

# Modicon TM3

## Analog I/O Modules

### Hardware Guide

03/2018



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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 nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

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

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# Safety Information

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## Important Information

### NOTICE

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.

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## 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 expansion modules, 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.

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# About the Book

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## At a Glance

### Document Scope

This guide describes the hardware implementation of TM3 analog I/O expansion modules. It provides the description, characteristics, wiring diagrams, and installation details for TM3 analog I/O expansion modules.

### Validity Note

This document has been updated for the release of TM3TI4D Add-on for SoMachine V4.3.

This document has been updated for the release of SoMachine Basic V1.6 SP1.

For product compliance and environmental information (RoHS, REACH, PEP, EOL, etc.), go to [www.schneider-electric.com/green-premium](http://www.schneider-electric.com/green-premium).

The technical characteristics of the devices described in this document also appear online. To access this information online:

Step	Action
1	Go to the Schneider Electric home page <a href="http://www.schneider-electric.com">www.schneider-electric.com</a> .
2	In the <b>Search</b> box type the reference of a product or the name of a product range. <ul style="list-style-type: none"><li>● Do not include blank spaces in the reference or product range.</li><li>● To get information on grouping similar modules, use asterisks (*).</li></ul>
3	If you entered a reference, go to the <b>Product Datasheets</b> search results and click on the reference that interests you. If you entered the name of a product range, go to the <b>Product Ranges</b> search results and click on the product range that interests you.
4	If more than one reference appears in the <b>Products</b> search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the data sheet.
6	To save or print a data sheet as a .pdf file, click <b>Download XXX product datasheet</b> .

The characteristics that are presented in this manual should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the manual and online information, use the online information as your reference.

## Related Documents

Title of Documentation	Reference Number
Modicon TM3 Expansion Modules Configuration - Programming Guide (SoMachine Basic)	<a href="#">EIO0000001396 (ENG)</a> <a href="#">EIO0000001397 (FRA)</a> <a href="#">EIO0000001398 (GER)</a> <a href="#">EIO0000001399 (SPA)</a> <a href="#">EIO0000001400 (ITA)</a> <a href="#">EIO0000001401 (CHS)</a> <a href="#">EIO0000001374 (POR)</a> <a href="#">EIO0000001375 (TUR)</a>
Modicon TM3 Expansion Modules Configuration - Programming Guide (SoMachine)	<a href="#">EIO0000001402 (ENG)</a> <a href="#">EIO0000001403 (FRA)</a> <a href="#">EIO0000001404 (GER)</a> <a href="#">EIO0000001405 (SPA)</a> <a href="#">EIO0000001406 (ITA)</a> <a href="#">EIO0000001407 (CHS)</a>
Modicon M221 Logic Controller - Hardware Guide	<a href="#">EIO0000001384 (ENG)</a> <a href="#">EIO0000001385 (FRA)</a> <a href="#">EIO0000001386 (GER)</a> <a href="#">EIO0000001387 (SPA)</a> <a href="#">EIO0000001388 (ITA)</a> <a href="#">EIO0000001389 (CHS)</a> <a href="#">EIO0000001370 (POR)</a> <a href="#">EIO0000001371 (TUR)</a>
Modicon M241 Logic Controller - Hardware Guide	<a href="#">EIO0000001456 (ENG)</a> <a href="#">EIO0000001457 (FRA)</a> <a href="#">EIO0000001458 (GER)</a> <a href="#">EIO0000001459 (SPA)</a> <a href="#">EIO0000001460 (ITA)</a> <a href="#">EIO0000001461 (CHS)</a>
Modicon M251 Logic Controller - Hardware Guide	<a href="#">EIO0000001486 (ENG)</a> <a href="#">EIO0000001487 (FRA)</a> <a href="#">EIO0000001488 (GER)</a> <a href="#">EIO0000001489 (SPA)</a> <a href="#">EIO0000001490 (ITA)</a> <a href="#">EIO0000001491 (CHS)</a>
TM3 Analog I/O Modules Instruction Sheet	<a href="#">HRB59605</a>

You can download these technical publications and other technical information from our website at <https://www.schneider-electric.com/en/download>



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## 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.**

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## WARNING

### LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.<sup>1</sup>
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

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

<sup>1</sup> 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

### 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.**

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## Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, 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
EN 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2008	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	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
EN 1088:2008 ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2006	Safety of machinery - Emergency stop - Principles for design
EN/IEC 62061:2005	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 61784-3:2008	Digital data communication for measurement and control: Functional safety field buses.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

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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.

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# Part I

## TM3 General Overview

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### What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
1	TM3 Description	15
2	TM3 Installation	23



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# Chapter 1

## TM3 Description

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### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
General Description	16
Physical Description	20
Accessories	21

## General Description

### Introduction

The range of TM3 analog I/O expansion modules includes:

- Input modules
- Output modules
- Mixed input/output modules

All TM3 analog I/O expansion modules are equipped with (depending on the reference):

- Removable screw terminal blocks
- Removable spring terminal blocks

### TM3 Analog Input Modules

The following table shows the TM3 analog input expansion modules, with corresponding resolution, channel type, nominal voltage/current, and terminal type:

Reference	Resolution	Channels	Channel Type	Mode	Terminal Type / Pitch
TM3AI2H <i>(see page 50)</i>	16 bit, or 15 bit + sign	2	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable screw terminal block / 5.08 mm
TM3AI2HG <i>(see page 50)</i>	16 bit, or 15 bit + sign	2	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable spring terminal block / 5.08 mm
TM3AI4 <i>(see page 58)</i>	12 bit, or 11 bit + sign	4	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable screw terminal block / 3.81 mm
TM3AI4G <i>(see page 58)</i>	12 bit, or 11 bit + sign	4	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable spring terminal blocks / 3.81 mm
TM3AI8 <i>(see page 66)</i>	12 bit, or 11 bit + sign	8	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA 0...20 mA extended 4...20 mA extended	Removable screw terminal block / 3.81 mm



Reference	Resolution	Channels	Channel Type	Mode	Terminal Type / Pitch
TM3AI8G <i>(see page 66)</i>	12 bit, or 11 bit + sign	8	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA 0...20 mA extended 4...20 mA extended	Removable spring terminal blocks / 3.81 mm
TM3TI4 <i>(see page 74)</i>	16 bit, or 15 bit + sign	4	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA Thermocouple PT100/1000 NI100/1000	Removable screw terminal block / 3.81 mm
TM3TI4G <i>(see page 74)</i>	16 bit, or 15 bit + sign	4	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA Thermocouple PT100/1000 NI100/1000	Removable spring terminal blocks / 3.81 mm
TM3TI4D <i>(see page 83)</i>	16 bit, or 15 bit + sign	4	inputs	Thermocouple	Removable screw terminal block / 3.81 mm
TM3TI4DG <i>(see page 83)</i>	16 bit, or 15 bit + sign	4	inputs	Thermocouple	Removable spring terminal blocks / 3.81 mm
TM3TI8T <i>(see page 94)</i>	16 bit, or 15 bit + sign	8	inputs	Thermocouple NTC/PTC Ohmmeter	Removable screw terminal block / 3.81 mm
TM3TI8TG <i>(see page 94)</i>	16 bit, or 15 bit + sign	8	inputs	Thermocouple NTC/PTC Ohmmeter	Removable spring terminal blocks / 3.81 mm

### TM3 Analog Output Modules

The following table shows the TM3 analog output modules, with corresponding resolution, channel type, nominal voltage/current, and terminal type:

Reference	Resolution	Channels	Channel Type	Mode	Terminal Type / Pitch
TM3AQ2 <i>(see page 106)</i>	12 bit, or 11 bit + sign	2	outputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable screw terminal block / 5.08 mm
TM3AQ2G <i>(see page 106)</i>	12 bit, or 11 bit + sign	2	outputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable spring terminal block / 5.08 mm
TM3AQ4 <i>(see page 114)</i>	12 bit, or 11 bit + sign	4	outputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable screw terminal block / 5.08 mm
TM3AQ4G <i>(see page 114)</i>	12 bit, or 11 bit + sign	4	outputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable spring terminal block / 5.08 mm

### TM3 Analog Mixed Input/Output Modules

The following table shows the TM3 analog mixed I/O modules, with corresponding resolution, channel type, nominal voltage/current, and terminal type:

Reference	Resolution	Channels	Channel Type	Mode	Terminal Type / Pitch
TM3AM6 ( <i>see page 124</i> )	12 bit, or 11 bit + sign	4	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable screw terminal block / 3.81 mm
		2	outputs		
TM3AM6G ( <i>see page 124</i> )	12 bit, or 11 bit + sign	4	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA	Removable spring terminal block / 3.81 mm
		2	outputs		
TM3TM3 ( <i>see page 132</i> )	16 bit, or 15 bit + sign	2	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA Thermocouple PT100/1000 NI100/1000	Removable screw terminal block / 5.08 mm
			1		
TM3TM3G ( <i>see page 132</i> )	16 bit, or 15 bit + sign	2	inputs	0...10 Vdc -10...+10 Vdc 0...20 mA 4...20 mA Thermocouple PT100/1000 NI100/1000	Removable spring terminal block / 5.08 mm
			1		

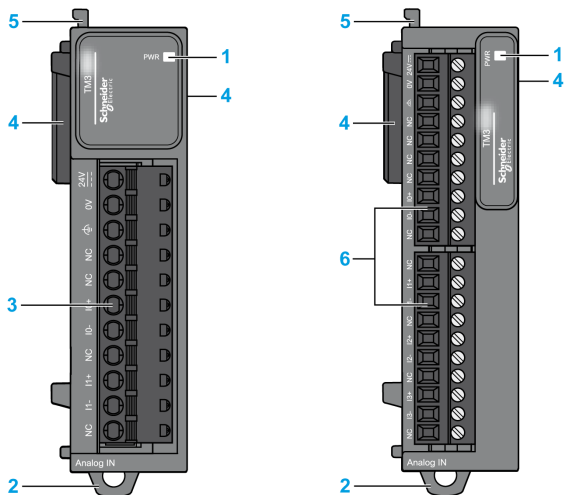
## Physical Description

### Introduction

This section describes the physical characteristics of the TM3 modules. The modules, depending on the reference, support removable screw or spring terminal block.

### TM3 with Removable Screw or Spring Terminal Block

The following figure shows the main elements of a TM3 expansion module with removable screw or spring terminal block:



This table describes the main elements of the TM3 expansion modules shown above:

Label	Elements	
1	Power supply LED.	
2	Clip-on lock for 35 mm (1.38 in.) top hat section rail (DIN-rail).	DIN Rail ( <a href="#">see page 36</a> )
3	Removable terminal block.	Rules for Removable Screw Terminal Block ( <a href="#">see page 44</a> )
4	Expansion connector for TM3 I/O bus (one on each side).	
5	Locking device for attachment to the previous module.	
6	Removable terminal block.	Rules for Removable Spring Terminal Block ( <a href="#">see page 45</a> )

## Accessories

### Overview

This section describes the accessories.

### Accessories

Reference	Description	Use	Quantity
TMAT2MSET	Set of 8 removable screw terminal blocks: <ul style="list-style-type: none"> <li>● 4 x Removable screw terminal blocks (pitch 3.81 mm) with 11 terminals for inputs/outputs</li> <li>● 4 x Removable screw terminal blocks (pitch 3.81 mm) with 10 terminals for inputs/outputs</li> </ul>	Connects the module I/Os.	1
TMAT2MSETG	Set of 8 removable spring terminal blocks: <ul style="list-style-type: none"> <li>● 4 x Removable spring terminal blocks (pitch 3.81 mm) with 11 terminals for inputs/outputs</li> <li>● 4 x Removable spring terminal blocks (pitch 3.81 mm) with 10 terminals for inputs/outputs</li> </ul>	Connects the module I/Os.	1
AB1AB8P35	End brackets	Help secure the logic controller or receiver module and their expansion modules on a top hat section rail (DIN rail).	1
TM2XMTGB	Grounding Bar	Connects the cable shield and the module to the functional ground.	1

## TM3 Description

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Reference	Description	Use	Quantity
TM200RSRCEMC	Shielding take-up clip	Mounts and connects the ground to the cable shielding.	25 pack
TMAM2	Mounting Kit	Mounts the controller and I/O modules directly to a flat, vertical panel.	1

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# Chapter 2

## TM3 Installation

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### What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
2.1	TM3 General Rules for Implementing	24
2.2	TM3 Expansion Module Installation	29
2.3	TM3 Electrical Requirements	42

# Section 2.1

## TM3 General Rules for Implementing

---

### What Is in This Section?

This section contains the following topics:

Topic	Page
Environmental Characteristics	25
Certifications and Standards	28



## Environmental Characteristics


### Enclosure Requirements

TM3 expansion module 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 these standards, 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 TM3 expansion module 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 TM3 expansion module components. Use enclosures with a keyed locking mechanism to minimize unauthorized access.

### Environmental Characteristics

All the TM3 expansion module components are electrically isolated between the internal electronic circuit and the input/output channels. This equipment meets CE requirements as indicated in the table below. This equipment is intended for use in a Pollution Degree 2 industrial environment.

 <b>WARNING</b>
<b>UNINTENDED EQUIPMENT OPERATION</b>
Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

The following table shows the general environmental characteristics:

Characteristic		Specification
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...35 °C (14...95 °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

Characteristic		Specification
Machine Safety conformance	IEC/EN 61010-2-201	Yes
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...8.5 Hz 29.4 m/s <sup>2</sup> or 96.45 ft/s <sup>2</sup> (3 g <sub>n</sub> ) fixed acceleration from 8.7...150 Hz
Mechanical shock resistance		147 m/s <sup>2</sup> or 482.28 ft/s <sup>2</sup> (15 g <sub>n</sub> ) for a duration of 11 ms

### Electromagnetic Susceptibility

The TM3 expansion module components meets electromagnetic susceptibility specifications as indicated in the following table:

Characteristic	Designed to specification	Range		
Electrostatic discharge	IEC/EN 61000-4-2	8 kV (air discharge) 4 kV (contact discharge)		
Radiated electromagnetic field	IEC/EN 61000-4-3	10 V/m (80...1000 MHz) 3 V/m (1.4...2 GHz) 1 V/m (2...3 GHz)		
Magnetic field	IEC/EN 61000-4-8	30 A/m 50 Hz, 60 Hz		
Fast transients burst	IEC/EN 61000-4-4	–	CM <sup>1</sup> and DM <sup>2</sup>	
		AC/DC Power lines	–	
		Relay Outputs	–	
		24 Vdc I/Os	–	
		Analog I/Os	1 kV	
		Communication line	–	
Surge immunity	IEC/EN 61000-4-5 IEC/EN 61131-2	–	CM <sup>1</sup>	DM <sup>2</sup>
		DC Power lines	1 kV	0.5 kV
		AC Power lines	–	–
		Relay Outputs	–	–
		24 Vdc I/Os	1 kV	–
		Shielded cable (between shield and ground)	–	
Induced electromagnetic field	IEC/EN 61000-4-6	10 Vrms (0.15...80 MHz)		

Characteristic	Designed to specification	Range
Conducted emission	IEC/EN 55011 (IEC/CISPR Publication 11)	AC power line: <ul style="list-style-type: none"> <li>● 0.15...0.5 MHz: 79 dB<math>\mu</math>V/m QP / 66 dB<math>\mu</math>V/m AV</li> <li>● 0.5...300 MHz: 73 dB<math>\mu</math>V/m QP / 60 dB<math>\mu</math>V/m AV</li> </ul>
		AC/DC power line: <ul style="list-style-type: none"> <li>● 10...150 kHz: 120...69 dB<math>\mu</math>V/m QP</li> <li>● 150...1500 kHz: 79...63 dB<math>\mu</math>V/m QP</li> <li>● 1.5...30 MHz: 63 dB<math>\mu</math>V/m QP</li> </ul>
Radiated emission	IEC/EN 55011 (IEC/CISPR Publication 11)	Class A, 10 m distance: <ul style="list-style-type: none"> <li>● 30...230 MHz: 40 dB<math>\mu</math>V/m QP</li> <li>● 230...1000 MHz: 47 dB<math>\mu</math>V/m QP</li> </ul>
1 Common Mode 2 Differential Mode		

## Certifications and Standards

### Introduction

The TM3 expansion modules are designed to conform to the main national and international standards concerning electronic industrial control devices:

- IEC/EN 61131-2
- UL 508

The TM3 have obtained the following conformity marks:

- CE
- UL/CSA
- EAC
- RCM
- cCSAus Hazardous Location

For product compliance and environmental information (RoHS, REACH, PEP, EOLI, etc.), go to [www.schneider-electric.com/green-premium](http://www.schneider-electric.com/green-premium).

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## Section 2.2

### TM3 Expansion Module Installation

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#### What Is in This Section?

This section contains the following topics:

Topic	Page
Installation and Maintenance Requirements	30
Installation Guidelines	33
Assembling a Module to a Controller or Receiver Module	34
Top Hat Section Rail (DIN rail)	36
Disassembling a Module from a Controller or Receiver Module	40
Direct Mounting on a Panel Surface	41

## 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**, refer to **Product Related Information** in 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 UL-recognized and CSA approved.



## Installation Guidelines

### Introduction

TM3 expansion modules are assembled by connecting them to a logic controller or receiver module.

The logic controller or receiver module and their expansion modules can be installed on a top hat section rail (DIN rail).

### Mounting Position and Minimum Clearances

The mounting position and minimum clearances of the expansion modules must conform with the rules defined for the appropriate hardware system. Refer to the *Installation chapter* in the *Controller Hardware* documentation for your specific controller.

## WARNING

### 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 in accordance with the specifications in the related documentation.

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

## Assembling a Module to a Controller or Receiver Module

### Introduction

This section describes how to assemble an expansion module to a controller, Receiver module or other modules.

#### 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.**

After connecting new modules to the controller, either directly or through a transmitter/receiver, update and reupload your application program before placing the system back in service. If you do not revise your application program to reflect the addition of new modules, I/O located on the expansion bus may no longer operate normally.

#### 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.**

### Assembling a Module to a Controller or Receiver Module

The following procedure shows how to assemble a controller or receiver module and a module together.

Step	Action
1	Remove all power and dismount any existing controller I/O assembly from its DIN mounting.
2	Remove the expansion connector sticker from the controller or the outermost installed expansion module.
3	Verify that the locking device on the new module is in the upper position.
4	Align the internal bus connector on the left side of the module with the internal bus connector on the right side of the controller, Receiver module or expansion module.
5	Press the new module towards the controller, Receiver module or expansion module until it is securely in place.
6	Push down the locking device on the top of the new module to lock it to the controller, Receiver module or previously installed expansion module.

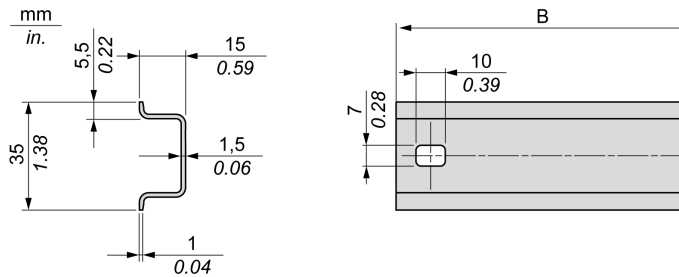
## Top Hat Section Rail (DIN rail)

### Dimensions of Top Hat Section Rail DIN Rail

You can mount the controller or receiver and its expansions on a 35 mm (1.38 in.) top hat section rail (DIN rail). It can be attached to a smooth mounting surface or suspended from a EIA rack or mounted in a NEMA cabinet.

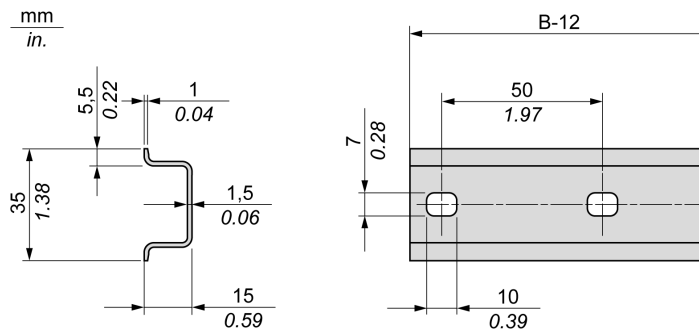
### Symmetric Top Hat Section Rails (DIN Rail)

The following illustration and table show the references of the top hat section rails (DIN rail) for the wall-mounting range:



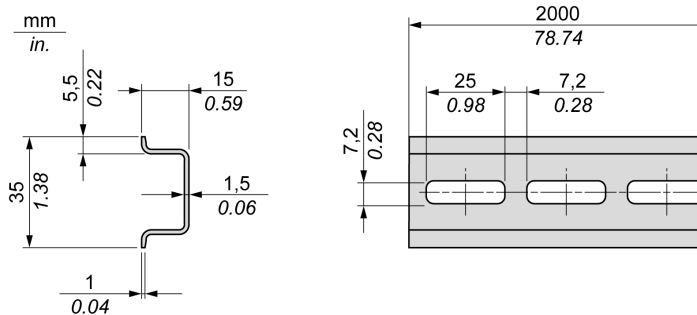
Reference	Type	Rail Length (B)
NSYSDR50A	A	450 mm (17.71 in.)
NSYSDR60A	A	550 mm (21.65 in.)
NSYSDR80A	A	750 mm (29.52 in.)
NSYSDR100A	A	950 mm (37.40 in.)

The following illustration and table show the references of the symmetric top hat section rails (DIN rail) for the metal enclosure range:



Reference	Type	Rail Length (B-12 mm)
NSYSDR60	A	588 mm (23.15 in.)
NSYSDR80	A	788 mm (31.02 in.)
NSYSDR100	A	988 mm (38.89 in.)
NSYSDR120	A	1188 mm (46.77 in.)

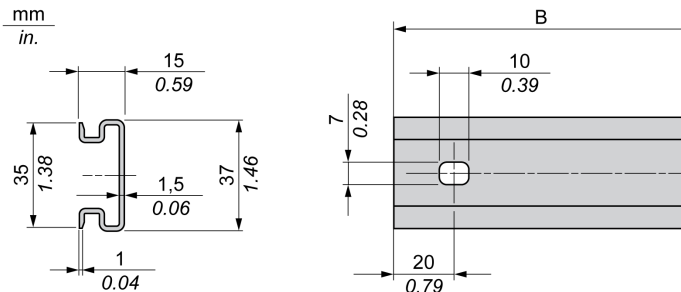
The following illustration and table shows the references of the symmetric top hat section rails (DIN rail) of 2000 mm (78.74 in.):



Reference	Type	Rail Length
NSYSDR200 <sup>1</sup>	A	2000 mm (78.74 in.)
NSYSDR200D <sup>2</sup>	A	
<b>1</b> Unperforated galvanized steel <b>2</b> Perforated galvanized steel		

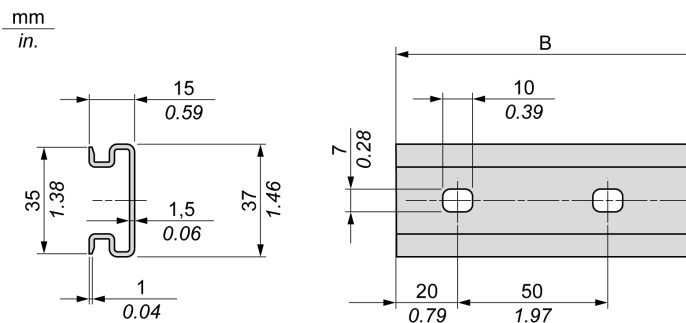
### Double-Profile Top Hat Section Rails (DIN rail)

The following illustration and table show the references of the double-profile top hat section rails (DIN rails) for the wall-mounting range:



Reference	Type	Rail Length (B)
NSYDPR25	W	250 mm (9.84 in.)
NSYDPR35	W	350 mm (13.77 in.)
NSYDPR45	W	450 mm (17.71 in.)
NSYDPR55	W	550 mm (21.65 in.)
NSYDPR65	W	650 mm (25.60 in.)
NSYDPR75	W	750 mm (29.52 in.)

The following illustration and table show the references of the double-profile top hat section rails (DIN rail) for the floor-standing range:




Reference	Type	Rail Length (B)
NSYDPR60	F	588 mm (23.15 in.)
NSYDPR80	F	788 mm (31.02 in.)
NSYDPR100	F	988 mm (38.89 in.)
NSYDPR120	F	1188 mm (46.77 in.)

## Disassembling a Module from a Controller or Receiver Module

### Introduction

This section describes how to disassemble a module from a controller or receiver module.


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.**

### Disassembling a Module from a Controller or Receiver Module

The following procedure describes how to disassemble a module from a controller or receiver module.

Step	Action
1	Remove all power from the control system.
2	Dismount the assembled controller and modules from the mounting rail.
3	Push up the locking device ( <i>see page 20</i> ) from the bottom of the module to disengage it from the controller or receiver module.
4	Pull apart module from the controller or receiver module.



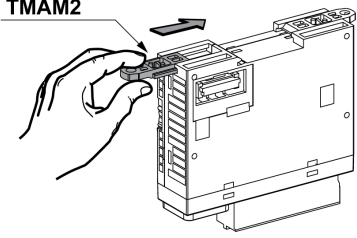
## Direct Mounting on a Panel Surface

### Overview

This section shows how to install TM3 expansion module using the Panel Mounting Kit. This section also provides mounting hole layout for all modules.

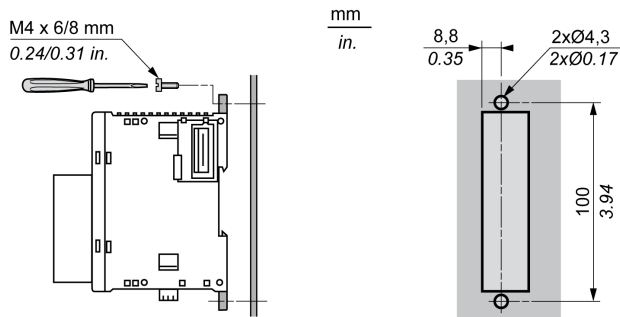
### Installing the Panel Mount Kit

The following procedure shows how to install a mounting strip:

Step	Action
1	<p>Insert the mounting strip TMAM2 into the slot at the top of the module.</p> 

### Mounting Hole Layout

The following diagram shows the mounting holes for TM3 with 2, 4 and 8 screw or spring I/Os channels:



## Section 2.3

### TM3 Electrical Requirements

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#### Wiring Best Practices

##### Overview

This section describes the wiring guidelines and associated best practices to be respected when using the TM3 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**

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.<sup>1</sup>
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

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

<sup>1</sup> 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.

**Functional Ground (FE) on the DIN Rail**

The DIN Rail for your TM3 system is common with the functional ground (FE) plane and must be mounted on a conductive backplane.

 **WARNING****UNINTENDED EQUIPMENT OPERATION**

Connect the DIN rail to the functional ground (FE) of your installation.

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


**Protective Ground (PE) on the Backplane**

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

### Wiring Guidelines

The following rules must be applied when wiring a TM3 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.
- Use twisted-pair, shielded cables for analog, and/or fast I/O.
- Use twisted-pair, shielded cables for networks, and field bus.

 **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 point<sup>1</sup>.
- Route communications and I/O cables separately from power cables.










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

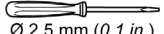

<sup>1</sup>Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short-circuit currents.

**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.

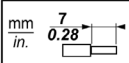








### Rules for Removable Screw Terminal Block

The following tables show the cable types and wire sizes for a **3.81 pitch** removable screw terminal block (I/Os and power supply):

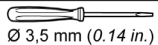

mm in.									
mm <sup>2</sup>		0.14...1.5	0.14...1.5	0.25...1.5	0.25...0.5	2 x 0.14...0.5	2 x 0.14...0.75	2 x 0.25...0.34	2 x 0.5
AWG		26...16	26...16	22...16	22...20	2 x 26...20	2 x 26...20	2 x 24...22	2 x 20

		<b>N•m</b>	0.28
Ø 2,5 mm (0.1 in.)		<b>lb-in</b>	2.48

The following tables show the cable types and wire sizes for a **5.08 pitch** removable screw terminal block (I/Os and power supply):

								
mm <sup>2</sup>	0.2...2.5	0.2...2.5	0.25...2.5	0.25...2.5	2 x 0.2...1	2 x 0.2...1.5	2 x 0.25...1	2 x 0.5...1.5
AWG	24...14	24...14	23...14	23...14	2 x 24...17	2 x 24...16	2 x 23...17	2 x 20...16

		N•m	0.49
Ø 3,5 mm (0.14 in.)		lb-in	4.34

The use of copper conductors is required.

**⚠ DANGER**

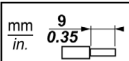




**FIRE HAZARD**

- 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 mm<sup>2</sup> (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 mm<sup>2</sup> (AWG 16) with a temperature rating of at least 80 °C (176 °F).

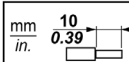





**Failure to follow these instructions will result in death or serious injury.**

### Rules for Removable Spring Terminal Block

The following tables show the cable types and wire sizes for a **3.81 pitch** removable spring terminal block (I/Os and power supply):

				
mm <sup>2</sup>	0.5...1.5	0.5...1.5	0.25...1.0	0.25...0.5
AWG	21...16	21...16	23...18	23...21

The following tables show the cable types and wire sizes for a **5.08 pitch** removable spring terminal block (I/Os and power supply):

					
mm <sup>2</sup>	0.2...2.5	0.2...2.5	0.25...2.5	0.25...2.5	2 x 0.5...1
AWG	24...14	24...14	23...14	23...14	2 x 20...17

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 mm<sup>2</sup> (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 mm<sup>2</sup> (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 terminal block unless using a double wire cable end (ferrule).

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

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## Part II

### TM3 Analog Input Modules

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#### What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
3	TM3AI2H / TM3AI2HG Module 2 Inputs	49
4	TM3AI4 / TM3AI4G Module 4 Inputs	57
5	TM3AI8 / TM3AI8G Module 8 Inputs	65
6	TM3TI4 / TM3TI4G Module 4 Inputs	73
7	TM3TI4D / TM3TI4DG Module 4 Inputs	83
8	TM3TI8T / TM3TI8TG Module 8 Inputs	93





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# Chapter 3

## TM3AI2H / TM3AI2HG Module 2 Inputs

---

### Overview

This chapter describes the TM3AI2H / TM3AI2HG expansion modules, its characteristics, and its connection to the different sensors.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3AI2H / TM3AI2HG Presentation	50
TM3AI2H / TM3AI2HG Characteristics	52
TM3AI2H / TM3AI2HG Wiring Diagram	55

## TM3AI2H / TM3AI2HG Presentation

### Overview

TM3AI2H (screw) and TM3AI2HG (spring) analog expansion modules:

- 2 channels 16 bits (Voltage, current)
- Removable screw and spring terminal block

### Main Characteristics

Characteristic		Value
Number of input channels		2 inputs
Rated power supply		24 Vdc
Signal type		Voltage                              Current
Input range		0...10 Vdc                              0...20 mA -10...+10 Vdc                         4...20 mA
Resolution		16 bits, or 15 bits + sign
Connection type	TM3AI2H	Removable screw terminal block
	TM3AI2HG	Removable spring terminal block
Cable type and length	Type	Twisted pair shielded
	Length	Max. 30 m (98 ft)
Weight	TM3AI2H	115 g (4.05 oz)
	TM3AI2HG	100 g (3.52 oz)

## Status LEDs

The following figure shows the status LEDs:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Indicates that TM3 bus power is applied.
		Off	Indicates that TM3 bus power is removed.

## TM3AI2H / TM3AI2HG Characteristics

### Introduction

This section provides a general description of the characteristics of the TM3AI2H / TM3AI2HG expansion modules.

See also Environmental Characteristics (*see page 25*).

### ⚠ WARNING

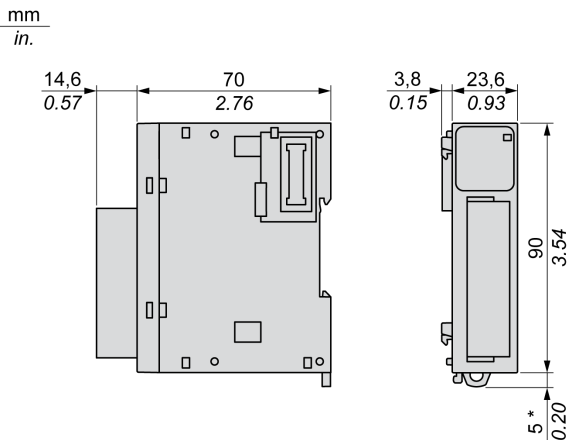
#### UNINTENDED EQUIPMENT OPERATION

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.**

### Dimensions

The following diagrams show the external dimensions for the TM3AI2H / TM3AI2HG expansion modules:



**NOTE:** \*8.5 mm (0.33 in.) when the clamp is pulled out.

## General Characteristics

Characteristics	Value
Rated power supply voltage	24 Vdc
Power supply range	20.4...28.8 Vdc
Connector insertion/removal durability	100 times minimum
Current draw on 5 Vdc internal bus	30 mA (no load) 30 mA (full load)
Current draw on 24 Vdc internal bus	0 mA
Current draw on external 24 Vdc	25 mA (no load) 25 mA (full load)

## Input Characteristics

The following table describes the input characteristics of the TM3AI2H / TM3AI2HG expansion modules:

Characteristics	Value	
	Voltage input	Current input
Input range	0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA
Input impedance	1 M $\Omega$ min	50 $\Omega$ max
Sample duration time	1 ms per enabled channel	
Input type	Single-ended input	
Operating mode	Self-scan	
Conversion mode	Sigma delta ADC	
Max accuracy at ambient 25 °C (77 °F)	$\pm 0.1$ % of full scale	
Temperature drift	$\pm 0.006$ % of full scale	
Repeatability after stabilization time	$\pm 0.5$ % of full scale	
Nonlinearity	$\pm 0.01$ % of full scale	
Maximum input deviation	$\pm 1.0$ % of full scale	
Resolution	16 bits, or 15 bits + sign (65536 points)	
Input value of LSB	0.153 mV (range 0...10 Vdc) 0.305 mV (range -10...+10 Vdc)	0.305 $\mu$ A (range 0...20 mA) 0.244 $\mu$ A (range 4...20 mA)
Data type in application program	Scalable from -32768 to 32767	
Input data out of range detection	Yes	

Characteristics		Value	
		Voltage input	Current input
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring	
	Cable	Twisted-pair shielded cable, max 30 m	
	Crosstalk	1 LSB max	
Isolation	Between external power supply and inputs	1500 Vac	
	Between inputs and internal logic circuits	500 Vac	
Maximum continuous allowed overload (no damage)		13 Vdc	40 mA
Input filter		Software filter: 0...10 s (per 0.01 s unit)	
Behavior when external power is off		Input value is 0 The External power supply error status bit in the controller is ON.	

## TM3AI2H / TM3AI2HG Wiring Diagram

### Introduction

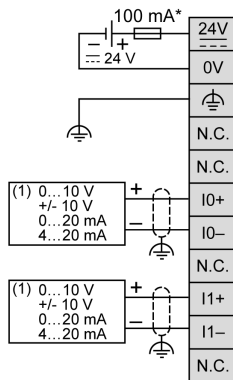
This expansion module has a built-in removable screw terminal block for the connection of inputs and power supply.

### Wiring Rules

See Wiring Best Practices (*see page 42*).

### Wiring Diagram

The following figure illustrates the connection between the inputs, the sensors, and their commons:



\* Type T fuse

(1) Current/Voltage analog output device

## **⚠ 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.**





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# Chapter 4

## TM3AI4 / TM3AI4G Module 4 Inputs

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### Overview

This chapter describes the TM3AI4 / TM3AI4G expansion modules, its characteristics, and its connection to the different sensors.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3AI4 / TM3AI4G Presentation	58
TM3AI4 / TM3AI4G Characteristics	60
TM3AI4 / TM3AI4G Wiring Diagram	63

## TM3AI4 / TM3AI4G Presentation

### Overview

TM3AI4 (screw) and TM3AI4G (spring) analog expansion modules:

- 4 channels 12 bits (Voltage, current)
- Removable screw or spring terminal block

### Main Characteristics

Characteristic		Value
Number of input channels		4 inputs
Rated power supply		24 Vdc
Signal type		Voltage                      Current
Input range		0...10 Vdc                      0...20 mA -10...+10 Vdc                      4...20 mA
Resolution		12 bits, or 11 bits + sign
Connection type	TM3AI4	Removable screw terminal block
	TM3AI4G	Removable spring terminal block
Cable type and length	Type	Twisted pair shielded
	Length	Max. 30 m (98 ft)
Weight	TM3AI4	110 g (4.05 oz)
	TM3AI4G	100 g (3.52 oz)

## Status LEDs

The following figure shows the status LEDs:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Indicates that TM3 bus power is applied.
		Off	Indicates that TM3 bus power is removed.

## TM3AI4 / TM3AI4G Characteristics

### Introduction

This section describes the general characteristics of the TM3AI4 / TM3AI4G expansion modules. See also Environmental Characteristics (*see page 25*).

### ⚠ WARNING

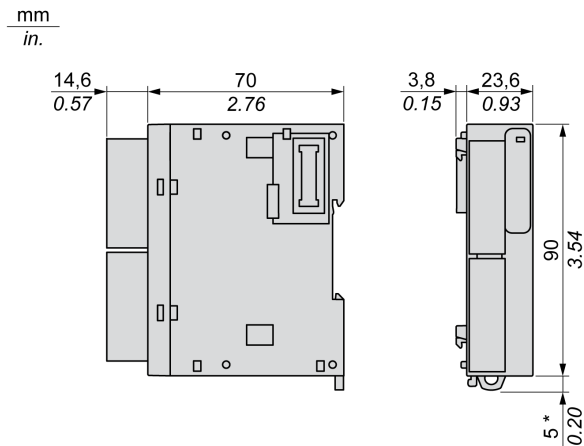
#### UNINTENDED EQUIPMENT OPERATION

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.**

### Dimensions

The following diagrams show the external dimensions for the TM3AI4 / TM3AI4G expansion modules:



**NOTE:** \* 8.5 mm (0.33 in.) when the clamp is pulled out.

## General Characteristics

Characteristics	Value
Rated power supply voltage	24 Vdc
Power supply range	20.4...28.8 Vdc
Connector insertion/removal durability	100 times minimum
Current draw on 5 Vdc internal bus	40 mA (no load) 40 mA (full load)
Current draw on 24 Vdc internal bus	0 mA
Current draw on external 24 Vdc	30 mA (no load) 30 mA (full load)

## Input Characteristics

The following table describes the input characteristics of the TM3AI4 / TM3AI4G expansion modules:

Characteristics	Value	
	Voltage input	Current input
Input range	0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA
Input impedance	1 M $\Omega$ min	50 $\Omega$ max
Sample duration time	1 ms per enabled channel	
Input type	Single-ended input	
Operating mode	Self-scan	
Conversion mode	Sigma delta ADC	
Max accuracy at ambient 25 °C (77 °F)	$\pm 0.2$ % of full scale	
Temperature drift	$\pm 0.01$ % of full scale	
Repeatability after stabilization time	$\pm 0.5$ % of full scale	
Nonlinearity	$\pm 0.2$ % of full scale	
Maximum input deviation	$\pm 1.0$ % of full scale	
Resolution	12 bits, or 11 bits + sign (4096 points)	
Input value of LSB	2.44 mV (range 0...10 Vdc) 4.88 mV (range -10...+10 Vdc)	4.88 $\mu$ A (range 0...20 mA) 3.91 $\mu$ A (range 4...20 mA)
Data type in application program	Scalable from -32768 to 32767	
Input data out of range detection	Yes	

Characteristics		Value	
		Voltage input	Current input
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring	
	Cable	Twisted-pair shielded cable, max 30 m	
	Crosstalk	1 LSB max	
Isolation	Between external power supply and inputs	1500 Vac	
	Between inputs and internal logic circuits	500 Vac	
Maximum continuous allowed overload (no damage)		13 Vdc	40 mA
Input filter		Software filter: 0...10 s (per 0.01 s unit)	
Behavior when external power is off		Input value is 0 The External power supply error status bit in the controller is ON.	

## TM3AI4 / TM3AI4G Wiring Diagram

### Introduction

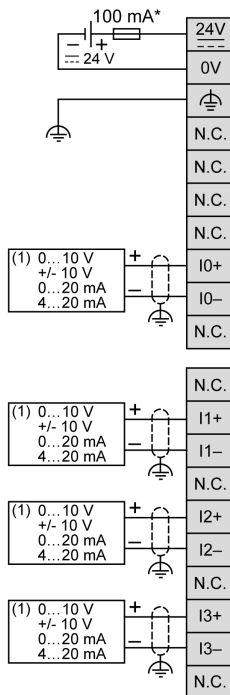
These expansion modules have a built-in removable screw or spring terminal block for the connection of inputs and power supply.

### Wiring Rules

See Wiring Best Practices (*see page 42*).

### Wiring Diagram

The following figure illustrates the connection between the inputs, the sensors, and their commons:



\* Type T fuse

(1) Current/Voltage analog output device

 **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.**



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# Chapter 5

## TM3AI8 / TM3AI8G Module 8 Inputs

---

### Overview

This chapter describes the TM3AI8 / TM3AI8G expansion modules, its characteristics, and its connection to the different sensors.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3AI8 / TM3AI8G Presentation	66
TM3AI8 / TM3AI8G Characteristics	68
TM3AI8 / TM3AI8G Wiring Diagrams	71

## TM3AI8 / TM3AI8G Presentation

### Overview

TM3AI8 (screw) and TM3AI8G (spring) analog expansion modules:

- 8 channels 12 bits (Voltage, current)
- Removable screw or spring terminal block

### Main Characteristics

Characteristic		Value
Number of input channels		8 inputs
Rated power supply		24 Vdc
Signal type		Voltage
Input range		Current
		0...10 Vdc
		-10...+10 Vdc
		0...20 mA
		4...20 mA
		0...20 mA extended
		4...20 mA extended
Resolution		12 bits, or 11 bits + sign
Connection type	TM3AI8	Removable screw terminal block
	TM3AI8G	Removable spring terminal block
Cable type and length	Type	Twisted pair shielded
	Length	Max. 30 m (98 ft)
Weight	TM3AI8	110 g (3.88 oz)
	TM3AI8G	100 g (3.52 oz)

## Status LEDs

The following figure shows the status LEDs:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Indicates that TM3 bus power is applied.
		Off	Indicates that TM3 bus power is removed.

## TM3AI8 / TM3AI8G Characteristics

### Introduction

This section provides a description of the input characteristics of TM3AI8 / TM3AI8G expansion modules.

See also Environmental Characteristics (*see page 25*).

### ⚠ WARNING

#### UNINTENDED EQUIPMENT OPERATION

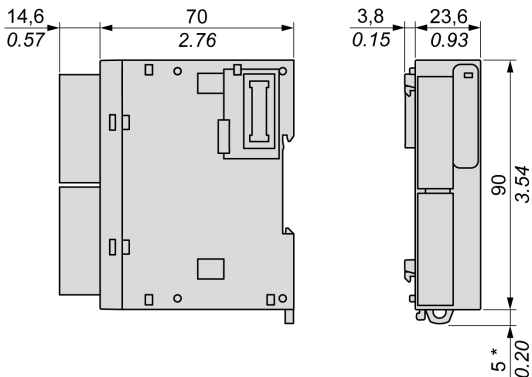
Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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

### Dimensions

The following diagrams show the external dimensions for the TM3AI8 / TM3AI8G expansion modules:

mm  
in.



**NOTE:** \*8.5 mm (0.33 in.) when the clamp is pulled out.

## General Characteristics

Characteristics	Value
Rated power supply voltage	24 Vdc
Power supply range	20.4...28.8 Vdc
Connector insertion/removal durability	100 times minimum
Current draw on 5 Vdc internal bus	35 mA (no load) 35 mA (full load)
Current draw on 24 Vdc internal bus	0 mA
Current draw on external 24 Vdc	30 mA (no load) 40 mA (full load)

## Input Characteristics

The following table describes the input characteristics of the TM3AI8 / TM3AI8G expansion modules:

Characteristics	Value	
	Voltage input	Current input
Input range	0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA 0...20 mA extended 4...20 mA extended
Input impedance	1 M $\Omega$ min	50 $\Omega$ max
Sample duration time	1 ms per enabled channel	
Input type	Single-ended input	
Operating mode	Self-scan	
Conversion mode	Sigma delta ADC	
Max accuracy at ambient 25 °C (77 °F)	$\pm 0.2$ % of full scale	
Temperature drift	$\pm 0.01$ % of full scale	
Repeatability after stabilization time	$\pm 0.5$ % of full scale	
Nonlinearity	$\pm 0.2$ % of full scale	
Maximum input deviation	$\pm 1.0$ % of full scale	
Resolution	12 bits, or 11 bits + sign (4096 points)	
Input value of LSB	2.44 mV (range 0...10 Vdc) 4.88 mV (range -10...+10 Vdc)	4.88 $\mu$ A (range 0...20 mA) 3.91 $\mu$ A (range 4...20 mA)
Data type in application program	Scalable from -32768 to 32767	
Input data out of range detection	Yes	

Characteristics		Value	
		Voltage input	Current input
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring	
	Cable	Twisted-pair shielded cable, max 30 m	
	Crosstalk	1 LSB max	
Isolation	Between external power supply and inputs	1500 Vac	
	Between inputs and internal logic circuits	500 Vac	
Maximum continuous allowed overload (no damage)		13 Vdc	40 mA
Input filter		Software filter: 0...10 s (per 0.01 s unit)	
Behavior when external power is off		Input value is 0 The External power supply error status bit in the controller is ON.	

## TM3AI8 / TM3AI8G Wiring Diagrams

### Introduction

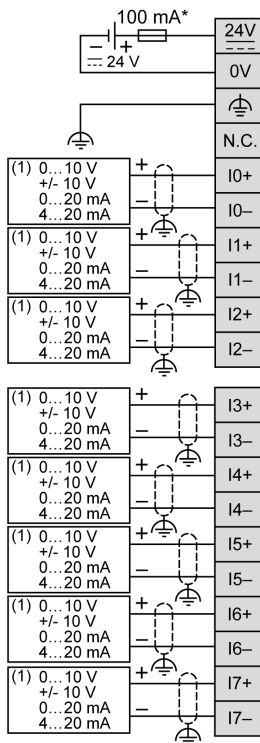
These expansion modules have a built-in removable screw or spring terminal block for the connection of inputs and power supply.

### Wiring Rules

See Wiring Best Practices (*see page 42*).

### Wiring Diagrams

The following figure illustrates the connection between the inputs, the sensors, and their commons:



- \* Type T fuse
- (1) Current/Voltage analog output device

 **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.**



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# Chapter 6

## TM3TI4 / TM3TI4G Module 4 Inputs

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### Overview

This chapter describes the TM3TI4 / TM3TI4G expansion modules, its characteristics, and its connection to the different sensors.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3TI4 / TM3TI4G Presentation	74
TM3TI4 / TM3TI4G Characteristics	76
TM3TI4 / TM3TI4G Wiring Diagram	80

## TM3TI4 / TM3TI4G Presentation

### Overview

TM3TI4 (screw) and TM3TI4G (spring) analog expansion modules:

- 4 channels 16 bits (Voltage, current, isolated thermocouple, 3-wire-RTD)
- Removable screw or spring terminal block

### Main Characteristics

Characteristic	Value			
Number of input channels	4 inputs			
Rated power supply	24 Vdc			
Signal type	Voltage	Current	Thermocouple	3-wire-RTD
Input range	0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA	Type K, J, R, S, B, E, T, N, C	PT100, PT1000, NI100, NI1000
Resolution max	16 bits, or 15 bits + sign (65536 points)			
Connection type	TM3TI4	Removable screw terminal block		
	TM3TI4G	Removable spring terminal block		
Cable type and length	Type	Twisted pair shielded		
	Length	Max. 30 m (98 ft)		
Weight	TM3TI4	110 g (3.88 oz)		
	TM3TI4G	100 g (3.52 oz)		

## Status LEDs

The following figure shows the status LEDs:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Indicates that TM3 bus power is applied.
		Off	Indicates that TM3 bus power is removed.

## TM3TI4 / TM3TI4G Characteristics

### Introduction

This section provides a description of the input characteristics of TM3TI4 / TM3TI4G expansion modules.

See also Environmental Characteristics (*see page 25*).

### ⚠ WARNING

#### UNINTENDED EQUIPMENT OPERATION

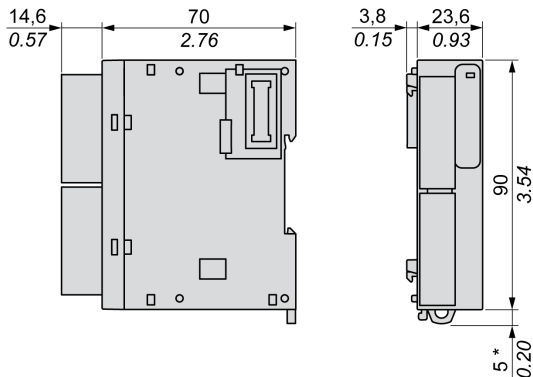
Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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

### Dimensions

The following diagrams show the external dimensions for the TM3TI4 / TM3TI4G expansion modules:

mm  
in.



**NOTE:** \*8.5 mm (0.33 in.) when the clamp is pulled out.

## General Characteristics

Characteristics	Value
Rated power supply voltage	24 Vdc
Power supply range	20.4...28.8 Vdc
Connector insertion/removal durability	100 times minimum
Current draw on 5 Vdc internal bus	40 mA (no load) 40 mA (full load)
Current draw on 24 Vdc internal bus	0 mA
Current draw on external 24 Vdc	35 mA (no load) 40 mA (full load)

## Input Characteristics

The following table describes the input characteristics of the TM3TI4 / TM3TI4G expansion modules:

Characteristics	Value					
	Voltage input	Current input	Thermocouple type		3-wire-RTD	
Input range	0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA	K	-200...1300 °C	PT100	-200...850 °C
				(-328...2372 °F)		(-328...1562 °F)
			J	-200...1000 °C	PT1000	-200...600 °C
				(-328...1832 °F)		(-328...1112 °F)
			R	0...1760 °C	NI100	-60...180 °C
			(32...3200 °F)		(-76...356 °F)	
			S	0...1760 °C	NI 1000	-60...180 °C
			(32...3200 °F)		(-76...356 °F)	
			B	0...1820 °C	-	
(32...3308 °F)						
E	-200...800 °C					
(-328...1472 °F)						
T	-200...400 °C					
(-328...752 °F)						
N	-200...1300 °C					
(-328...2372 °F)						
C	0...2315 °C					
(32...4199 °F)						
Input impedance	1 MΩ min	50 Ω max	1 MΩ min			
Sample duration time (software configurable)	10 ms or 100 ms per enabled channel		100 ms per enabled channel			

Characteristics	Value				
	Voltage input	Current input	Thermocouple type		3-wire-RTD
Input type	Single-ended input. Use only isolated thermocouples. All the shields of the sensor cables must be referenced to the logic controller ground.				
Operating mode	Self-scan				
Conversion mode	Sigma delta ADC				
Max accuracy at ambient 25 °C (77 °F)	±0.2 % of full scale				
	–		Cold junction accuracy ±4.0 °C (±7.2 °F)		–
			except:		
			R S	±6.0 °C (0...200 °C) (±10.8 °F (32...392 °F))	
			B	Not available (0...300 °C (32...572 °F))	
			K J E T N	±0.4 % of full scale under 0 °C (32 °F)	
Temperature drift	±0.01 % of full scale				
Repeatability after stabilization time	±0.5 % of full scale				
Nonlinearity	±0.2 % of full scale				
Maximum input deviation	±1.0 % of full scale				
Resolution	16 bits, or 15 bits + sign (65536 points)		K J R S B E T N C	15000 points 12000 points 17600 points 17600 points 18200 points 10000 points 6000 points 15000 points 23150 points	PT100 PT1000 NI100 NI1000
					10500 points 8000 points 2400 points 2400 points
Input value of LSB	2.44 mV (range 0...10 Vdc) 4.88 mV (range –10...+10 Vdc)	4.88 µA (range 0...20 mA) 3.91 µA (range 4...20 mA)	0.1 °C (0.18 °F)		

Characteristics		Value			
		Voltage input	Current input	Thermocouple type	3-wire-RTD
Data type in application program		Scalable from -32768 to 32767			
Input data out of range detection		Yes			
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring			
	Cable	Twisted-pair shielded cable			
	Crosstalk	1 LSB max			
Isolation	Between external power supply and inputs	1500 Vac			
	Between inputs and internal logic circuits	500 Vac			
	Between inputs	Not isolated			
Maximum continuous allowed overload (no damage)		13 Vdc	40 mA	N/A	
Input filter		Software filter: 0...10 s (per 0.01 s unit)			
Behavior when temperature sensor is broken		N/A		Input value is highest limit value Highest limit flag is ON	
Behavior when external power is off		Input value is 0		Input value is highest limit value	
		The External power supply error status bit in the controller is ON.			

## TM3TI4 / TM3TI4G Wiring Diagram

### Introduction

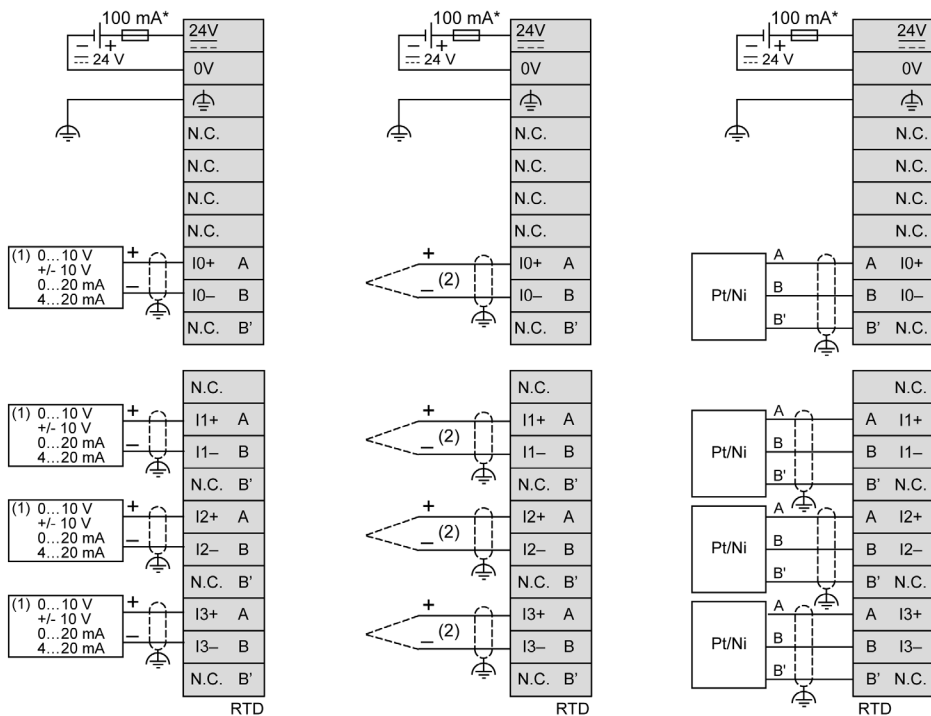
These expansion modules have a built-in removable screw or spring terminal block for the connection of inputs and power supply.

### Wiring Rules

See Wiring Best Practices (*see page 42*).

### Wiring Diagram

The following figure illustrates the connection between the inputs, the sensors, and their commons:



\* Type T fuse

(1) Current/Voltage analog output device

(2) Electrically isolated thermocouple only

RTD (A, B, B'): Resistance Temperature Detector



 **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.**



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# Chapter 7

## TM3TI4D / TM3TI4DG Module 4 Inputs

---

### Overview

This chapter describes the TM3TI4D / TM3TI4DG expansion modules, its characteristics, and its connection to the different sensors.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3TI4D / TM3TI4DG Presentation	84
TM3TI4D / TM3TI4DG Characteristics	86
TM3TI4D / TM3TI4DG Wiring Diagram	90

## TM3TI4D / TM3TI4DG Presentation

### Overview

TM3TI4D (screw) and TM3TI4DG (spring) analog expansion modules:

- 4 channels 16 bits, electrically isolated or non isolated thermocouple
- Removable screw or spring terminal block

### Main Characteristics

Characteristic	Value	
Number of input channels	4 inputs	
Rated power supply	24 Vdc	
Signal type	Electrically isolated or non isolated thermocouple	
Input range	Type K, J, R, S, B, E, T, N, C	
Resolution max	16 bits, or 15 bits + sign (65536 points)	
Connection type	TM3TI4D	Removable screw terminal block
	TM3TI4DG	Removable spring terminal block
Cable type and length	Type	Twisted pair shielded
	Length	Maximum 30 m (98 ft)
Weight	TM3TI4D	110 g (3.88 oz)
	TM3TI4DG	100 g (3.52 oz)

### Status LEDs

The following figure shows the status LEDs:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Indicates that TM3 bus power is applied.
		Off	Indicates that TM3 bus power is removed.

## TM3TI4D / TM3TI4DG Characteristics

### Introduction

This section provides a description of the input characteristics of TM3TI4D / TM3TI4DG expansion modules.

See also Environmental Characteristics (*see page 25*).

### **⚠ WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

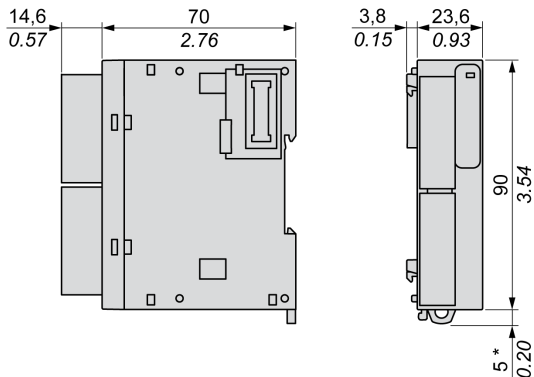
Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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

### Dimensions

The following diagrams show the external dimensions for the TM3TI4D / TM3TI4DG expansion modules:

mm  
in.



**NOTE:** \*8.5 mm (0.33 in.) when the clamp is pulled out.

## General Characteristics

Characteristics	Value
Rated power supply voltage	24 Vdc
Power supply range	20.4...28.8 Vdc
Connector insertion/removal durability	100 times minimum
Current draw on 5 Vdc internal bus	40 mA (no load) 40 mA (full load)
Current draw on 24 Vdc internal bus	0 mA
Current draw on external 24 Vdc	35 mA (no load) 40 mA (full load)

## Input Characteristics

The following table describes the input characteristics of the TM3TI4D / TM3TI4DG expansion modules:

Characteristics	Value	
	Thermocouple type	
Input range	K	-200...1300 °C (-328...2372 °F)
	J	-200...1000 °C (-328...1832 °F)
	R	0...1760 °C (32...3200 °F)
	S	0...1760 °C (32...3200 °F)
	B	0...1820 °C (32...3308 °F)
	E	-200...800 °C (-328...1472 °F)
	T	-200...400 °C (-328...752 °F)
	N	-200...1300 °C (-328...2372 °F)
	C	0...2315 °C (32...4199 °F)
Input impedance	1 MΩ min	
Sample duration time (software configurable)	100 ms per enabled channel	

Characteristics	Value	
	Thermocouple type	
Input type	Single-ended input. Use isolated or non isolated thermocouples. All the shields of the sensor cables must be referenced to the logic controller ground.	
Operating mode	Self-scan	
Conversion mode	Sigma delta ADC	
Max accuracy at ambient 25 °C (77 °F)	±0.2 % of full scale	
	Cold junction accuracy ±4.0 °C (±7.2 °F)	
	except:	
	R S	±6.0 °C (0...200 °C) (±10.8 °F (32...392 °F))
	B	Not available (0...300 °C (32...572 °F))
K J E T N	±0.4 % of full scale under 0 °C (32 °F)	
Temperature drift	±0.01 % of full scale	
Repeatability after stabilization time	±0.5 % of full scale	
Nonlinearity	±0.2 % of full scale	
Maximum input deviation	±1.0 % of full scale	
Resolution	K J R S B E T N C	15000 points 12000 points 17600 points 17600 points 18200 points 10000 points 6000 points 15000 points 23150 points
Input value of LSB	0.1 °C (0.18 °F)	
Data type in application program	Scalable from -32768 to 32767	
Input data out of range detection	Yes	



Characteristics		Value	
		Thermocouple type	
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring	
	Cable	Twisted-pair shielded cable	
	Crosstalk	1 LSB max	
Isolation	Between external power supply and inputs	1500 Vac	
	Between inputs and internal logic circuits	500 Vac	
	Between inputs	250 Vac	
Maximum continuous allowed overload (no damage)		N/A	
Input filter		Software filter: 0...10 s (per 0.01 s unit)	
Behavior when temperature sensor is broken		Input value is highest limit value Highest limit flag is ON	
Behavior when external power is off	Input value is highest limit value		
	The external power supply error status bit in the controller is ON.		

## TM3TI4D / TM3TI4DG Wiring Diagram

### Introduction

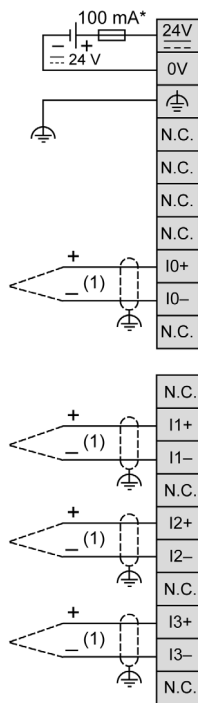
These expansion modules have a built-in removable screw or spring terminal block for the connection of inputs and power supply.

### Wiring Rules

See Wiring Best Practices (*see page 42*).

### Wiring Diagram

The following figure illustrates the connection between the inputs, the sensors, and their commons:



- \* Type T fuse
- (1) Electrically isolated or non isolated thermocouple

 **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.**



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# Chapter 8

## TM3TI8T / TM3TI8TG Module 8 Inputs

---

### Overview

This chapter describes the TM3TI8T / TM3TI8TG expansion modules, its characteristics, and its connection to the different sensors.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3TI8T / TM3TI8TG Presentation	94
TM3TI8T / TM3TI8TG Characteristics	96
TM3TI8T / TM3TI8TG Wiring Diagram	100

## TM3TI8T / TM3TI8TG Presentation

### Overview

TM3TI8T (screw) and TM3TI8TG (spring) analog expansion modules:

- 8 channels 16 bits (thermocouple, thermistor, resistor)
- Removable screw or spring terminal block

### Main Characteristics

Characteristic	Value		
Number of input channels	8 inputs		
Rated power supply	24 Vdc		
Signal type	Thermocouple	Thermistor	Resistor
Input range	Type K, J, R, S, B, E, T, N, C	NTC, PTC	Ohmmeter
Resolution max	16 bits, or 15 bits + sign (65536 points)		
Connection type	TM3TI8T	Removable screw terminal block	
	TM3TI8TG	Removable spring terminal block	
Cable type and length	Type	Twisted pair shielded	
	Length	Max. 30 m (98 ft)	
Weight	TM3TI8T	110 g (3.88 oz)	
	TM3TI8TG	100 g (3.52 oz)	

**Status LEDs**

The following figure shows the status LEDs:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Indicates that TM3 bus power is applied.
		Off	Indicates that TM3 bus power is removed.

## TM3TI8T / TM3TI8TG Characteristics

### Introduction

This section provides a description of the electrical and input/output characteristics of the TM3TI8T / TM3TI8TG expansion modules.

See also Environmental Characteristics (*see page 25*).

### WARNING

#### UNINTENDED EQUIPMENT OPERATION

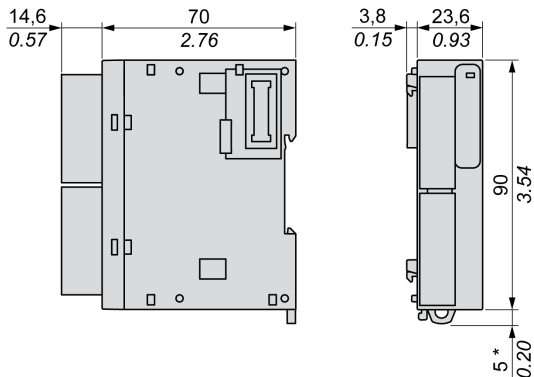
Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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

### Dimensions

The following diagrams show the external dimensions for the TM3TI8T / TM3TI8TG expansion modules:

mm  
in.



**NOTE:** \* 8.5 mm (0.33 in) when the clamp is pulled out.



## General Characteristics

Characteristics	Value
Rated power supply voltage	24 Vdc
Power supply range	20.4...28.8 Vdc
Connector insertion/removal durability	100 times minimum
Current draw on 5 Vdc internal bus	30 mA (no load) 30 mA (full load)
Current draw on 24 Vdc internal bus	0 mA
Current draw on external 24 Vdc	30 mA (no load) 30 mA (full load)

## Input Characteristics

The following table describes the input characteristics of the TM3TI8T / TM3TI8TG expansion modules:

Characteristics	Value				
	Thermocouple type		Thermistor		Resistor
Input range	K	-200...1300 °C (-328...2372 °F)	NTC	Measured resistor range: 100 Ω...200 kΩ Calculated temperature range: -90...150 °C (-130...302 °F)	100 Ω...32 kΩ
	J	-200...1000 °C (-328...1832 °F)			
	R	0...1760 °C (32...3200 °F)			
	S	0...1760 °C (32...3200 °F)			
	B	0...1820 °C (32...3308 °F)			
	E	-200...800 °C (-328...1472 °F)	PTC	100 Ω...10 kΩ	
	T	-200...400 °C (-328...752 °F)			
	N	-200...1300 °C (-328...2372 °F)			
	C	0...2315 °C (32...4199 °F)			
Input impedance	1 MΩ min		1 MΩ min		
Sample duration time	100 ms per enabled channel				
Input type	Single-ended input. Use only isolated thermocouples. All the shields of the sensor cables must be referenced to the logic controller ground.				

Characteristics	Value				
	Thermocouple type		Thermistor		Resistor
Operating mode	Self-scan				
Conversion mode	Sigma delta ADC				
Max accuracy at ambient 25 °C (77 °F)	±0.2 % of full scale Except:		NTC PTC	Value is that of the thermistor used	–
	R	±6 °C at 0...200 °C			
	S	(±10.8 °F at 32...392 °F)			
	B	Not available at 0...300 °C (32...572 °F)			
	K	±0.4 % of full scale under 0 °C (32 °F)			
	J				
	E				
	T				
	N				
Temperature drift	±0.01 % of full scale				
Repeatability after stabilization time	±0.5 % of full scale				
Nonlinearity	±0.2 % of full scale				
Maximum input deviation	±1.0 % of full scale				
Resolution	K	15000 points	NTC	2400 points (–90...150 °C)	31900 points (100...32000 Ω)
	J	12000 points			
	R	17600 points	PTC	9900 points (100...10000 Ω)	
	S	17600 points			
	B	18200 points			
	E	10000 points			
	T	6000 points			
	N	15000 points			
C	23150 points				
Input value of LSB	0.1 °C (0.18 °F)		NTC	1 Ω or 0.1 °C (0.18 °F)	–
			PTC	1 Ω	
Thermistor parameters (configuration per channel)	–		R: 0...65535 (1 Ω /LSB) T: 1...1000 (1 °C/LSB) B: 1...32767 (1 K/LSB)		–
Data type in application program	Scalable from –32768 to 32767				
Input data out of range detection	Yes				

Characteristics		Value		
		Thermocouple type	Thermistor	Resistor
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring		
	Cable	Twisted-pair shielded cable		
	Crosstalk	1 LSB max		
Isolation	Between external power supply and inputs	1500 Vac		
	Between inputs and internal logic circuits	500 Vac		
Maximum continuous allowed overload (no damage)		N/A		
Input filter		Software filter: 0...10 s (per 0.01 s unit)		
Behavior when external power is off		Input value is not relevant The external power supply error status bit in the controller is ON.		

## TM3TI8T / TM3TI8TG Wiring Diagram

### Introduction

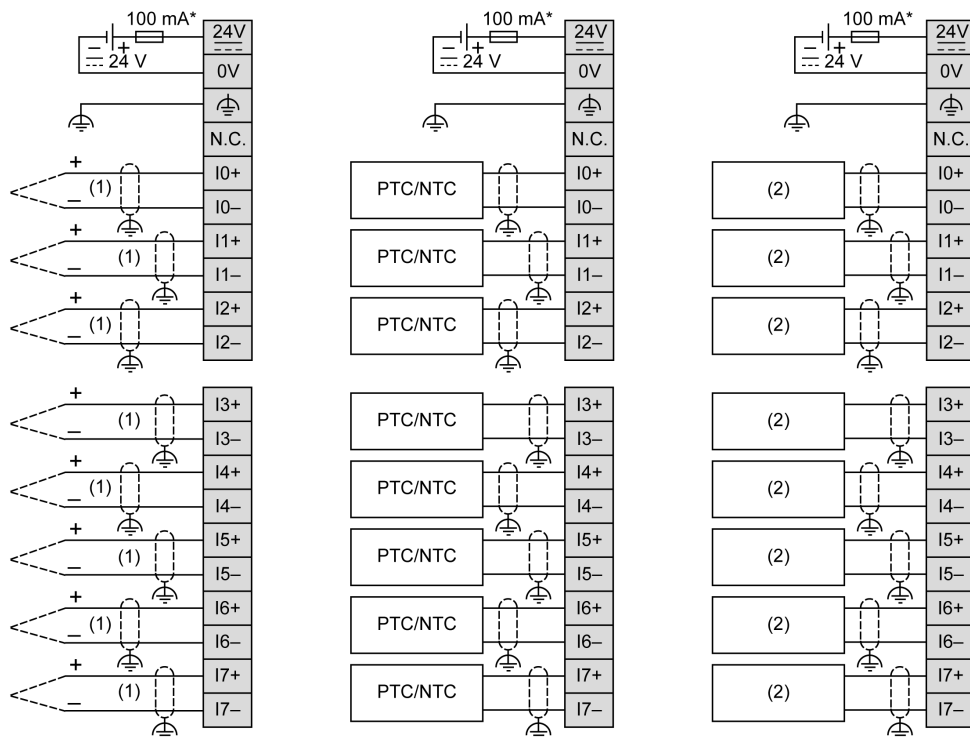
These expansion modules have a built-in removable spring or screw terminal block for the connection of inputs and power supply.

### Wiring Rules

See Wiring Best Practices (*see page 42*).

### Wiring Diagram

The following figure illustrates the connection between the inputs, the sensors, and their commons:



- \* Type T fuse
- (1) Thermocouple
- (2) Resistor

 **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.**



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# Part III

## TM3 Analog Output Modules

---

### What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
9	TM3AQ2 / TM3AQ2G Module 2 Outputs	105
10	TM3AQ4 / TM3AQ4G Module 4 Outputs	113





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# Chapter 9

## TM3AQ2 / TM3AQ2G Module 2 Outputs

---

### Overview

This chapter describes the TM3AQ2 / TM3AQ2G expansion modules, its characteristics, and its connection to the different actuators.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3AQ2 / TM3AQ2G Presentation	106
TM3AQ2 / TM3AQ2G Characteristics	108
TM3AQ2 / TM3AQ2G Wiring Diagram	111

## TM3AQ2 / TM3AQ2G Presentation

### Overview

TM3AQ2 (screw) and TM3AQ2G (spring) analog expansion modules:

- 2 channels 12 bits (Voltage, current)
- Removable screw or spring terminal block

### Main Characteristics

Characteristic		Value
Number of output channels		2 outputs
Rated power supply		24 Vdc
Signal type		Voltage                      Current
Output range		0...10 Vdc                      0...20 mA -10...+10 Vdc                      4...20 mA
Resolution		12 bits, or 11 bits + sign
Connection type	TM3AQ2	Removable screw terminal block
	TM3AQ2G	Removable spring terminal block
Cable type and length	Type	Twisted pair shielded
	Length	Max. 30 m (98 ft)
Weight	TM3AQ2	115 g (4.05 oz)
	TM3AQ2G	100 g (3.52 oz)

**Status LEDs**

The following figure shows the status LEDs:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Indicates that TM3 bus power is applied.
		Off	Indicates that TM3 bus power is removed.

## TM3AQ2 / TM3AQ2G Characteristics

### Introduction

This section provides a description of the power limitation and the output characteristics of the TM3AQ2 / TM3AQ2G expansion modules.

See also Environmental Characteristics (*see page 25*).

### **⚠ WARNING**

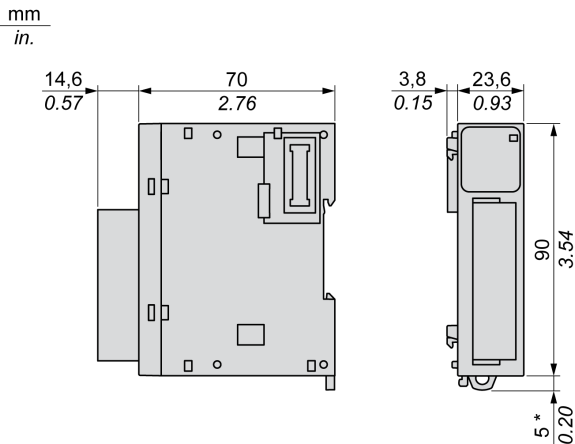
#### **UNINTENDED EQUIPMENT OPERATION**

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.**

### Dimensions

The following diagrams show the external dimensions for the TM3AQ2 / TM3AQ2G expansion modules:



**NOTE:** \* 8.5 mm (0.33 in) when the clamp is pulled out.

## General Characteristics

Characteristics	Value
Rated power supply voltage	24 Vdc
Power supply range	20.4...28.8 Vdc
Connector insertion/removal durability	100 times minimum
Current draw on 5 Vdc internal bus	30 mA (no load) 40 mA (full load)
Current draw on 24 Vdc internal bus	0 mA
Current draw on external 24 Vdc	30 mA (no load) 70 mA (full load)

## Output Characteristics

The table below describes the output characteristics of the TM3AQ2 / TM3AQ2G expansion modules:

Characteristics	Value	
	Voltage output	Current output
Software configurable signal type	Voltage output	Current output
Output range	0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA
Load impedance	1 k $\Omega$ min	300 $\Omega$ max
Application load type	Resistive load	
Settling time	1 ms	
Max accuracy at ambient 25 °C (77 °F)	$\pm 0.1$ % of full scale	
Temperature drift	$\pm 0.006$ % of full scale	
Repeatability after stabilization time	$\pm 0.4$ % of full scale	
Nonlinearity	$\pm 0.01$ % of full scale	
Output ripple	20 mV max	
Overshoot	0 %	
Maximum output deviation	$\pm 1.0$ % of full scale	
Resolution	12 bits, or 11 bits + sign (4096 points)	
Input value of LSB	2.44 mV (range 0...10 Vdc) 4.88 mV (range -10...+10 Vdc)	4.88 $\mu$ A (range 0...20 mA) 3.91 $\mu$ A (range 4...20 mA)
Data type in application program	0...4095 (range 0...10 Vdc) -2048...+2047 (range -10...+10 Vdc)	0...4095
	Scalable from -32768 to 32767	
Input data out of range detection	Yes	

Characteristics		Value	
		Voltage output	Current output
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring	
	Cable	Twisted-pair shielded cable	
	Crosstalk	1 LSB max	
Isolation	Between external power supply and inputs	1500 Vac	
	Between inputs and internal logic circuits	500 Vac	
Output protection		Short- circuit protection	Open-circuit protection
Behavior when external power is off		Input value is 0 The External power supply error status bit in the controller is ON.	

## TM3AQ2 / TM3AQ2G Wiring Diagram

### Introduction

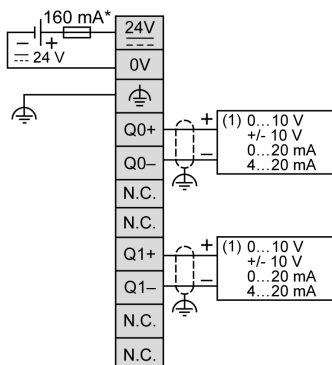
These expansion modules have a built-in removable screw or spring terminal block for the connection of outputs and power supply.

### Wiring Rules

See Wiring Best Practices (*see page 42*).

### Wiring Diagram

The following figure illustrates the connection between the outputs, the actuators, and their commons:



\* Type T fuse

(1) Voltage/current pre-actuator

## **⚠ 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.**





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# Chapter 10

## TM3AQ4 / TM3AQ4G Module 4 Outputs

---

### Overview

This chapter describes the TM3AQ4 / TM3AQ4G expansion modules, its characteristics, and its connection to the different actuators.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3AQ4 / TM3AQ4G Presentation	114
TM3AQ4 / TM3AQ4G Characteristics	116
TM3AQ4 / TM3AQ4G Wiring Diagram	119

## TM3AQ4 / TM3AQ4G Presentation

### Overview

TM3AQ4 (screw) and TM3AQ4G (spring) analog expansion modules:

- 4 channels 12 bits (Voltage, current)
- Removable screw or spring terminal block

### Main Characteristics

Characteristic		Value
Number of output channels		4 outputs
Rated power supply		24 Vdc
Signal type		Voltage                      Current
Output range		0...10 Vdc                      0...20 mA -10...+10 Vdc                      4...20 mA
Resolution		12 bits, or 11 bits + sign
Connection type	TM3AQ4	Removable screw terminal block
	TM3AQ4G	Removable spring terminal block
Cable type and length	Type	Twisted pair shielded
	Length	Max. 30 m (98 ft)
Weight	TM3AQ4	115 g (4.05 oz)
	TM3AQ4G	100 g (3.52 oz)

## Status LEDs

The following figure shows the status LEDs:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Indicates that TM3 bus power is applied.
		Off	Indicates that TM3 bus power is removed.

## TM3AQ4 / TM3AQ4G Characteristics

### Introduction

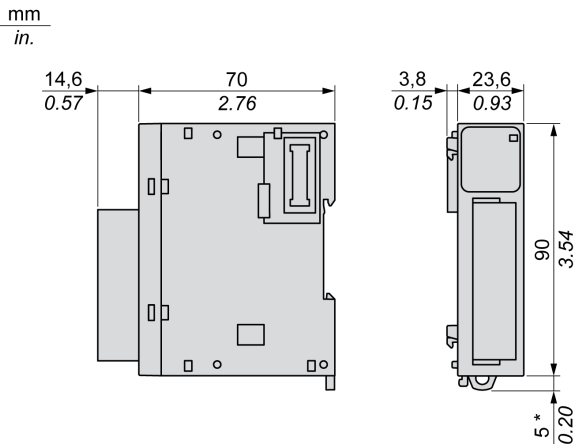
This section provides a description of the output characteristics of the TM3AQ4 / TM3AQ4G expansion modules.

See also Environmental Characteristics (*see page 25*).

<b>⚠ WARNING</b>
<b>UNINTENDED EQUIPMENT OPERATION</b>
Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

### Dimensions

The following diagrams show the external dimensions for the TM3AQ4 / TM3AQ4G expansion modules:



**NOTE:** \* 8.5 mm (0.33 in) when the clamp is pulled out.

## General Characteristics

Characteristics	Value
Rated power supply voltage	24 Vdc
Power supply range	20.4...28.8 Vdc
Connector insertion/removal durability	100 times minimum
Current draw on 5 Vdc internal bus	40 mA (no load) 60 mA (full load)
Current draw on 24 Vdc internal bus	0 mA
Current draw on external 24 Vdc	50 mA (no load) 125 mA (full load)

## Output Characteristics

The table below describes the output characteristics of the TM3AQ4 / TM3AQ4G expansion modules:

Characteristics	Value	
	Voltage output	Current output
Software configurable signal type	Voltage output	Current output
Output range	0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA
Load impedance	1 k $\Omega$ min	300 $\Omega$ max
Application load type	Resistive load	
Settling time	1 ms	
Max accuracy at ambient 25 °C (77 °F)	$\pm 0.2$ % of full scale	
Temperature drift	$\pm 0.01$ % of full scale	
Repeatability after stabilization time	$\pm 0.4$ % of full scale	
Nonlinearity	$\pm 0.2$ % of full scale	
Output ripple	20 mV max	
Overshoot	0 %	
Maximum output deviation	$\pm 1.0$ % of full scale	
Resolution	12 bits, or 11 bits + sign (4096 points)	
Input value of LSB	2.44 mV (range 0...10 Vdc) 4.88 mV (range -10...+10 Vdc)	4.88 $\mu$ A (range 0...20 mA) 3.91 $\mu$ A (range 4...20 mA)
Data type in application program	0...4095 (range 0...10 Vdc) -2048...+2047 (range -10...+10 Vdc)	0...4095
	Scalable from -32768 to 32767	
Input data out of range detection	Yes	

Characteristics		Value	
		Voltage output	Current output
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring	
	Cable	Twisted-pair shielded cable	
	Crosstalk	1 LSB max	
Isolation	Between external power supply and inputs	1500 Vac	
	Between inputs and internal logic circuits	500 Vac	
Output protection		Short-circuit protection	Open-circuit protection
Behavior when external power is off		The External power supply error status bit in the controller is ON.	

## TM3AQ4 / TM3AQ4G Wiring Diagram

### Introduction

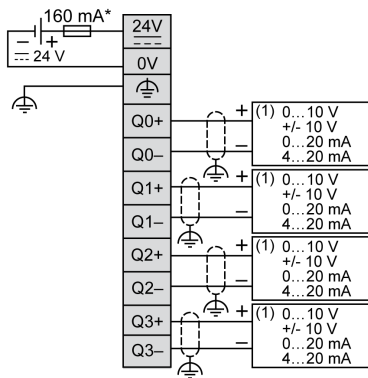
These expansion modules have a built-in removable screw or spring terminal block for the connection of outputs and power supply.

### Wiring Rules

See Wiring Best Practices (*see page 42*).

### Wiring Diagram

The following figure illustrates the connection between the outputs, the actuators, and their commons:



\* Type T fuse

(1) Voltage/current pre-actuator





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# Part IV

## TM3 Analog Mixed Input/Output Modules

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### What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
11	TM3AM6 / TM3AM6G Mixed I/O Module 4 Inputs/2 Outputs	123
12	TM3TM3 / TM3TM3G Mixed I/O Module 2 Inputs/1 Output	131



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# Chapter 11

## TM3AM6 / TM3AM6G Mixed I/O Module 4 Inputs/2 Outputs

---

### Overview

This chapter describes the TM3AM6 / TM3AM6G expansion modules, its characteristics, and its connection to the different sensors and actuators.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3AM6 / TM3AM6G Presentation	124
TM3AM6 / TM3AM6G Characteristics	126
TM3AM6 / TM3AM6G Wiring Diagram	130

## TM3AM6 / TM3AM6G Presentation

### Overview

TM3AM6 (screw) and TM3AM6G (spring) analog expansion modules:

- 4 input channels 12 bits (Voltage, current)
- 2 output channels 12 bits (Voltage, current)
- Removable screw or spring terminal block

### Main Characteristics

Characteristic		Value			
Number of channels		4 inputs		2 outputs	
Rated power supply		24 Vdc			
Signal type		Voltage	Current	Voltage	Current
Input range		0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA	0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA
Resolution		12 bits, or 11 bits + sign			
Connection type	TM3AM6	Removable screw terminal block			
	TM3AM6G	Removable spring terminal block			
Cable type and length	Type	Twisted pair shielded			
	Length	Max. 30 m (98 ft)			
Weight	TM3AM6	110 g (3.88 oz)			
	TM3AM6G	100 g (3.52 oz)			

## Status LEDs

The following figure shows the status LEDs:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Indicates that TM3 bus power is applied.
		Off	Indicates that TM3 bus power is removed.

## TM3AM6 / TM3AM6G Characteristics

### Introduction

This section provides a description of the electrical, the input/output characteristics of the TM3AM6 / TM3AM6G expansion modules.

See also Environmental Characteristics (*see page 25*).

### ⚠ WARNING

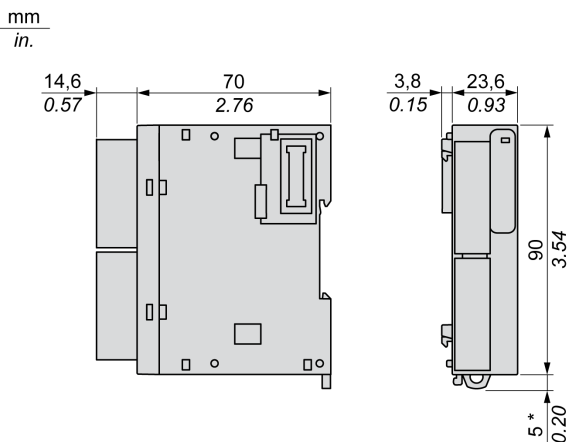
#### UNINTENDED EQUIPMENT OPERATION

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.**

### Dimensions

The following diagrams show the external dimensions for the TM3AM6 / TM3AM6G expansion modules:



**NOTE:** \* 8.5 mm (0.33 in) when the clamp is pulled out.

## General Characteristics

Characteristics	Value
Rated power supply voltage	24 Vdc
Power supply range	20.4...28.8 Vdc
Connector insertion/removal durability	100 times minimum
Current draw on 5 Vdc internal bus	40 mA (no load) 50 mA (full load)
Current draw on 24 Vdc internal bus	0 mA
Current draw on external 24 Vdc	55 mA (no load) 100 mA (full load)

## Input Characteristics

The table below describes the input characteristics of the TM3AM6 / TM3AM6G expansion modules:

Characteristics	Value	
	Voltage input	Current input
Input range	0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA
Input impedance	1 MΩ min	50 Ω max
Sample duration time	Software configurable: 1 ms or 10 ms per channel	
Input type	single-ended input	
Operating mode	Self-scan	
Conversion mode	Sigma delta ADC	
Max accuracy at ambient 25 °C (77 °F)	±0.2 % of full scale	
Temperature drift	±0.01 % of full scale	
Repeatability after stabilization time	±0.5 % of full scale	
Nonlinearity	±0.2 % of full scale	
Maximum input deviation	±1.0 % of full scale	
Resolution	12 bits (4096 points)	
Input value of LSB	2.44 mV (range 0...10 Vdc) 4.88 mV (range -10...+10 Vdc)	4.88 μA (range 0...20 mA) 3.91 μA (range 4...20 mA)
Data type in application program	Scalable from -32768 to 32767	
Input data out of range detection	Yes	

Characteristics		Value	
		Voltage input	Current input
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring	
	Cable	Twisted-pair shielded cable	
	Crosstalk	1 LSB max	
Isolation	Between external power supply and inputs	1500 Vac	
	Between inputs and internal logic circuits	500 Vac	
Maximum continuous allowed overload (no damage)		13 Vdc	40 mA
Input filter		Software filter: 0...10 s (per 0.01 s unit)	
Behavior when external power is off		Input value is 0 The External power supply error status bit in the controller is ON.	

### Output Characteristics

The table below describes the output characteristics of the TM3AM6 / TM3AM6G expansion modules:

Characteristics		Value	
		Voltage output	Current output
Software configurable signal type		Voltage output	Current output
Output range		0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA
Load impedance		1 kΩ min	300 Ω max
Application load time		Resistive load	
Settling time		1 ms	
Max accuracy at ambient 25 °C (77 °F)		±0.2 % of full scale	
Temperature drift		±0.01 % of full scale	
Repeatability after stabilization time		±0.4 % of full scale	



Characteristics		Value	
		Voltage output	Current output
Nonlinearity		±0.2 % of full scale	
Output ripple		20 mV max	
Overshoot		0 %	
Maximum output deviation		±1.0 % of full scale	
Resolution		12 bits (4096 points)	
Input value of LSB		2.44 mV (range 0...10 Vdc) 4.88 mV (range -10...+10 Vdc)	4.88 µA (range 0...20 mA) 3.91 µA (range 4...20 mA)
Data type in application program		0...4095 (range 0...10 Vdc) -2048...+2047 (range -10...+10 Vdc)	0...4095
		Scalable from -32768 to 32767	
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring	
	Cable	Twisted-pair shielded cable	
	Crosstalk	1 LSB max	
Isolation	Between external power supply and inputs	1500 Vac	
	Between inputs and internal logic circuits	500 Vac	
Output protection		Short-circuit protection	Open-circuit protection
Behavior when external power is off		The External power supply error status bit in the controller is ON.	

## TM3AM6 / TM3AM6G Wiring Diagram

### Introduction

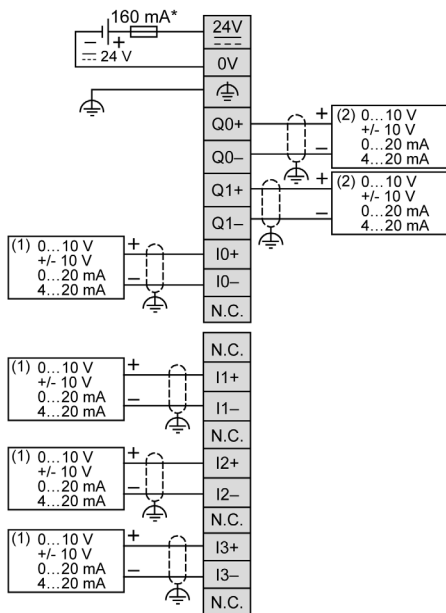
These expansion modules have a built-in removable screw or spring terminal block for the connection of inputs, outputs, and power supply.

### Wiring Rules

See Wiring Best Practices (*see page 42*).

### Wiring Diagram

The following figure illustrates the connections between the inputs and outputs, the sensors and actuators, and their commons:



\* Type T fuse

(1) Current/Voltage analog output device

(2) Current/Voltage analog input device

## **⚠ 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.**

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# Chapter 12

## TM3TM3 / TM3TM3G Mixed I/O Module 2 Inputs/1 Output

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### Overview

This chapter describes the TM3TM3 / TM3TM3G expansion modules, its characteristics, and its connection to the different sensors and actuators.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3TM3 / TM3TM3G Presentation	132
TM3TM3 / TM3TM3G Characteristics	134
TM3TM3 / TM3TM3G Wiring Diagram	139

## TM3TM3 / TM3TM3G Presentation

### Overview

TM3TM3 (screw) and TM3TM3G (spring) analog expansion modules:

- 2 input channels 16 bits (Voltage, current, thermocouple, 3-wire-RTD)
- 1 output channel 12 bits (Voltage, current)
- Removable screw or spring terminal block

### Main Characteristics

Characteristic		Value					
Number of channels		2 inputs			1 output		
Rated power supply		24 Vdc					
Signal type		Voltage	Current	Thermocouple	3-wire-RTD	Voltage	Current
Input range		0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA	Type K, J, R, S, B, E, T, N, C	PT100, PT1000, NI100, NI1000	0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA
Resolution max		16 bits, or 15 bits + sign			12 bits (4096 points)		
Connection type	TM3TM3	Removable screw terminal block					
	TM3TM3G	Removable spring terminal block					
Cable type and length	Type	Twisted pair shielded					
	Length	Max. 30 m (98 ft)					
Weight	TM3TM3	115 g (4.05 oz)					
	TM3TM3G	100 g (3.52 oz)					

### Status LEDs

The following figure shows the status LEDs:



The following table describes the status LEDs:

LED	Color	Status	Description
PWR	Green	On	Indicates that TM3 bus power is applied.
		Off	Indicates that TM3 bus power is removed.

## TM3TM3 / TM3TM3G Characteristics

### Introduction

This section provides a description of the electrical, the input/output characteristics of the TM3TM3 / TM3TM3G expansion modules.

See also Environmental Characteristics (*see page 25*).

### **⚠ WARNING**

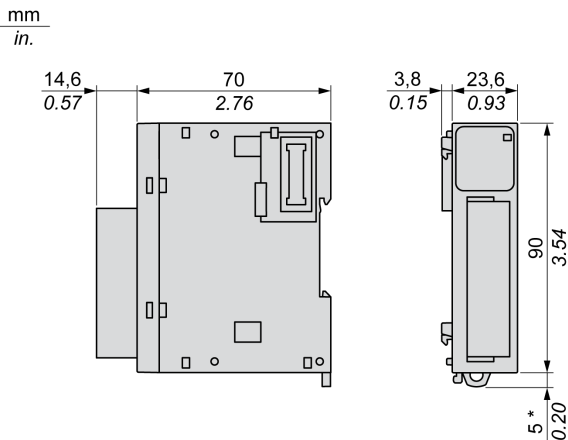
#### **UNINTENDED EQUIPMENT OPERATION**

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.**

### Dimensions

The following diagrams show the external dimensions for the TM3TM3 / TM3TM3G expansion modules:



**NOTE:** \* 8.5 mm (0.33 in) when the clamp is pulled out.

## General Characteristics

Characteristics	Value
Rated power supply voltage	24 Vdc
Power supply range	20.4...28.8 Vdc
Connector insertion/removal durability	100 times minimum
Current draw on 5 Vdc internal bus	55 mA (no load) 60 mA (full load)
Current draw on 24 Vdc internal bus	0 mA
Current draw on external 24 Vdc	55 mA (no load) 80 mA (full load)

## Input Characteristics

The table below describes the input characteristics of the TM3TM3 / TM3TM3G expansion modules:

Characteristics	Value					
	Voltage input	Current input	Thermocouple type		3-wire-RTD	
Input range	0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA	K	-200...1300 °C (-328...2372 °F)	PT100	-200...850 °C (-328...1562 °F)
			J	-200...1000 °C (-328...1832 °F)	PT1000	-200...600 °C (-328...1112 °F)
			R	0...1760 (32...3200 °F)	NI100	-60...180 °C (-76...356 °F)
			S	0...1760 °C (32...3200 °F)	NI1000	-60...180 °C (-76...356 °F)
			B	0...1820 °C (32...3308 °F)		
			E	-200...800 (-328...1472 °F)		
			T	-200...400 °C (-328...752 °F)		
			N	-200...1300 (-328...2372 °F)		
			C	0...2315 °C (32...4199 °F)		
Input impedance	1 MΩ min	50 Ω max	1 MΩ min		1 MΩ min	
Sample duration time	Software configurable: 10 ms or 100 ms per enabled channel		100 ms per enabled channel			
Input type	Single-ended input					

Characteristics	Value					
	Voltage input	Current input	Thermocouple type		3-wire-RTD	
Operating mode	Self-scan					
Conversion mode	Sigma delta ADC					
Max accuracy at ambient 25 °C (77 °F)	±0.1 % of full scale		±0.1 % of full scale Except:		±0.1 % of full scale	
			R	±6 °C at 0...200 °C (±10.8 °F at 32...392 °F)		
			S			
			B	Not available at 0...300 °C (32...572 °F)		
		K	±0.4 % of full scale under 0 °C (32 °F)			
		J				
		E				
		T				
		N				
		C				
Temperature drift	±0.006 % of full scale					
Repeatability after stabilization time	±0.5 % of full scale					
Nonlinearity	±0.1 % of full scale					
Maximum input deviation	±1.0 % of full scale					
Resolution	16 bits, or 15 bits + sign (65536 points)		K	15000 points	PT100	10500 points
			J	12000 points	PT1000	8000 points
			R	17600 points	NI100	2400 points
			S	17600 points	NI1000	2400 points
			B	18200 points		
			E	10000 points		
			T	6000 points		
			N	15000 points		
			C	23150 points		
Input value of LSB	0.15 mV (range 0...10 Vdc) 0.30 mV (range -10...+10 Vdc)	0.30 µA (range 0...20 mA) 0.244 µA (range 4...20 mA)	0.1 °C (0.18 °F)			
Data type in application program	Scalable from -32768 to 32767					
Input data out of range detection	Yes					



Characteristics		Value			
		Voltage input	Current input	Thermocouple type	3-wire-RTD
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring			
	Cable	Twisted-pair shielded cable			
	Crosstalk	1 LSB max			
Isolation	Between external power supply and inputs	1500 Vac			
	Between inputs and internal logic circuits	500 Vac			
Maximum continuous allowed overload (no damage)	13 Vdc	40 mA	N/A		
Input filter	Software filter: 0...10 s (per 0.01 s unit)				
Behavior when temperature sensor is broken	N/A			Input value is highest limit value Highest limit flag is ON	
Behavior when external power is off	Input value is 0			Input value is highest limit value	
	The External power supply error status bit in the controller is ON.				

## Output Characteristics

The table below describes the output characteristics of the TM3TM3 / TM3TM3G expansion modules:

Characteristics		Value	
		Voltage output	Current output
Software configurable signal type		Voltage output	Current output
Output range		0...10 Vdc -10...+10 Vdc	0...20 mA 4...20 mA
Load impedance		1 kΩ min	300 Ω max
Application load time		Resistive load	
Settling time		1 ms	
Max accuracy at ambient 25 °C (77 °F)		±0.1 % of full scale	
Temperature drift		±0.006 % of full scale	
Repeatability after stabilization time		±0.4 % of full scale	
Nonlinearity		±0.01 % of full scale	
Output ripple		20 mV max	
Overshoot		0 %	
Maximum output deviation		±1.0 % of full scale	
Resolution		12 bits (4096 points)	
Input value of LSB		2.44 mV (range 0...10 Vdc) 4.88 mV (range -10...+10 Vdc)	4.88 μA (range 0...20 mA) 3.91 μA (range 4...20 mA)
Data type in application program		0...4095 (range 0...10 Vdc) -2048...+2047 (range -10...+10 Vdc)	0...4095
		Scalable from -32768 to 32767	
Noise resistance	Maximum temporary deviation during perturbations	±4 % maximum when EMC perturbation is applied to the power and I/O wiring	
	Cable	Twisted-pair shielded cable	
	Crosstalk	1 LSB max	
Isolation	Between external power supply and inputs	1500 Vac	
	Between inputs and internal logic circuits	500 Vac	
Output protection		Short-circuit protection	Open-circuit protection
Behavior when external power is off		The External power supply error status bit in the controller is ON.	

## TM3TM3 / TM3TM3G Wiring Diagram

### Introduction

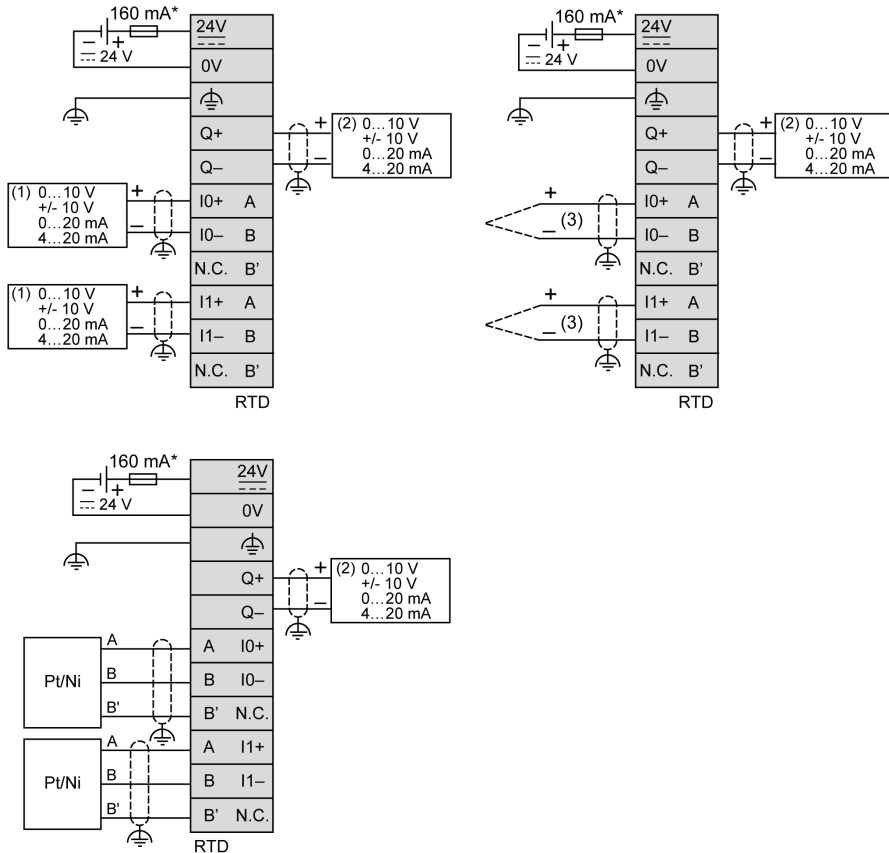
These expansion modules have a built-in removable screw or spring terminal block for the connection of inputs, outputs, and power supply.

### Wiring Rules

See Wiring Best Practices (*see page 42*).

## Wiring Diagram

The following figure illustrates the connections between the inputs and outputs, the sensors and actuators, and their commons:



- \* Type T fuse
- (1) Current/Voltage analog output device
- (2) Current/Voltage analog input device
- (3) Thermocouple

## ⚠ 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.**

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# Glossary

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## A

### **application**

A program including configuration data, symbols, and documentation.

## C

### **controller**

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

## E

### **EIA rack**

*(electronic industries alliance rack)* A standardized (EIA 310-D, IEC 60297, and DIN 41494 SC48D) system for mounting various electronic modules in a stack or rack that is 19 inches (482.6 mm) wide.

### **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*).

### **expansion bus**

An electronic communication bus between expansion I/O modules and a controller.

### **expansion connector**

A connector to attach expansion I/O modules.

## H

### **HE10**

Rectangular connector for electrical signals with frequencies below 3 MHz, complying with IEC 60807-2.

## 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.

### IP 20

(*ingress protection*) The protection classification according to IEC 60529 offered by an enclosure, shown by the letter IP and 2 digits. The first digit indicates 2 factors: helping protect persons and for equipment. The second digit indicates helping protect against water. IP 20 devices help protect against electric contact of objects larger than 12.5 mm, but not against water.

## 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

### program

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

## R

### RJ45

A standard type of 8-pin connector for network cables defined for Ethernet.

## T

### terminal block

(*terminal block*) The component that mounts in an electronic module and provides electrical connections between the controller and the field devices.



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