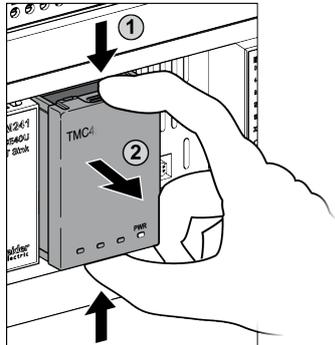
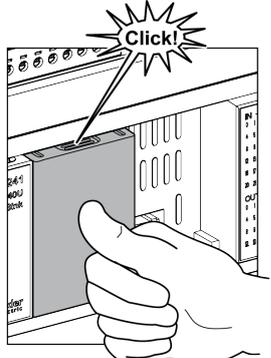
NOTICE

ELECTROSTATIC DISCHARGE

- Verify that empty cartridge slots have their covers in place before applying power to the controller.
- Do not touch the contacts of the cartridge.
- Only handle the cartridge on the housing.
- Take the necessary protective measures against electrostatic discharges.

Failure to follow these instructions can result in equipment damage.

The following table describes the different steps to de-install a TMC4 cartridge from the controller:

Step	Action
1	Disconnect all power from all equipment, including connected devices, prior to removing a cartridge.
2	Pull out by hand the removable spring terminal block from the cartridge. 
3	Place the terminal block slot cover in the slot on the top of the controller and push it until it clicks. 
4	Press the locking clips on the top and bottom of the cartridge with your fingers and pull up the cartridge gently. Remove by hand the cartridge from the controller. 
5	Place the cartridge slot cover in the slot on the controller. Push the cartridge slot cover into the slot until it clicks. 

TMC4 Electrical Requirements

Wiring Best Practices

Overview

This section describes the wiring guidelines and associated best practices to be respected when using the M241 Logic Controller system.

⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

⚠️ WARNING

LOSS OF CONTROL

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.¹
- Test each implementation of a system for proper operation before placing it into service.

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

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

Wiring Guidelines

The following rules must be applied when wiring a M241 Logic Controller system:

- I/O and communication wiring must be kept separate from the power wiring. Route these 2 types of wiring in separate cable ducting.
- Verify that the operating conditions and environment are within the specification values.
- Use proper wire sizes to meet voltage and current requirements.
- Use copper conductors (required).
- Use twisted pair, shielded cables for analog, and/or fast I/O.
- Use twisted pair, shielded cables for networks, and fieldbus.

Use shielded, properly grounded cables for all analog and high-speed inputs or outputs and communication connections. If you do not use shielded cable for these connections, electromagnetic interference can cause signal degradation. Degraded signals can cause the controller or attached modules and equipment to perform in an unintended manner.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use shielded cables for all fast I/O, analog I/O and communication signals.
- Ground cable shields for all analog I/O, fast I/O and communication signals at a single point¹.
- Route communication and I/O cables separately from power cables.

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

¹Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short-circuit currents.

For more details, refer to *Grounding Shielded Cables*, page 25.

NOTE: Surface temperatures may exceed 60 °C (140 °F). To conform to IEC 61010 standards, route primary wiring (wires connected to power mains) separately and apart from secondary wiring (extra low voltage wiring coming from intervening power sources). If that is not possible, double insulation is required such as conduit or cable gains.

Rules for Removable Spring Terminal Block

The following table shows the cable types and wire sizes for a **3.5 mm (0.14 in.) pitch** removable spring terminal block:

$\frac{\text{mm}}{\text{in.}}$ 9 0.35				
mm ²	0.2...1.5	0.2...1.5	0.25...1.5	0.25...0.75
AWG	24...16	24...16	23...16	23...19

The use of copper conductors is required.

⚠ DANGER**FIRE HAZARD**

- Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.
- For relay output (2 A) wiring, use conductors of at least 0.5 mm² (AWG 20) with a temperature rating of at least 80 °C (176 °F).
- For common conductors of relay output wiring (7 A), or relay output wiring greater than 2 A, use conductors of at least 1.0 mm² (AWG 16) with a temperature rating of at least 80 °C (176 °F).

Failure to follow these instructions will result in death or serious injury.

The spring clamp connectors of the terminal block are designed for only one wire or one cable end. Two wires to the same connector must be installed with a double wire cable end to help prevent loosening.

⚠⚠ DANGER**LOOSE WIRING CAUSES ELECTRIC SHOCK**

Do not insert more than one wire per connector of the spring terminal blocks unless using a double wire cable end (ferrule).

Failure to follow these instructions will result in death or serious injury.

Grounding the M241 System

Overview

To help minimize the effects of electromagnetic interference, cables carrying the fast I/O, analog I/O, and field bus communication signals must be shielded.

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

- Use shielded cables for all fast I/O, analog I/O, and communication signals.
- Ground cable shields for all fast I/O, analog I/O, and communication signals at a single point¹.
- Route communications and I/O cables separately from power cables.

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

¹Multipoint grounding is permissible (and in some cases inevitable) if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short-circuit currents.

The use of shielded cables requires compliance with the following wiring rules:

- For protective earth ground connections (PE), metal conduit or ducting can be used for part of the shielding length, provided there is no break in the continuity of the ground connections. For functional earth ground (FE), the shielding is intended to attenuate electromagnetic interference and the shielding must be continuous for the length of the cable. If the purpose is both functional and protective, as is often the case for communication cables, the cable must have continuous shielding.
- Wherever possible, keep cables carrying one type of signal separate from the cables carrying other types of signals or power.

Protective Earth Ground (PE) on the Backplane

The protective earth ground (PE) should be connected to the conductive backplane by a heavy-duty wire, usually a braided copper cable with the maximum allowable cable section.

Shielded Cables Connections

Cables carrying the fast I/O, analog I/O, and field bus communication signals must be shielded. The shielding must be securely connected to ground. The fast I/O and analog I/O shields may be connected either to the functional earth ground (FE) or to the protective earth ground (PE) of your M241 Logic Controller. The field bus communication cable shields must be connected to the protective earth ground (PE) with a connecting clamp secured to the conductive backplane of your installation.

The shielding of the Modbus cable must be connected to the protective earth ground (PE).

DANGER

HAZARD OF ELECTRIC SHOCK

- The grounding terminal connection (PE) must be used to provide a protective ground at all times.
- Make sure that an appropriate, braided ground cable is attached to the PE/PG ground terminal before connecting or disconnecting the network cable to the equipment.

Failure to follow these instructions will result in death or serious injury.

WARNING

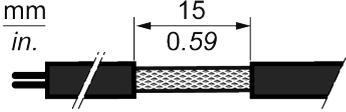
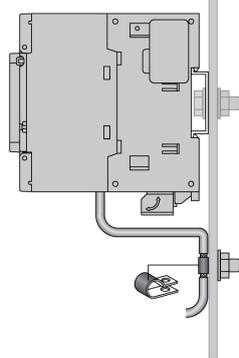
ACCIDENTAL DISCONNECTION FROM PROTECTIVE GROUND (PE)

- Do not use the Grounding Bar to provide a protective earth ground (PE).
- Use the Grounding Bar only to provide a functional earth ground (FE).

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

Protective Earth Ground (PE) Cable Shielding

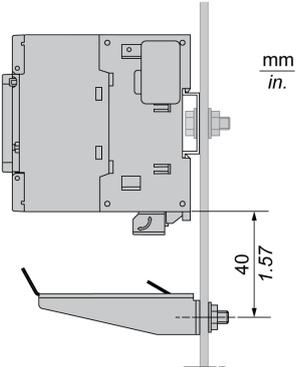
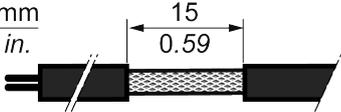
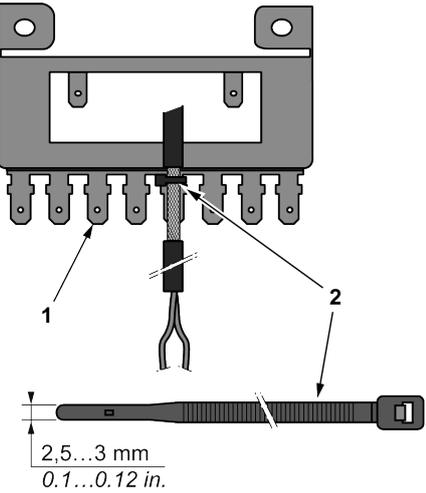
To ground the shield of a cable through a grounding clamp:

Step	Description	
1	Strip the shielding for a length of 15 mm (0.59 in.).	
2	Attach the cable to the conductive backplane plate by attaching the grounding clamp to the stripped part of the shielding as close as possible to the M241 Logic Controller system base.	

NOTE: The shielding must be clamped securely to the conductive backplane to ensure a good contact.

Functional Earth Ground (FE) Cable Shielding

To connect the shield of a cable through the grounding bar:

Step	Description	
1	Install the grounding bar directly on the conductive backplane below the M241 Logic Controller system as illustrated.	
2	Strip the shielding for a length of 15 mm (0.59 in.).	
3	Tightly clamp on the blade connector (1) using nylon fastener (2) (width 2.5...3 mm (0.1...0.12 in.)) and appropriate tool.	

TMC4 Standard Cartridges

What's in This Part

TMC4AI2 Analog Voltage/Current Inputs.....	30
TMC4TI2 Analog Temperature Inputs	35
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TMC4AI2 Analog Voltage/Current Inputs

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TMC4AI2 Presentation	30
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TMC4AI2 Wiring Diagram	34

Overview

This chapter describes the TMC4AI2 cartridge, its characteristics, and its connections.

TMC4AI2 Presentation

Overview

The following features are integrated into the TMC4AI2 cartridge:

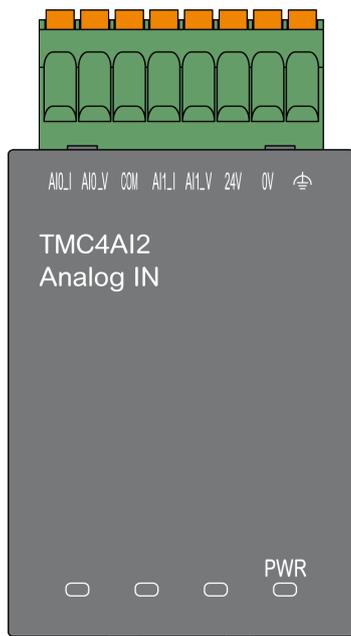
- 2 analog inputs (voltage or current)
- removable spring terminal block, 3.5 mm (0.14 in.) pitch

Main Characteristics

Characteristics	Value	
	Voltage input	Current input
Number of input channels	2	
Input range	0...10 Vdc	0...20 mA 4...20 mA
Resolution	12 bits (4096 steps)	
Connection type	3.5 mm (0.14 in.) pitch, removable spring terminal block	
Weight	55 g (1.94 oz)	

Power LED

The following diagram shows a TMC4A12 cartridge with its power LED labeled **PWR**:



LED	Color	Status	Description
PWR	Green	On	The cartridge is powered by the logic controller and the external power supply (24 Vdc) is applied.
		Flashing	The cartridge is powered by the logic controller but the external power supply (24 Vdc) is not applied.
		Off	The cartridge is not powered by the logic controller.

TMC4AI2 Characteristics

Introduction

This section provides a general description of the TMC4AI2 cartridge characteristics.

See also Environmental Characteristics, page 14.

⚠ WARNING

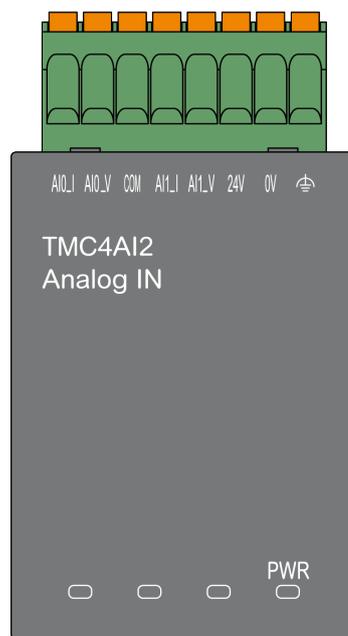
UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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

Connectors

The following diagram shows a TMC4AI2 cartridge marking and connectors:



Input Characteristics

The following table describes the cartridge input characteristics:

Characteristics		Value	
		Voltage input	Current input
Rated input range		0...10 Vdc	0...20 mA 4...20 mA
Input impedance		> 1 M Ω	< 250 Ω
Sample duration time		1 ms per enabled channel	
Input type		Single-ended	
Operating mode		Self-scan	
Conversion mode		SAR type	
Maximum accuracy at ambient temperature: 25 °C (77 °F)		± 0.2 % of full scale	
Maximum accuracy on full operating temperature range		± 0.5 % of full scale	
Temperature drift		± 0.006 % of full scale per 1 °C (1.8 °F)	
Repeatability after stabilization time		± 0.2 % of full scale	
Non-linearity		± 0.05 % of full scale	
Digital resolution		12 bits (4096 steps)	
Input value of LSB		2.44 mV	4.88 μ A
Data type in application program		Scalable from -32768 to 32767	
Input data out of detection range		Yes	
Noise resistance	Maximum temporary deviation during perturbations	± 2.0 % of full scale	
	Cable type and maximum length	Shielded	
		< 30 m (98.4 ft)	
	Crosstalk (minimum)	80 dB	
Common-mode rejection ratio (minimum)	65 dB		
Isolation	Isolation between inputs and internal logic	500 Vdc	
	Isolation between inputs	Not isolated	
Maximum continuous overload allowed (without damage)		30 Vdc	40 mA
Input filter		Software filter: 6 levels	
External power supply	Supply voltage	24 Vdc ± 15 %	
	Power consumption	2 W	

TMC4AI2 Wiring Diagram

Introduction

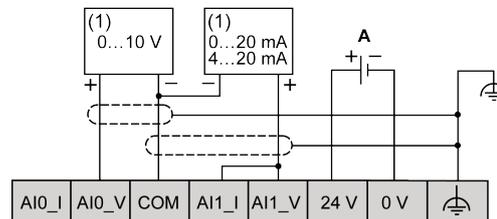
This cartridge has a removable spring terminal block for the connection of the inputs.

Wiring Rules

See Wiring Best Practices, page 23.

Wiring Diagram

The following figure shows an example of the voltage and current input connection:



(1): Current/Voltage analog output device

A: External power supply

NOTE: Each input can be connected to either a voltage or current input.

TMC4TI2 Analog Temperature Inputs

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TMC4TI2 Wiring Diagram	40

Overview

This chapter describes the TMC4TI2 cartridge, its characteristics, and its connections.

TMC4TI2 Presentation

Overview

The following features are integrated into the TMC4TI2 cartridge:

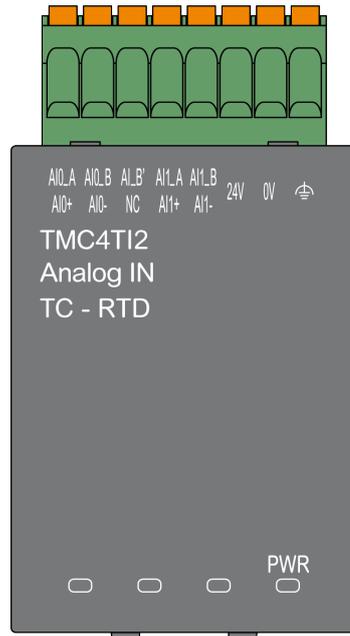
- 2 analog temperature inputs (thermocouple or RTD)
- removable spring terminal block, 3.5 mm (0.14 in.) pitch

Main Characteristics

Characteristics	Value	
	Thermocouple	RTD
Number of input channels	2	
Input range	Type K, J, R, S, B, E, T, N	Type Pt100, Pt1000, Ni100, Ni1000
Resolution	14 bits (16384 steps)	
Connection type	3.5 mm (0.14 in.) pitch, removable spring terminal block	
Weight	55 g (1.94 oz)	

Power LED

The following diagram shows a TMC4TI2 cartridge with its power LED labeled **PWR**:



LED	Color	Status	Description
PWR	Green	On	The cartridge is powered by the logic controller and the external power supply (24 Vdc) is applied.
		Flashing	The cartridge is powered by the logic controller but the external power supply (24 Vdc) is not applied.
		Off	The cartridge is not powered by the logic controller.

TMC4TI2 Characteristics

Introduction

This section provides a general description of the TMC4TI2 cartridge characteristics.

See also Environmental Characteristics, page 14.

⚠ WARNING

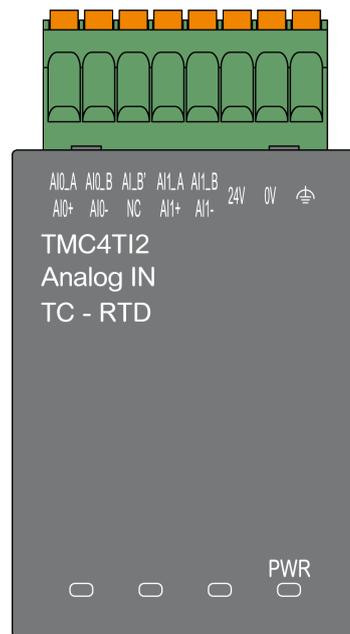
UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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

Connectors

The following diagram shows a TMC4TI2 cartridge marking and connectors:



Input Characteristics

The following table describes the cartridge input characteristics:

Characteristics	Value			
	Thermocouple		RTD (2, 3, or 4 wires)	
Rated input range	K	–200...+1300 °C (–328...+2372 °F)	Pt100	–200...+850 °C (–328...+1562 °F)
	J	–200...+1000 °C (–328...+1832 °F)		
	R	0...+1760 °C (+32...+3200 °F)	Pt1000	–200...+850 °C (–328...+1562 °F)
	S	0...+1760 °C (+32...+3200 °F)		
	B	+250...+1820 °C (+482...+3308 °F)	Ni100	–60...+180 °C (–76...+356 °F)
	E	–200...+800 °C (–328...+1472 °F)		
	T	–200...+400 °C (–328...+752 °F)	Ni1000	–60...+180 °C (–76...+356 °F)
	N	–200...+1300 °C (–328...+2372 °F)		
Cold junction compensation	Internal compensation		–	
Input impedance	> 1 MΩ			
Sample duration time	100 ms per enabled channel + 1 scan time			
Input type	Single-ended			
Operating mode	Self-scan			
Conversion mode	SAR type			
Maximum accuracy at ambient temperature: 25 °C (77 °F)	K, J, R, S, E, T, N	± 0.2 % of full scale + junction compensation accuracy (± 4 °C (± 7.2 °F))		± 0.5 °C (± 0.9 °F)
	B	± 0.2 % of full scale for measured temperature range: 250...400 °C (482...752 °F) ± 0.1 % of full scale for measured temperature range: 400...1280 °C (752...2336 °F)		
Temperature drift	± 0.008 % of full scale per 1 °C (1.8 °F)			
Repeatability after stabilization time	± 0.1 % of full scale			
Non-linearity	± 0.05 % of full scale			
Digital resolution	14 bits (16384 steps)			
Input value of LSB	0.1 °C (0.18 °F)			
Data type in application program	Scalable from –32768 to 32767			
Input data out of detection range	Yes			

Characteristics		Value	
		Thermocouple	RTD (2, 3, or 4 wires)
Noise resistance	Maximum temporary deviation during perturbations	$\pm 2\%$ of full scale	
	Total cable type, length, and resistance	Twisted-pair shielded	
		< 100 m (328.1 ft)	
		< 100 Ω	< 30 Ω
	External crosstalk (minimum)	80 dB	
	50/60 Hz common-mode rejection ratio (minimum)	90 dB	
50/60 Hz differential-mode rejection ratio (minimum)	60 dB		
Isolation	Isolation between inputs and internal logic	500 Vdc	
	Isolation between inputs	Not isolated	
Maximum continuous overload allowed (without damage)		6 Vdc	
Behavior when the temperature sensor is disconnected or broken		Detected	
External power supply	Supply voltage	24 Vdc $\pm 15\%$	
	Power consumption	2 W	

TMC4TI2 Wiring Diagram

Introduction

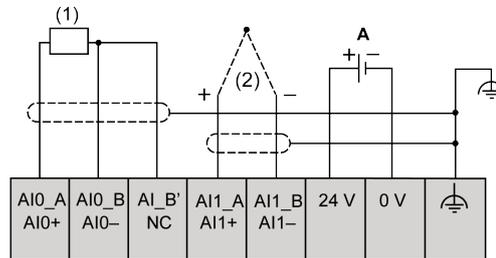
This cartridge has a removable spring terminal block for the connection of the inputs.

Wiring Rules

See Wiring Best Practices, page 23.

Wiring Diagram

The following figure shows an example of 3-wire RTD and thermocouple probe connections:

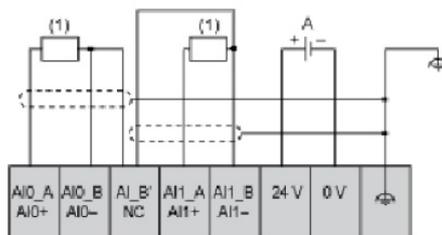


(1): RTD

(2): Thermocouple

A: External power supply

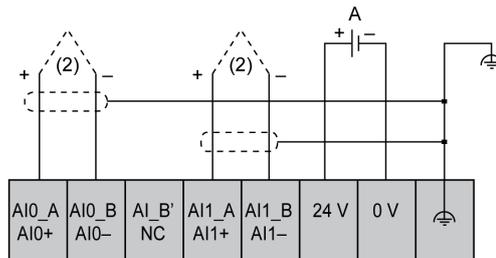
The following figure shows an example of a pair of 3-wire RTD connections:



(1): RTD

A: External power supply

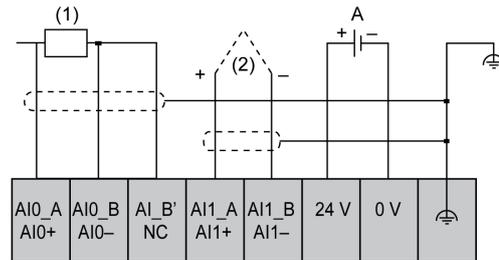
The following figure shows an example of a pair of thermocouple connections:



(2): Thermocouple

A: External power supply

The following figure shows an example of 4-wire RTD and thermocouple connections:



(1): RTD

(2): Thermocouple

A: External power supply

NOTE: Each input can be connected to either an RTD or thermocouple probe.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not connect wires to unused terminals and/or terminals indicated as "No Connection (N.C.)".

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

TMC4AQ2 Analog Voltage/Current Outputs

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Overview

This chapter describes the TMC4AQ2 cartridge, its characteristics, and its connections.

TMC4AQ2 Presentation

Overview

The following features are integrated into the TMC4AQ2 cartridge:

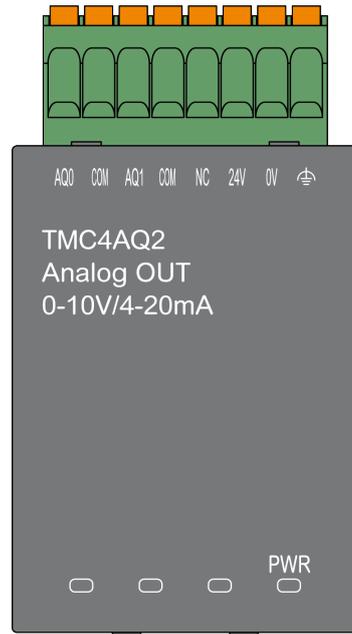
- 2 analog outputs (voltage or current)
- removable spring terminal block, 3.5 mm (0.14 in.) pitch

Main Characteristics

Characteristics	Value	
	Voltage output	Current output
Number of output channels	2	
Output range	0...10 Vdc	4...20 mA
Resolution	16 bits (65536 steps)	
Connection type	3.5 mm (0.14 in.) pitch, removable spring terminal block	
Weight	55 g (1.94 oz)	

Power LED

The following diagram shows a TMC4AQ2 cartridge with its power LED labeled **PWR**:



LED	Color	Status	Description
PWR	Green	On	The cartridge is powered by the logic controller and the external power supply (24 Vdc) is applied.
		Flashing	The cartridge is powered by the logic controller but the external power supply (24 Vdc) is not applied.
		Off	The cartridge is not powered by the logic controller.

TMC4AQ2 Characteristics

Introduction

This section provides a general description of the TMC4AQ2 cartridge characteristics.

See also Environmental Characteristics, page 14.

⚠ WARNING

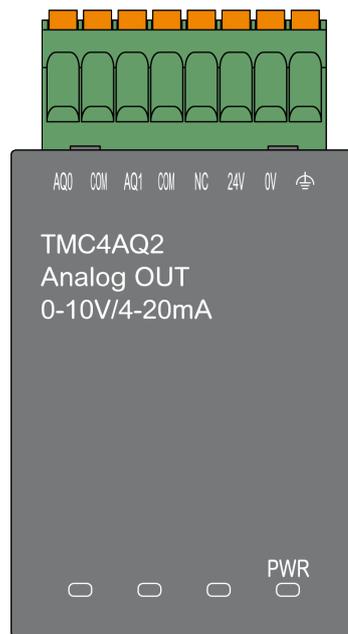
UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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

Connectors

The following diagram shows a TMC4AQ2 cartridge marking and connectors:



Output Characteristics

The following table describes the cartridge output characteristics:

Characteristics		Value	
		Voltage output	Current output
Rated output range		0...10 Vdc	4...20 mA
Load impedance		> 2 K Ω	< 500 Ω
Application load type		Resistive load	
Settling time		10 ms	
Total output system transfer time		10 ms + 1 scan time	
Maximum accuracy at ambient temperature without EMC disturbance: 25 °C (77 °F)		± 0.2 % of full scale	
Temperature drift		± 0.006 % of full scale per 1 °C (1.8 °F)	
Repeatability after stabilization time		± 0.5 % of full scale	
Non-linearity		± 0.05 % of full scale	
Output ripple		± 20 mV	
Output voltage drop		1 %	
Overshoot		0 %	
Maximum output deviation		± 0.5 % of full scale	
Digital resolution		16 bits (65536 steps)	
Output value of LSB		0.153 mV	0.305 μ A
Data type in application program		0...4095	
Noise resistance	Maximum temporary deviation during perturbations	± 2 % of full scale	
	Cable type and maximum length	Shielded	
		< 30 m (98.4 ft)	
	External crosstalk (minimum)	80 dB	
50/60 Hz common-mode rejection ratio (minimum)	90 dB		
Isolation	Isolation between outputs and internal logic	500 Vdc	
	Isolation between outputs	Not isolated	
Output protection		Short circuit protection	Open circuit protection
Behavior when internal power supply level is lower than threshold		Outputs are set to 0	
Behavior when external power is not applied		PWR LED flashing	
External power supply	Supply voltage	24 Vdc ± 15 %	
	Power consumption	2 W	

TMC4AQ2 Wiring Diagram

Introduction

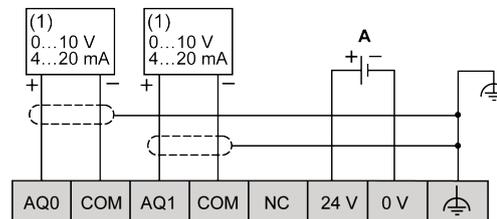
This cartridge has a removable spring terminal block for the connection of the outputs.

Wiring Rules

See Wiring Best Practices, page 23.

Wiring Diagram

The following figure shows an example of the voltage and current outputs connection:



(1): Current/Voltage analog input device

A: External power supply

NOTE: Each output can be connected either as a voltage or current output.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not connect wires to unused terminals and/or terminals indicated as "No Connection (N.C.)".

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

TMC4 Application Cartridges

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TMC4HOIS01 Hoisting

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TMC4HOIS01 Wiring Diagram	52

Overview

This chapter describes the TMC4HOIS01 cartridge, its characteristics, and its connections.

TMC4HOIS01 Presentation

Overview

The following features are integrated into the TMC4HOIS01 cartridge:

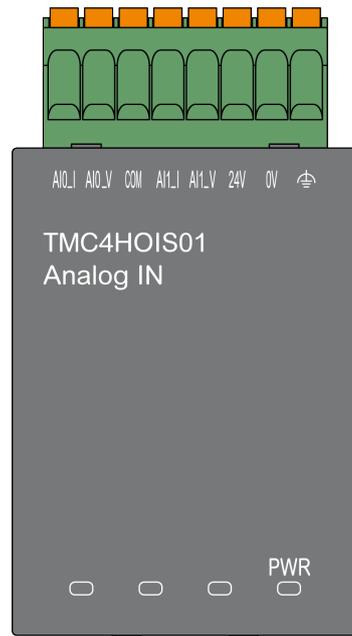
- 2 analog inputs (voltage or current) for hoisting load cell
- removable spring terminal block, 3.5 mm (0.14 in.) pitch

Main Characteristics

Characteristics	Value	
	Voltage input	Current input
Number of input channels	2	
Input range	0...10 Vdc	0...20 mA 4...20 mA
Resolution	12 bits (4096 steps)	
Connection type	3.5 mm (0.14 in.) pitch, removable spring terminal block	
Weight	55 g (1.94 oz)	

Power LED

The following diagram shows a TMC4HOIS01 cartridge with its power LED labeled **PWR**:



LED	Color	Status	Description
PWR	Green	On	The cartridge is powered by the logic controller and the external power supply (24 Vdc) is applied.
		Flashing	The cartridge is powered by the logic controller but the external power supply (24 Vdc) is not applied.
		Off	The cartridge is not powered by the logic controller.

TMC4HOIS01 Characteristics

Introduction

This section provides a general description of the TMC4HOIS01 cartridge characteristics.

See also Environmental Characteristics, page 14.

⚠ WARNING

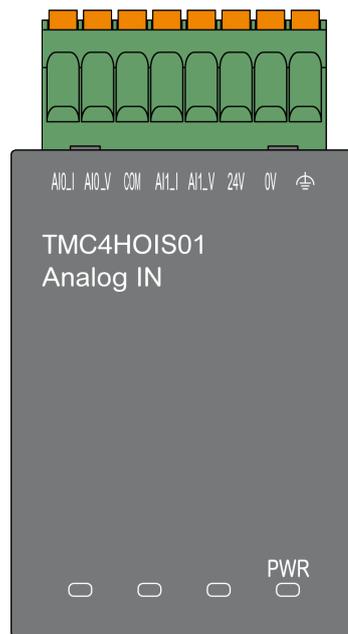
UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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

Connectors

The following diagram shows a TMC4HOIS01 cartridge marking and connectors:



Input Characteristics

The following table describes the cartridge input characteristics:

Characteristics		Value	
		Voltage input	Current input
Rated input range		0...10 Vdc	0...20 mA 4...20 mA
Input impedance		> 1 MΩ	< 250 Ω
Sample duration time		1 ms per enabled channel	
Input type		Single-ended	
Operating mode		Self-scan	
Conversion mode		SAR type	
Maximum accuracy at ambient temperature: 25 °C (77 °F)		± 0.2 % of full scale	
Maximum accuracy on full operating temperature range		± 0.5 % of full scale	
Temperature drift		± 0.006 % of full scale per 1 °C (1.8 °F)	
Repeatability after stabilization time		± 0.2 % of full scale	
Non-linearity		± 0.05 % of full scale	
Digital resolution		12 bits (4096 steps)	
Input value of LSB		2.44 mV	4.88 μA
Data type in application program		Scalable from -32768 to 32767	
Input data out of detection range		Yes	
Noise resistance	Maximum temporary deviation during perturbations	± 2.0 % of full scale	
	Cable type and maximum length	Shielded	
		< 30 m (98.4 ft)	
	Crosstalk (minimum)	80 dB	
Common-mode rejection ratio (minimum)	65 dB		
Isolation	Isolation between inputs and internal logic	500 Vdc	
	Isolation between inputs	Not isolated	
Maximum continuous overload allowed (without damage)		30 Vdc	40 mA
Input filter		Software filter: 6 levels	
External power supply	Supply voltage	24 Vdc ± 15 %	
	Power consumption	2 W	

TMC4HOIS01 Wiring Diagram

Introduction

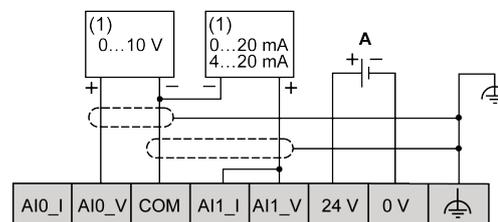
This cartridge has a removable spring terminal block for the connection of the inputs.

Wiring Rules

See Wiring Best Practices, page 23.

Wiring Diagram

The following figure shows an example of the voltage and current input connection:



(1): Current/Voltage analog output device

A: External power supply

NOTE: Each input can be connected to either a voltage or current input.

TMC4PACK01 Packaging

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Overview

This chapter describes the TMC4PACK01 cartridge, its characteristics, and its connections.

TMC4PACK01 Presentation

Overview

The following features are integrated into the TMC4PACK01 cartridge:

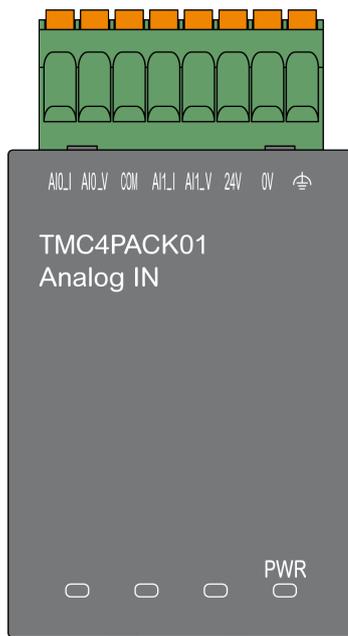
- 2 analog inputs (voltage or current) for packaging
- removable spring terminal block, 3.5 mm (0.14 in.) pitch

Main Characteristics

Characteristics	Value	
	Voltage input	Current input
Number of input channels	2	
Input range	0...10 Vdc	0...20 mA 4...20 mA
Resolution	12 bits (4096 steps)	
Connection type	3.5 mm (0.14 in.) pitch, removable spring terminal block	
Weight	55 g (1.94 oz)	

Power LED

The following diagram shows a TMC4PACK01 cartridge with its power LED labeled **PWR**:



LED	Color	Status	Description
PWR	Green	On	The cartridge is powered by the logic controller and the external power supply (24 Vdc) is applied.
		Flashing	The cartridge is powered by the logic controller but the external power supply (24 Vdc) is not applied.
		Off	The cartridge is not powered by the logic controller.

TMC4PACK01 Characteristics

Introduction

This section provides a general description of the TMC4PACK01 cartridge characteristics.

See also Environmental Characteristics, page 14.

⚠ WARNING

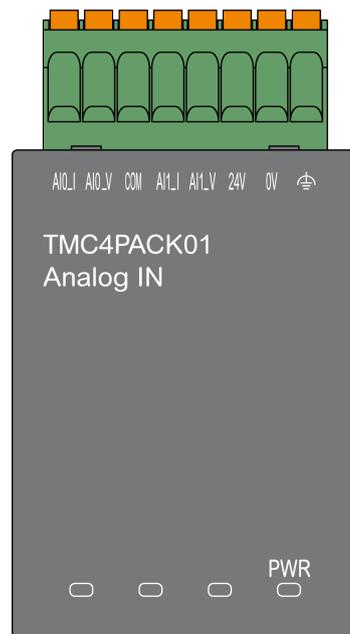
UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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

Connectors

The following diagram shows a TMC4PACK01 cartridge marking and connectors:



Input Characteristics

The following table describes the cartridge input characteristics:

Characteristics		Value	
		Voltage input	Current input
Rated input range		0...10 Vdc	0...20 mA 4...20 mA
Input impedance		> 1 MΩ	< 250 Ω
Sample duration time		1 ms per enabled channel	
Input type		Single-ended	
Operating mode		Self-scan	
Conversion mode		SAR type	
Maximum accuracy at ambient temperature: 25 °C (77 °F)		± 0.2 % of full scale	
Maximum accuracy on full operating temperature range		± 0.5 % of full scale	
Temperature drift		± 0.006 % of full scale per 1 °C (1.8 °F)	
Repeatability after stabilization time		± 0.2 % of full scale	
Non-linearity		± 0.05 % of full scale	
Digital resolution		12 bits (4096 steps)	
Input value of LSB		2.44 mV	4.88 μA
Data type in application program		Scalable from –32768 to 32767	
Input data out of detection range		Yes	
Noise resistance	Maximum temporary deviation during perturbations	± 2.0 % of full scale	
	Cable type and maximum length	Shielded	
		< 30 m (98.4 ft)	
	Crosstalk (minimum)	80 dB	
Common-mode rejection ratio (minimum)	65 dB		
Isolation	Isolation between inputs and internal logic	500 Vdc	
	Isolation between inputs	Not isolated	
Maximum continuous overload allowed (without damage)		30 Vdc	40 mA
Input filter		Software filter: 6 levels	
External power supply	Supply voltage	24 Vdc ± 15 %	
	Power consumption	2 W	

TMC4PACK01 Wiring Diagram

Introduction

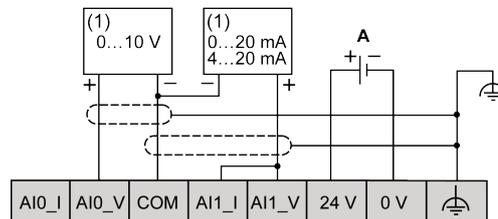
This cartridge has a removable spring terminal block for the connection of the inputs.

Wiring Rules

See Wiring Best Practices, page 23.

Wiring Diagram

The following figure shows an example of the voltage and current input connection:



(1): Current/Voltage analog output device

A: External power supply

NOTE: Each input can be connected to either a voltage or current input.

Glossary

A

analog input:

Converts received voltage or current levels into numerical values. You can store and process these values within the logic controller.

application:

A program including configuration data, symbols, and documentation.

C

configuration:

The arrangement and interconnection of hardware components within a system and the hardware and software parameters that determine the operating characteristics of the system.

controller:

Automates industrial processes (also known as programmable logic controller or programmable controller).

E

EN:

EN identifies one of many European standards maintained by CEN (*European Committee for Standardization*), CENELEC (*European Committee for Electrotechnical Standardization*), or ETSI (*European Telecommunications Standards Institute*).

F

FE:

(functional Earth) A common grounding connection to enhance or otherwise allow normal operation of electrically sensitive equipment (also referred to as functional ground in North America).

In contrast to a protective Earth (protective ground), a functional earth connection serves a purpose other than shock protection, and may normally carry current. Examples of devices that use functional earth connections include surge suppressors and electromagnetic interference filters, certain antennas, and measurement instruments.

I

I/O:

(input/output)

IEC:

(international electrotechnical commission) A non-profit and non-governmental international standards organization that prepares and publishes international standards for electrical, electronic, and related technologies.

M

Modbus:

The protocol that allows communications between many devices connected to the same network.

N

NEMA:

(national electrical manufacturers association) The standard for the performance of various classes of electrical enclosures. The NEMA standards cover corrosion resistance, ability to help protect from rain, submersion, and so on. For IEC member countries, the IEC 60529 standard classifies the ingress protection rating for enclosures.

P

PE:

(Protective Earth) A common grounding connection to help avoid the hazard of electric shock by keeping any exposed conductive surface of a device at earth potential. To avoid possible voltage drop, no current is allowed to flow in this conductor (also referred to as *protective ground* in North America or as an equipment grounding conductor in the US national electrical code).

program:

The component of an application that consists of compiled source code capable of being installed in the memory of a logic controller.

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As standards, specifications, and design change from time to time,
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