

# Modicon TM3

## Digital I/O Modules

### Hardware Guide

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As part of a group of responsible, inclusive companies, we are updating our communications that contain non-inclusive terminology. Until we complete this process, however, our content may still contain standardized industry terms that may be deemed inappropriate by our customers.

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# Safety Information

## Important Information

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



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



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

<b>⚠ DANGER</b>
<b>DANGER</b> indicates a hazardous situation which, if not avoided, <b>will result in</b> death or serious injury.
<b>⚠ WARNING</b>
<b>WARNING</b> indicates a hazardous situation which, if not avoided, <b>could result in</b> death or serious injury.
<b>⚠ CAUTION</b>
<b>CAUTION</b> indicates a hazardous situation which, if not avoided, <b>could result in</b> minor or moderate injury.
<b>NOTICE</b>
<b>NOTICE</b> is used to address practices not related to physical injury.

## Please Note

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

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

## Qualification of Personnel

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

The qualified person must be able to detect possible hazards that may arise from parameterization, modifying parameter values and generally from mechanical, electrical, or electronic equipment. The qualified person must be familiar with the standards, provisions, and regulations for the prevention of industrial accidents, which they must observe when designing and implementing the system.

## Intended Use

The products described or affected by this document, together with software, accessories, and options, are 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.



# About the Book

## Document Scope

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

## Validity Note

This document has been updated for the release of EcoStruxure™ Machine Expert V2.0.2.

The technical characteristics of the devices described in the present document also appear online. To access the information online, go to the Schneider Electric home page [www.se.com/ww/en/download/](http://www.se.com/ww/en/download/).

The characteristics that are described in the present document 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 document and online information, use the online information as your reference.

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

## Related Documents

Title of Documentation	Reference Number
Modicon TM3 Expansion Modules Configuration - Programming Guide (EcoStruxure Machine Expert - Basic)	EIO0000003345 (ENG) EIO0000003346 (FRE) EIO0000003347 (GER) EIO0000003348 (SPA) EIO0000003349 (ITA) EIO0000003350 (CHS) EIO0000003351 (POR) EIO0000003352 (TUR)
Modicon TM3 Expansion Modules Configuration - Programming Guide (EcoStruxure Machine Expert)	EIO0000003119 (ENG) EIO0000003120 (FRE) EIO0000003121 (GER) EIO0000003122 (SPA) EIO0000003123 (ITA) EIO0000003124 (CHS)
Modicon M221 Logic Controller - Hardware Guide	EIO0000003313 (ENG) EIO0000003314 (FRE) EIO0000003315 (GER) EIO0000003316 (SPA) EIO0000003317 (ITA) EIO0000003318 (CHS) EIO0000003319 (POR)

Title of Documentation	Reference Number
	EIO0000003320 (TUR)
Modicon M241 Logic Controller - Hardware Guide	EIO0000003083 (ENG) EIO0000003084 (FRE) EIO0000003085 (GER) EIO0000003086 (SPA) EIO0000003087 (ITA) EIO0000003088 (CHS)
Modicon M251 Logic Controller - Hardware Guide	EIO0000003101 (ENG) EIO0000003102 (FRE) EIO0000003103 (GER) EIO0000003104 (SPA) EIO0000003105 (ITA) EIO0000003106 (CHS)
TM3 Digital I/O Modules Instruction Sheet	HRB59605

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

## Product Related Information

### DANGER

#### HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

### DANGER

#### POTENTIAL FOR EXPLOSION

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

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

<b>▲ WARNING</b>
<p><b>LOSS OF CONTROL</b></p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• Separate or redundant control paths must be provided for critical control functions.</li> <li>• System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.</li> <li>• Observe all accident prevention regulations and local safety guidelines.<sup>1</sup></li> <li>• Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

<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.

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

## 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
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2015	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

Standard	Description
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
IEC 62061:2015	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 61784-3:2016	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

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

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

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

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

# TM3 General Overview

## What's in This Part

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# TM3 Description

## What's in This Chapter

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## General Description

### Introduction

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

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

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

- Removable screw terminal blocks
- Removable spring terminal blocks
- HE10 (MIL 20) connectors

For modules with HE10 (MIL 20) connectors, a group of products known as Telefast 2 are available that enable these modules to be quickly connected to sensors and actuators.

### TM3 Digital Input Modules

The following table shows the TM3 digital input expansion modules, page 39, with corresponding channel type, nominal voltage/current, and terminal type:

Reference	Channels	Channel Type	Voltage Current	Terminal Type / Pitch
TM3DI8A, page 40	8	Regular inputs	120 Vac 7.5 mA	Removable screw terminal block / 5.08 mm
TM3DI8, page 44	8	Regular inputs	24 Vdc 7 mA	Removable screw terminal block / 5.08 mm
TM3DI8G, page 44	8	Regular inputs	24 Vdc 7 mA	Removable spring terminal block / 5.08 mm
TM3DI16, page 48	16	Regular inputs	24 Vdc 7 mA	Removable screw terminal blocks / 3.81 mm
TM3DI16G, page 48	16	Regular inputs	24 Vdc 7 mA	Removable spring terminal blocks / 3.81 mm
TM3DI16K, page 53	16	Regular inputs	24 Vdc 5 mA	HE10 (MIL 20) connector
TM3DI32K, page 58	32	Regular inputs	24 Vdc 5 mA	HE10 (MIL 20) connector

### TM3 Digital Output Modules

The following table shows the TM3 digital output expansion modules, page 63, with corresponding channel type, nominal voltage/current, and terminal type:

Reference	Channels	Channel Type	Voltage Current	Terminal Type / Pitch
TM3DQ8R, page 64	8	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	Removable screw terminal block / 5.08 mm
TM3DQ8RG, page 64	8	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	Removable spring terminal block / 5.08 mm
TM3DQ8T, page 69	8	Regular transistor outputs (source)	24 Vdc 4 A maximum per common line/0.5 A maximum per output	Removable screw terminal block / 5.08 mm
TM3DQ8TG, page 69	8	Regular transistor outputs (source)	24 Vdc 4 A maximum per common line/0.5 A maximum per output	Removable spring terminal block / 5.08 mm
TM3DQ8U, page 73	8	Regular transistor outputs (sink)	24 Vdc 4 A maximum per common line/0.5 A maximum per output	Removable screw terminal block / 5.08 mm
TM3DQ8UG, page 73	8	Regular transistor outputs (sink)	24 Vdc 4 A maximum per common line/0.5 A maximum per output	Removable spring terminal block / 5.08 mm
TM3DQ16R, page 77	16	Relay outputs	24 Vdc / 240 Vac 8 A maximum per common line / 2 A maximum per output	Removable screw terminal blocks / 3.81 mm
TM3DQ16RG, page 77	16	Relay outputs	24 Vdc / 240 Vac 8 A maximum per common line / 2 A maximum per output	Removable spring terminal blocks / 3.81 mm
TM3DQ16T, page 82	16	Regular transistor outputs (source)	24 Vdc 8 A maximum per common line / 0.5 A maximum per output	Removable screw terminal blocks / 3.81 mm
TM3DQ16TG, page 82	16	Regular transistor outputs (source)	24 Vdc 8 A maximum per common line / 0.5 A maximum per output	Removable spring terminal blocks / 3.81 mm
TM3DQ16U, page 91	16	Regular transistor outputs (sink)	24 Vdc 8 A maximum per common line / 0.5 A maximum per output	Removable screw terminal blocks / 3.81 mm
TM3DQ16UG, page 91	16	Regular transistor outputs (sink)	24 Vdc 8 A maximum per common line / 0.5 A maximum per output	Removable spring terminal blocks / 3.81 mm
TM3DQ16TK, page 87	16	Regular transistor outputs (source)	24 Vdc 2 A maximum per common line / 0.1 A maximum per output	HE10 (MIL 20) connector
TM3DQ16UK, page 96	16	Regular transistor outputs (sink)	24 Vdc 2 A maximum per common line / 0.1 A maximum per output	HE10 (MIL 20) connector

Reference	Channels	Channel Type	Voltage	Terminal Type / Pitch
			Current	
TM3DQ32TK, page 100	32	Regular transistor outputs (source)	24 Vdc 2 A maximum per common line / 0.1 A maximum per output	HE10 (MIL 20) connectors
TM3DQ32UK, page 105	32	Regular transistor outputs (sink)	24 Vdc 2 A maximum per common line / 0.1 A maximum per output	HE10 (MIL 20) connectors

## TM3 Digital Mixed Input/Output Modules

This following table shows the TM3 mixed I/O modules, page 110, with corresponding channel type, nominal voltage/current, and terminal type:

Reference	Channels	Channel Type	Voltage	Terminal Type / Pitch
			Current	
TM3DM8R, page 111	4	Regular inputs	24 Vdc 7 mA	Removable screw terminal block / 5.08 mm
	4	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	
TM3DM8RG, page 111	4	Regular inputs	24 Vdc 7 mA	Removable spring terminal block / 5.08 mm
	4	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	
TM3DM16R, page 118 <sup>(1)</sup>	8	Regular inputs	24 Vdc 5 mA	Removable screw terminal block / 3.81 mm
	8	Relay outputs	24 Vdc / 240 Vac 4 A maximum per common line / 2 A maximum per output	
TM3DM24R, page 125	16	Regular inputs	24 Vdc 7 mA	Removable screw terminal blocks / 3.81 mm
	8	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	
TM3DM24RG, page 125	16	Regular inputs	24 Vdc 7 mA	Removable spring terminal blocks / 3.81 mm
	8	Relay outputs	24 Vdc / 240 Vac 7 A maximum per common line / 2 A maximum per output	



Reference	Channels	Channel Type	Voltage Current	Terminal Type / Pitch
TM3DM32R, page 132 (1)	16	Regular inputs	24 Vdc 5 mA	Removable screw terminal block / 3.81 mm
	16	Relay outputs	24 Vdc / 240 Vac 4 A maximum per common line / 2 A maximum per output	
(1) This expansion module is available only in selected countries.				

## Physical Description

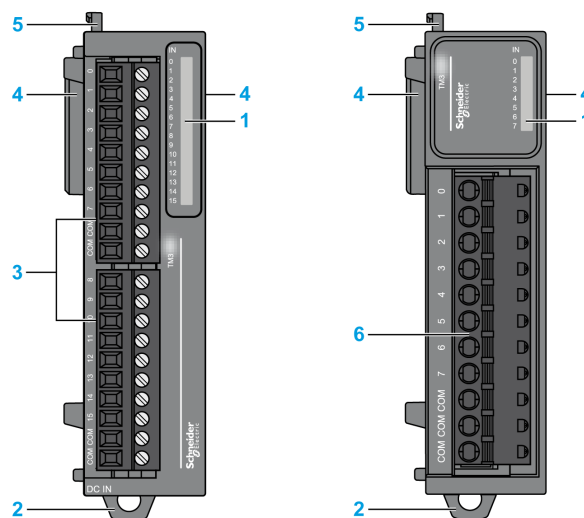
### Introduction

This section describes the physical characteristics of the TM3 modules. The modules, depending on the reference, support one of two different types of connectors:

- Removable screw or spring terminal block
- HE10 (MIL 20) connector

### 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:



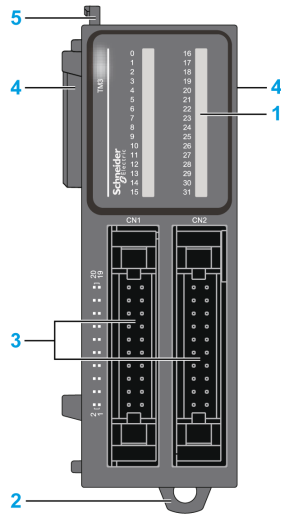
This table describes the main elements of the TM3 expansion modules shown above:

La- bel	Elements	
1	LEDs for displaying the state of the I/O channel.	
2	Clip-on lock for 35 mm (1.38 in.) top hat section rail (DIN-rail).	DIN Rail, page 27
3	Removable terminal block.	Rules for Removable Screw Terminal Block, page 34
4	Expansion connector for TM3 I/O bus (one on each side).	

Label	Elements	
5	Locking device for attachment to the previous module.	
6	Removable terminal block.	Rules for Removable Spring Terminal Block, page 35

### TM3 with HE10 (MIL 20) Connector

The following figure shows the main elements of a TM3 expansion module with HE10 (MIL 20) connector:



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

Label	Elements	
1	LEDs for displaying the state of the I/O channel.	
2	Clip-on lock for 35 mm (1.38 in.) top hat section rail (DIN-rail).	DIN Rail, page 27
3	HE10 (MIL 20) connector socket.	Cable list
4	Expansion connector for TM3 I/O bus (one on each side).	
5	Locking device for attachment to the previous module.	

## Accessories

### Overview

This section describes the accessories, cables, and Telefast.

### 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
NSYTRAAB35	End brackets	Helps secure the 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
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

### Cables

Reference	Description	Details	Length
TWDFCW30K	Digital I/O cables with free wires for 20-pin Modular controller	Cable equipped at a one end with an HE10 connector. (AWG 22 / 0.34 mm <sup>2</sup> ).	3 m (9.84 ft)
TWDFCW50K			5 m (16.4 ft)

### TWDFCW••K Cable Description

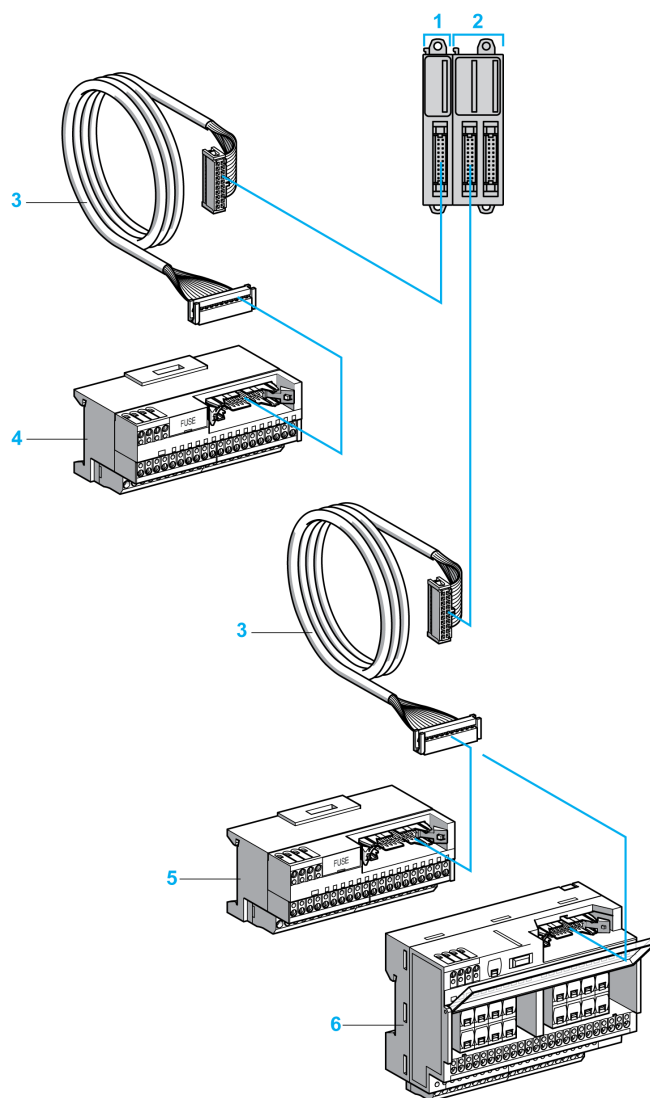
The following table provides specifications for the TWDFCW30K/50K with free wires for 20-pin connectors (HE10 or MIL20):

Cable illustration	Pin Connector	Wire Color
	1	White
	2	Brown
	3	Green
	4	Yellow
	5	Grey
	6	Pink
	7	Blue

Cable illustration	Pin Connector	Wire Color
	8	Red
	9	Black
	10	Violet
	11	Grey and pink
	12	Red and blue
	13	White and green
	14	Brown and green
	15	White and yellow
	16	Yellow and brown
	17	White and grey
	18	Grey and brown
	19	White and pink
	20	Pink and brown

### Telefast Pre-Wiring Sub-bases

The following illustration shows the Telefast system:



**1** TM3DI16K / TM3DI32K

**2** TM3DQ16TK / TM3DQ32TK

**3** Cable equipped with a 20-way HE 10 connector at each end.)

**4** 16 channel sub-base for input extension modules.

**5-6** 16 channel sub-base for output extension modules.

Refer to TM3 Digital I/O Modules Instruction Sheet.

# TM3 Installation

## What's in This Chapter

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 TM3 Expansion Module Installation ..... 24  
 TM3 Electrical Requirements ..... 32

## TM3 General Rules for Implementing

### 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	Minimum Specification	Tested Range	
Standard compliance	IEC/EN 61131-2	-	
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	Minimum Specification	Tested Range	
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)	10 mm (0.39 in) fixed amplitude from 5...8.7 Hz 29.4 m/s <sup>2</sup> (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	
<p><b>NOTE:</b> The tested ranges may indicate values beyond that of the IEC Standard. However, our internal standards define what is necessary for industrial environments. In all cases, we uphold the minimum specification if indicated.</p>			

### Electromagnetic Susceptibility

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

Characteristic	Minimum Specification	Tested Range		
Electrostatic discharge	IEC/EN 61000-4-2	8 kV (air discharge) 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	2 kV	
		24 Vdc I/Os	1 kV	
		Analog I/Os	–	
		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	2 kV	1 kV
		Relay Outputs	2 kV	1 kV
		24 Vdc I/Os	1 kV	–
		Shielded cable (between shield and ground)	1 kV	–
Induced electromagnetic field	IEC/EN 61000-4-6	10 Vrms (0.15...80 MHz)		
Conducted emission	IEC 61000-6-4	AC power line:		
		<ul style="list-style-type: none"> <li>0.15...0.5 MHz: 79 dBµV/m QP / 66 dBµV/m AV</li> <li>0.5...300 MHz: 73 dBµV/m QP / 60 dBµV/m AV</li> </ul>		
		AC/DC power line:		
		<ul style="list-style-type: none"> <li>10...150 kHz: 120...69 dBµV/m QP</li> <li>150...1500 kHz: 79...63 dBµV/m QP</li> <li>1.5...30 MHz: 63 dBµV/m QP</li> </ul>		

Characteristic	Minimum Specification	Tested Range
Radiated emission	IEC 61000-6-4	30...230 MHz: 40 dB $\mu$ V/m QP 230...1000 MHz: 47 dB $\mu$ V/m QP
<b>1</b> Common Mode <b>2</b> Differential Mode <b>NOTE:</b> The tested ranges may indicate values beyond that of the IEC Standard. However, our internal standards define what is necessary for industrial environments. In all cases, we uphold the minimum specification if indicated.		

## Certifications and Standards

### Introduction

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

- IEC/EN 61131-2
- SV  $\geq$  2.0
  - UL 61010-1
  - UL 61010-2-201
- SV < 2.0
  - UL 508
- ANSI/UL 121201
- CSA 22.2 n° 213

The TM3 have obtained the following conformity marks:

- CE
- cULus/CSA
- EAC
- RCM
- cULus/CSA Hazardous Location

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

**NOTE:** Certifications for the TM3DM16R and TM3DM32R expansion modules are pending. The modules, however, are part of the CE Declaration of Conformity.

## TM3 Expansion Module Installation

### Installation and Maintenance Requirements

#### Before Starting

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

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



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

### Disconnecting Power

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

<b>⚡⚠ DANGER</b>
<b>HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH</b>
<ul style="list-style-type: none"> <li>• 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.</li> <li>• Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.</li> <li>• Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.</li> <li>• Use only the specified voltage when operating this equipment and any associated products.</li> </ul>
<b>Failure to follow these instructions will result in death or serious injury.</b>

### Programming Considerations

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

### 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.

<b>⚠ WARNING</b>
<b>UNINTENDED EQUIPMENT OPERATION</b>
Install and operate this equipment according to the conditions described in the Environmental Characteristics.
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

## 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 tooling 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.**

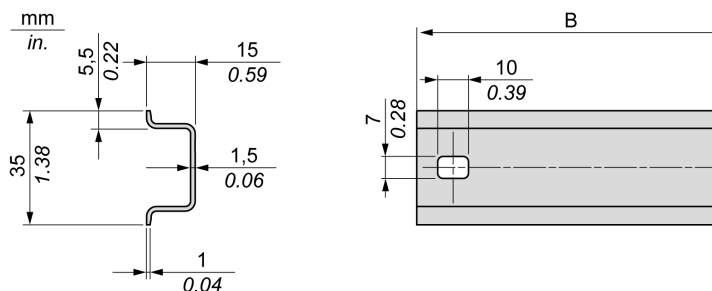
## Top Hat Section Rail (DIN rail)

### Dimensions of Top Hat Section Rail (DIN Rail)

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

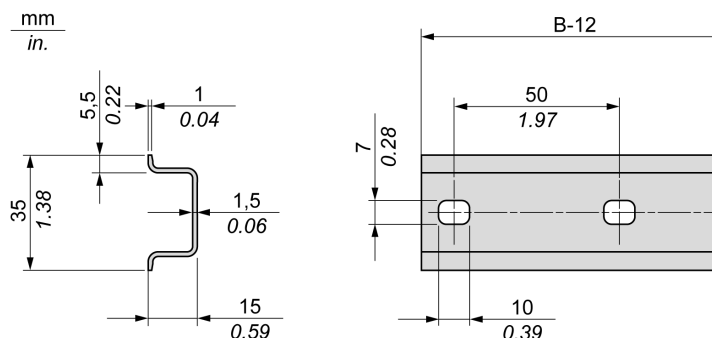
### Symmetric Top Hat Section Rails (DIN Rail)

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



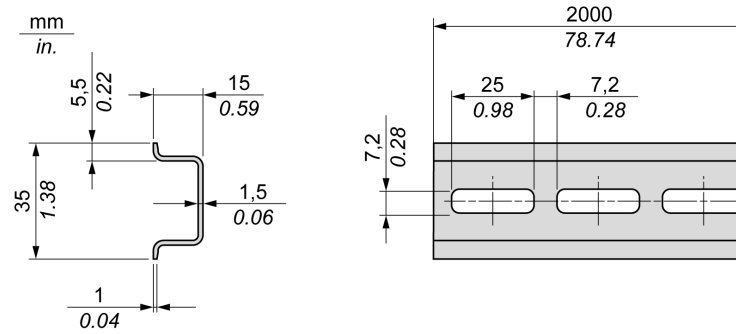
Reference	Type	Rail Length (B)
NSYSDR50A	A	450 mm (17.71 in.)
NSYSDR60A	A	550 mm (21.65 in.)
NSYSDR80A	A	750 mm (29.52 in.)
NSYSDR100A	A	950 mm (37.40 in.)

The following illustration and table indicate 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.)

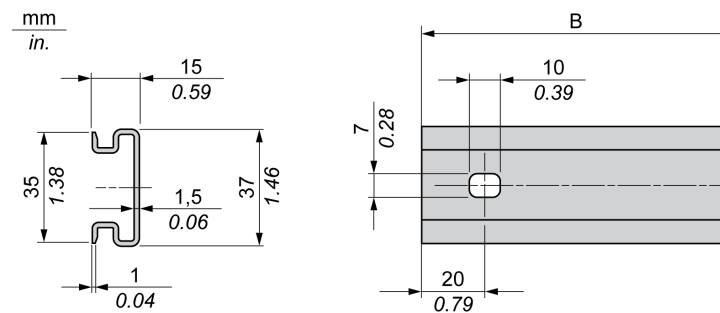
The following illustration and table indicate the references of the symmetric top hat section rails (DIN rail) of 2000 mm (78.74 in.):



Reference	Type	Rail Length
NSYS DR200 <sup>1</sup>	A	2000 mm (78.74 in.)
NSYS DR200D <sup>2</sup>	A	
<sup>1</sup> Unperforated galvanized steel <sup>2</sup> Perforated galvanized steel		

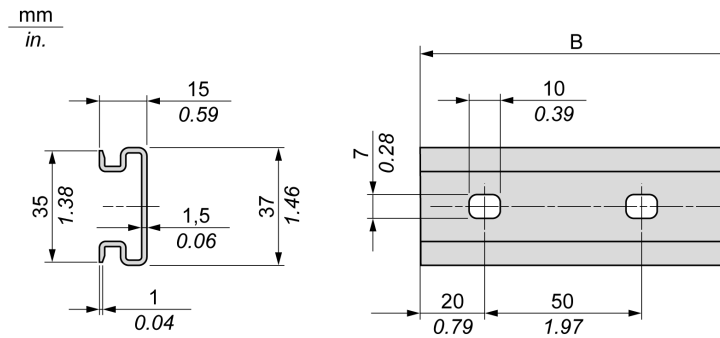
### Double-Profile Top Hat Section Rails (DIN rail)

The following illustration and table indicate 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 indicate 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.)

## 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.

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

### 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 (see Modicon TM3, Transmitter and Receiver Modules, Hardware Guide) 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 (see Modicon TM3, Transmitter and Receiver Modules, Hardware Guide) on the top of the new module to lock it to the controller, Receiver module or previously installed expansion module.

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

#### Introduction

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

<b>⚡⚠ DANGER</b>
<p><b>HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH</b></p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.</li> <li>• Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.</li> <li>• Use only the specified voltage when operating this equipment and any associated products.</li> </ul> <p><b>Failure to follow these instructions will result in death or serious injury.</b></p>

### 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, page 17 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.

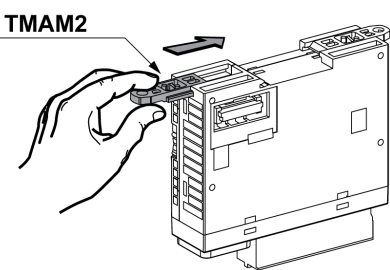
## Direct Mounting on a Panel Surface

### 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.

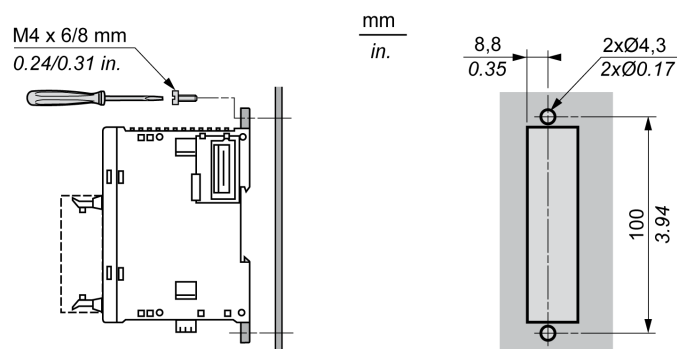
### Installing the Panel Mount Kit

The following procedure shows how to install a mounting strip:

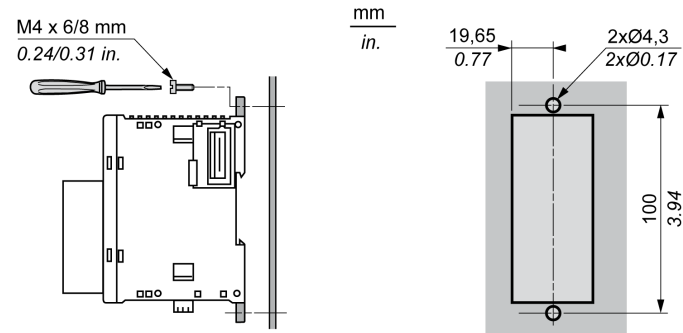
Step	Action
1	Insert the mounting strip TMAM2 into the slot at the top of the module.  

### Mounting Hole Layout

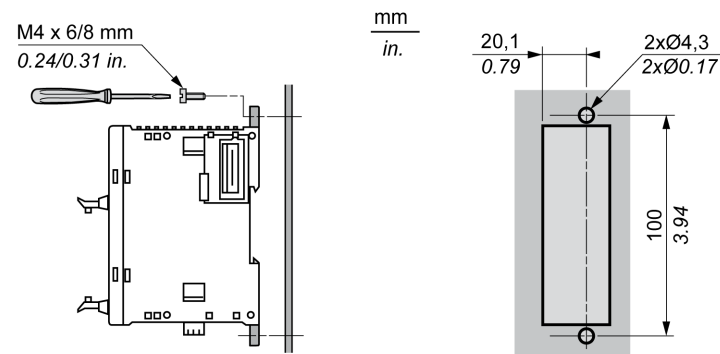
The following diagram shows the mounting hole layout for TM3 with 8 I/Os ,16 I/Os ,TM3XTRA1 , TM3XREC1 and TM3XTYS4 expansion modules:



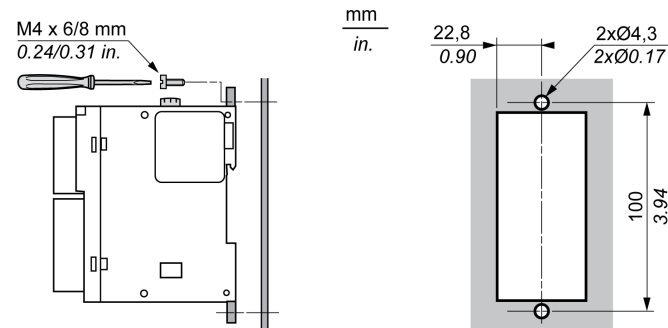
The following diagram shows the mounting hole layout for TM3 with 24 screw or spring I/O channels:



The following diagram shows the mounting hole layout for TM3 with 32 HE10 (MIL 20) I/O channels:



The following diagram shows the mounting hole layout for the TM3DM32R expansion module:



## TM3 Electrical Requirements

### 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 heavyduty 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.

<b>⚠ WARNING</b>
<b>UNINTENDED EQUIPMENT OPERATION</b>
<ul style="list-style-type: none"> <li>• Use shielded cables for all fast I/O, analog I/O, and communication signals.</li> <li>• Ground cable shields for all fast I/O, analog I/O, and communication signals at a single point<sup>1</sup>.</li> <li>• Route communications and I/O cables separately from power cables.</li> </ul>
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

<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.	9 0.35								
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	
				N•m		0.28			
Ø 2,5 mm (0.1 in.)				lb-in		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 in.	7 0.28								
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 maximum 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 in.					
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 in.						
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 maximum 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 spring terminal blocks unless using a double wire cable end (ferrule).

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

## Protecting Outputs from Inductive Load Damage

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

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

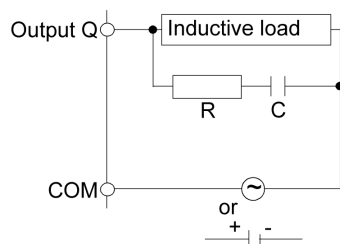
If your controller or module contains relay outputs, these types of outputs can support up to 240 Vac. Inductive damage to these types of outputs can result in welded contacts and loss of control. Each inductive load must include a protection device such as a peak limiter, RC circuit or flyback diode. Capacitive loads are not supported by these relays.

<b>⚠ WARNING</b>
<b>RELAY OUTPUTS WELDED CLOSED</b>
<ul style="list-style-type: none"> <li>• Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.</li> <li>• Do not connect relay outputs to capacitive loads.</li> </ul>
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

AC-driven contactor coils are, under certain circumstances, inductive loads that generate pronounced high-frequency interference and electrical transients when the contactor coil is de-energized. This interference may cause the logic controller to detect an I/O bus error.

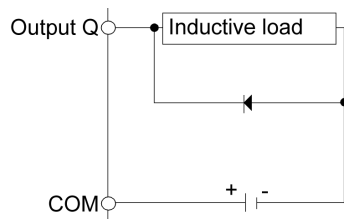
<b>⚠ WARNING</b>
<b>CONSEQUENTIAL LOSS OF CONTROL</b>
Install an RC surge suppressor or similar means, such as an interposing relay, on each TM3 expansion module relay output when connecting to AC-driven contactors or other forms of inductive loads.
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

Protective circuit A: this protection circuit can be used for both AC and DC load power circuits.



- C represents a value from 0.1 to 1  $\mu$ F.
- R represents a resistor of approximately the same resistance value as the load.

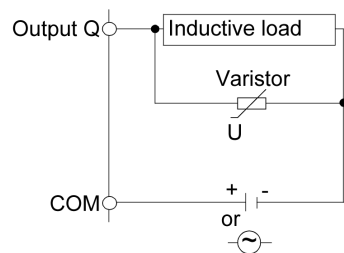
Protective circuit B: this protection circuit can be used for DC load power circuits.



Use a diode with the following ratings:

- Reverse withstand voltage: power voltage of the load circuit x 10.
- Forward current: more than the load current.

Protective circuit C: this protection circuit can be used for both AC and DC load power circuits.



- In applications where the inductive load is switched on and off frequently and/or rapidly, ensure that the continuous energy rating (J) of the varistor exceeds the peak load energy by 20 % or more.

## DC Power Supply Characteristics

### Overview

This section provides the characteristics of the DC power supply.

### Power Supply Voltage Range

If the specified voltage range is not maintained, outputs may not switch as expected. Use appropriate safety interlocks and voltage monitoring circuits.

## ⚠ DANGER

### FIRE HAZARD

Use only the correct wire sizes for the maximum current capacity of the I/O channels and power supplies.

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

## ⚠ 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.**

## DC Power Supply Characteristics

The 24 Vdc power supplies must be rated at least Protective Extra Low Voltage (PELV) according to IEC 61140. These power supplies are isolated between the electrical input and output circuits of the power supply.

### **⚠ WARNING**

#### **POTENTIAL OF OVERHEATING AND FIRE**

- Do not connect the equipment directly to line voltage.
- Use only isolating PELV power supplies to supply power to the equipment<sup>1</sup>.

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

<sup>1</sup>For compliance to UL (Underwriters Laboratories) requirements, the power supply must also conform to the various criteria of NEC Class 2, and be inherently current limited to a maximum power output availability of less than 100 VA (approximately 4 A at nominal voltage), or not inherently limited but with an additional protection device such as a circuit breaker or fuse meeting the requirements of clause 9.4 Limited-energy circuit of UL 61010-1. In all cases, the current limit should never exceed that of the electric characteristics and wiring diagrams for the equipment described in the present documentation. In all cases, the power supply must be grounded, and you must separate Class 2 circuits from other circuits. If the indicated rating of the electrical characteristics or wiring diagrams are greater than the specified current limit, multiple Class 2 power supplies may be used.

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# TM3 Digital Input Modules

## What's in This Part

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# TM3DI8A Module 8 Inputs 120 Vac

## What's in This Chapter

TM3DI8A Presentation ..... 40  
 TM3DI8A Characteristics ..... 41  
 TM3DI8A Wiring Diagram ..... 42

## Overview

This chapter describes the TM3DI8A expansion modules, its characteristics, and its connection to the different sensors.

## TM3DI8A Presentation

### Overview

TM3DI8A (screw) digital expansion module:

- 8 channels
- 120 Vac digital input
- 2 common lines
- removable screw terminal block

### Main Characteristics

Characteristic		Value
Number of input channels		8
Input type		Type 1 (IEC/EN 61131-2)
Logic type		N/A
Rated input voltage		120 Vac
Connection type		Removable screw terminal block
Cable type and length	Type	stranded wire 2,5 mm <sup>2</sup>
	Length	-

### Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...7	Green	On	The input channel is activated.



LED	Color	Status	Description
		Off	The input channel is deactivated.

## TM3DI8A Characteristics

### Introduction

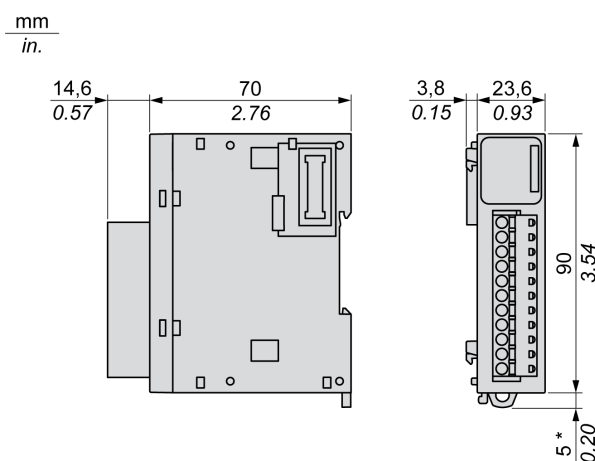
This section provides a general description of the characteristics of the TM3DI8A expansion module.

See also Environmental Characteristics, page 22.

▲ WARNING
UNINTENDED EQUIPMENT OPERATION
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 TM3DI8A module:



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

### Input Characteristics

The table below describes the inputs characteristics of the TM3DI8A expansion module:

Characteristic	Value
Number of input channels	8 inputs
Number of channels groups	2 common lines of 4 channels each
Input type	Type 1 (IEC/EN 61131-2))
Logic type	N/A
Rated input voltage	120 Vac
Input voltage range	0...132 Vac
Rated input current	7.5 mA at 100 Vac

Characteristic		Value
Input impedance		11 kΩ
Turn on time		25 ms
De-rating	-10...55 °C (14...131 °F)	No de-rating
Input limit values	Voltage at state 1	> 79 Vac (79...132 Vac)
	Voltage at state 0	< 20 Vac (0...20 Vac)
	Current at state 1	2 mA < I < 15 mA
Isolation	Between input and internal logic	1500 Vac
	Between input groups	1500 Vac
Connector type		Removable screw terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		60 mA (all inputs on)
		25 mA (all inputs off)
Current draw on 24 Vdc internal bus		0 mA (all inputs on)
		0 mA (all inputs off)

## TM3DI8A Wiring Diagram

### Introduction

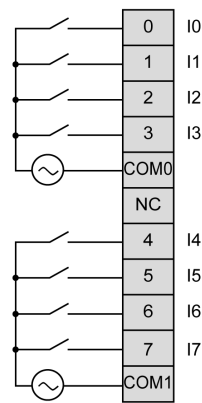
This expansion module has a built-in removable screw terminal block for the connection of inputs and power supply.

### Wiring Rules

See *Wiring Best Practices*, page 32.

### Wiring Diagram

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



The COM0 and COM1 terminal are **not** connected internally.

**▲ 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.**

# TM3DI8 / TM3DI8G Module 8 Regular Inputs 24 Vdc

## What's in This Chapter

TM3DI8 / TM3DI8G Presentation..... 44  
 TM3DI8 / TM3DI8G Characteristics ..... 45  
 TM3DI8 / TM3DI8G Wiring Diagram ..... 46

## Overview

This chapter describes the TM3DI8 / TM3DI8G expansion modules, its characteristics and its connection to the different sensors.

## TM3DI8 / TM3DI8G Presentation

### Overview

TM3DI8 (screw) and TM3DI8G (spring) digital expansion module:

- 8 channels
- 24 Vdc digital input
- 1 common line
- Sink/source
- removable screw or spring terminal block

### Main Characteristics

Characteristic		Value
Number of input channels		8 inputs
Input type		Type 1 (IEC/EN 61131-2)
Logic type		Sink/Source
Rated input voltage		24 Vdc
Connection type	TM3DI8	Removable screw terminal block
	TM3DI8G	Removable spring terminal block
Cable type and length	Type	Unshielded
	Length	Max. 30 m (98 ft)
Weight		85g (3 oz)

### Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...7	Green	On	The input channel is activated
		Off	The input channel is deactivated

## TM3DI8 / TM3DI8G Characteristics

### Introduction

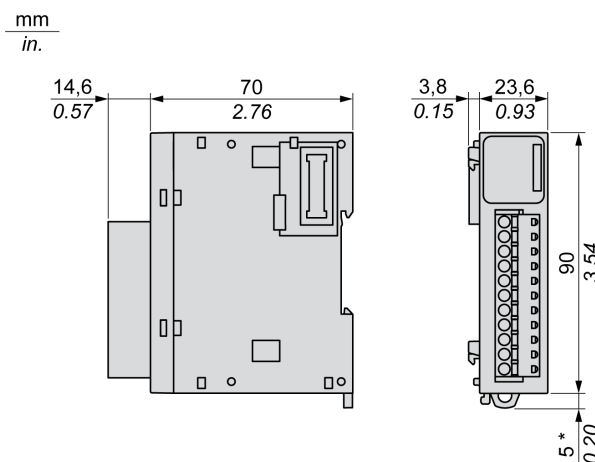
This section provides a description of the input characteristics of TM3DI8 / TM3DI8G expansion modules.

See also Environmental Characteristics, page 22.

▲ WARNING
UNINTENDED EQUIPMENT OPERATION
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 TM3DI8 / TM3DI8G expansion modules:



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

### Input Characteristics

The table below describes the inputs characteristics of the TM3DI8 / TM3DI8G:

Characteristic	Value
Number of input channels	8 inputs
Number of channels groups	1 common line on three terminals for 8 channels
Input type	Type 1 (IEC/EN 61131-2)
Logic type	Sink/Source
Rated input voltage	24 Vdc
Input voltage range	19.2...28.8 Vdc

Characteristic		Value
Rated input current		7 mA
Input impedance		3.4 kΩ
Turn on time		SV <sup>(1)</sup> < 2.0: 4 ms
Turn off time		SV <sup>(1)</sup> ≥ 2.0: 100 μs <sup>(2)</sup>
Input limit values	Voltage at state 1	> 15 Vdc (15...28.8 Vdc)
	Voltage at state 0	< 5 Vdc (0...5 Vdc)
	Current at state 1	> 2.5 mA
	Current at state 0	<1 mA
Isolation	Between input and internal logic	500 Vac
	Between input groups	N/A
Connection type	TM3DI8	Removable screw terminal block
	TM3DI8G	Removable spring terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus	22 mA (all inputs on)	
	5 mA (all inputs off)	
Current draw on 24 Vdc internal bus	0 mA (all inputs on)	
	0 mA (all inputs off)	
<p>(1) SV refers to the version and is printed on the product label.  (2) The range depends on the configured filter value. If you use EcoStruxure Machine Expert - Basic, refer to the Modicon TM3 (EcoStruxure Machine Expert - Basic) Expansion Modules Configuration - Programming Guide. If you use EcoStruxure Machine Expert, refer to the Modicon TM3 Expansion Modules - Programming Guide.</p>		

## TM3DI8 / TM3DI8G Wiring Diagram

### Introduction

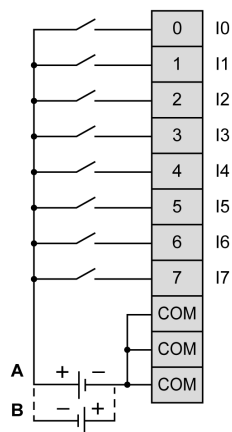
These expansion modules have a built-in removable screw or spring terminal block for the connection of inputs and power supply.

### Wiring Rules

See Wiring Best Practices, page 32.

## Wiring Diagram

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



The 3 COM terminals are connected internally.

**A** Sink wiring (positive logic)

**B** Source wiring (negative logic)

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

# TM3DI16 / TM3DI16G Module 16 Regular Inputs 24 Vdc

## What's in This Chapter

TM3DI16 / TM3DI16G Presentation .....48  
 TM3DI16 / TM3DI16G Characteristics.....49  
 TM3DI16 / TM3DI16G Wiring Diagrams ..... 51

## Overview

This chapter describes the TM3DI16 / TM3DI16G expansion modules, its characteristics and its connection to the different sensors.

## TM3DI16 / TM3DI16G Presentation

### Overview

TM3DI16 (screw) and TM3DI16G (spring) digital expansion module:

- 16 channels
- 24 Vdc digital input
- 1 common line
- Sink/source
- Removable screw or spring terminal block

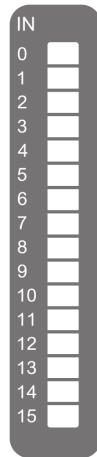
### Main Characteristics

Characteristic		Value
Number of input channels		16
Input type		Type 1 (IEC/EN 61131-2)
Logic type		Sink/Source
Rated input voltage		24 Vdc
Connection type	TM3DI16	Removable screw terminal blocks
	TM3DI16G	Removable spring terminal blocks
Cable type and length	Type	Unshielded
	Length	Max. 30 m (98 ft)
Weight		100 g (3.52 oz)



## Status LEDs

The following figure show the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...15	Green	On	The input channel is activated
		Off	The input channel is deactivated

## TM3DI16 / TM3DI16G Characteristics

### Introduction

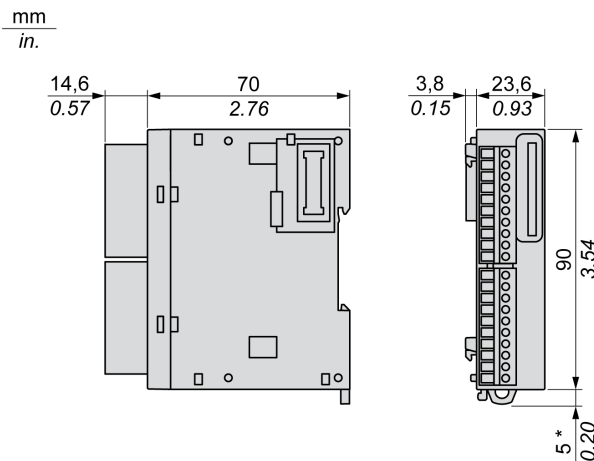
This section provides a description of the input characteristics of TM3DI16 / TM3DI16G expansion modules.

See also Environmental Characteristics, page 22.

<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 TM3DI16 / TM3DI16G expansion modules:



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

## Input Characteristics

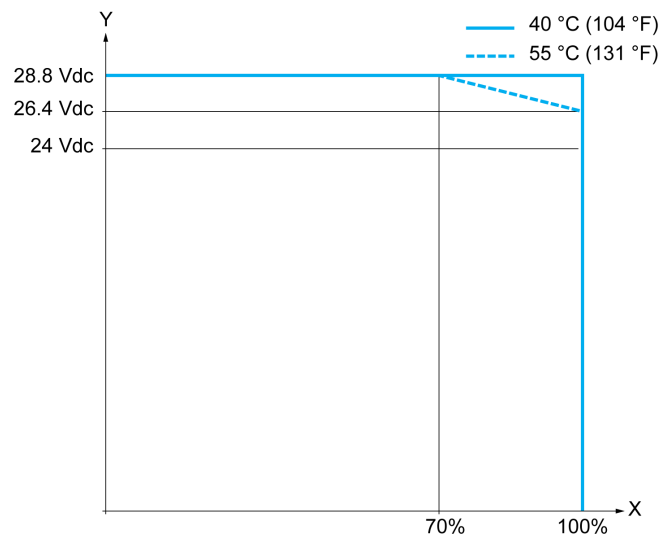
The table below describes the inputs characteristics of the TM3DI16 / TM3DI16G:

Characteristic		Value
Number of input channels		16 inputs
Number of channels groups		1 common line on 4 terminals (2 per connector) for 16 channels
Input type		Type 1 (IEC/EN 61131-2)
Logic type		Sink/Source
Rated input voltage		24 Vdc
Input voltage range		19.2...28.8 Vdc
Rated input current		7 mA
Input impedance		3.4 kΩ
Input limit values	Voltage at state 1	> 15 Vdc (15...28.8 Vdc)
	Voltage at state 0	< 5 Vdc (0...5 Vdc)
	Current at state 1	> 2.5 mA
	Current at state 0	<1 mA
Turn on time		SV <sup>(1)</sup> < 2.0: 4 ms
Turn off time		SV <sup>(1)</sup> ≥ 2.0: 100 μs <sup>(2)</sup>
Isolation	Between input and internal logic	500 Vac
	Between input groups	N/A
Connection type	TM3DI16	Removable screw terminal blocks
	TM3DI16G	Removable spring terminal blocks
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		34 mA (all inputs on) 5 mA (all inputs off)

Characteristic	Value
Current draw on 24 Vdc internal bus	0 mA (all inputs on)
	0 mA (all inputs off)
<p>(1) SV refers to the version and is printed on the product label.</p> <p>(2) The range depends on the configured filter value. If you use EcoStruxure Machine Expert - Basic, refer to the Modicon TM3 (EcoStruxure Machine Expert - Basic) Expansion Modules Configuration - Programming Guide. If you use EcoStruxure Machine Expert, refer to the Modicon TM3 Expansion Modules - Programming Guide.</p>	

## I/O Re-rating

When using TM3DI16 / TM3DI16G:



X Input simultaneous ON ratio

Y Input voltage

## TM3DI16 / TM3DI16G Wiring Diagrams

### Introduction

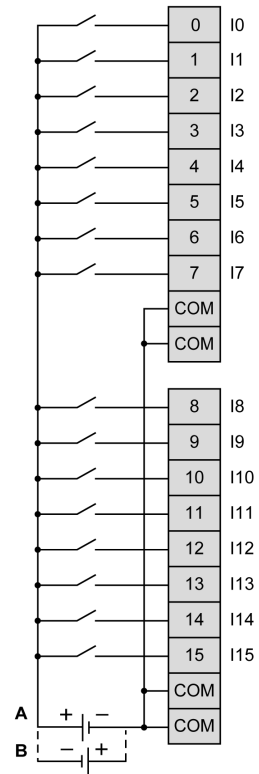
These expansion modules have a built-in removable screw or spring terminal block for the connection of inputs and power supply.

### Wiring Rules

See Wiring Best Practices, page 32.

## Wiring Diagrams

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



The 4 COM terminals are connected internally

**A** Sink wiring (positive logic)

**B** Source wiring (negative logic)

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

# TM3DI16K Module 16 Regular Inputs 24 Vdc

## What's in This Chapter

TM3DI16K Presentation.....	53
TM3DI16K Characteristics .....	54
TM3DI16K Wiring Diagrams.....	56

## Overview

This chapter describes the TM3DI16K expansion module, its characteristics and its connection to the different sensors.

## TM3DI16K Presentation

### Overview

TM3DI16K (HE10) digital expansion module:

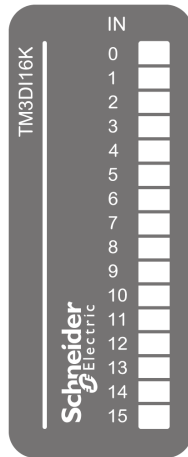
- 16 channels
- 24 Vdc digital input
- 1 common line
- Sink/source
- HE10 (MIL 20) connector

### Main Characteristics

Characteristic		Value
Number of input channels		16
Input type		Type 1 (IEC/EN 61131-2)
Logic type		Sink/Source
Rated input voltage		24 Vdc
Connection type		HE10 (MIL 20) connector
Cable type and length	Type	Unshielded
	Length	Max. 30 m (98 ft)
Weight		65 g (2.30 oz)

## Status LEDs

The following figure show the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...15	Green	On	The input channel is activated
		Off	The input channel is deactivated

## TM3DI16K Characteristics

### Introduction

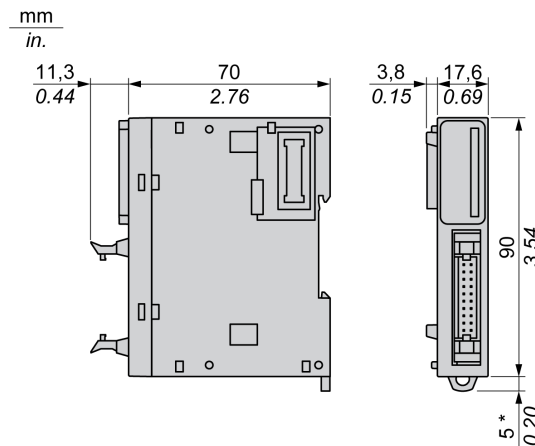
This section provides a description of the input characteristics of TM3DI16K expansion module.

See also Environmental Characteristics, page 22.

<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 TM3DI16K expansion module:



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

## Input Characteristics

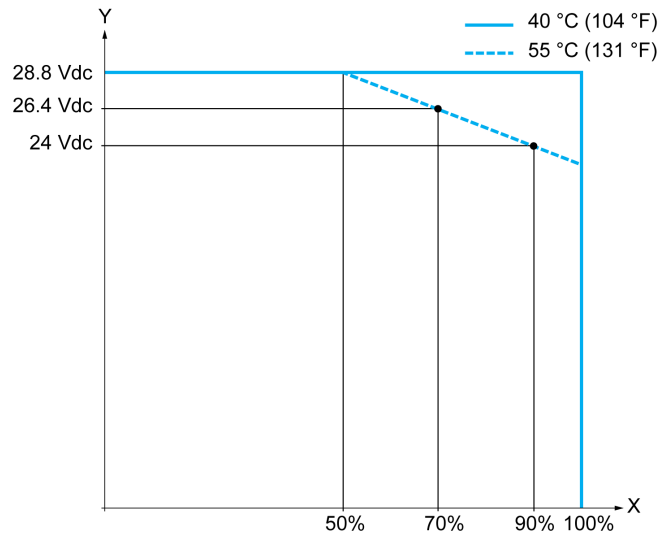
The table below describes the inputs characteristics of the TM3DI16K:

Characteristic		Value
Number of input channels		16 inputs
Number of channels groups		1 common line on 2 pins for 16 channels
Input type		Type 1 (IEC/EN 61131-2)
Logic type		Sink/Source
Rated input voltage		24 Vdc
Input voltage range		19.2...28.8 Vdc
Rated input current		5 mA
Input impedance		4.4 kΩ
Input limit values	Voltage at state 1	> 15 Vdc (15...28.8 Vdc)
	Voltage at state 0	< 5 Vdc (0...5 Vdc)
	Current at state 1	> 2.5 mA
	Current at state 0	<1 mA
Turn on time		SV <sup>(1)</sup> < 2.0: 4 ms
Turn off time		SV <sup>(1)</sup> ≥ 2.0: 100 μs <sup>(2)</sup>
Isolation	Between input and internal logic	500 Vac
	Between input groups	N/A
Connection type		HE10 (MIL 20) connector
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		34 mA (all inputs on) 5 mA (all inputs off)

Characteristic	Value
Current draw on 24 Vdc internal bus	0 mA (all inputs on)
	0 mA (all inputs off)
<p>(1) SV refers to the version and is printed on the product label.</p> <p>(2) The range depends on the configured filter value. If you use EcoStruxure Machine Expert - Basic, refer to the Modicon TM3 (EcoStruxure Machine Expert - Basic) Expansion Modules Configuration - Programming Guide. If you use EcoStruxure Machine Expert, refer to the Modicon TM3 Expansion Modules - Programming Guide.</p>	

## I/O Re-rating

When using TM3DI16K:



**X** Input simultaneous ON ratio

**Y** Input voltage

## TM3DI16K Wiring Diagrams

### Introduction

This expansion module has a built-in HE10 (MIL 20) connector for the connection of inputs and power supply.

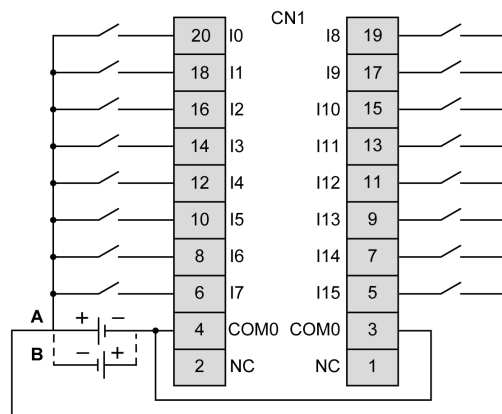
### Wiring Rules

See Wiring Best Practices, page 32.



## Wiring Diagram with Free-Wire Cables

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



The COM0 terminals are connected internally

**A** Sink wiring (positive logic)

**B** Source wiring (negative logic)

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

For more information on the cable color for TWDFCW30K/TWDFCW50K, refer to TWDFCW••K Cable Description.

# TM3DI32K Module 32 Regular Inputs 24 Vdc

## What's in This Chapter

TM3DI32K Presentation..... 58  
 TM3DI32K Characteristics ..... 59  
 TM3DI32K Wiring Diagram ..... 61

## Overview

This chapter describes the TM3DI32K expansion module, its characteristics, and its connection to the different sensors.

## TM3DI32K Presentation

### Overview

TM3DI32K (HE10) digital expansion module:

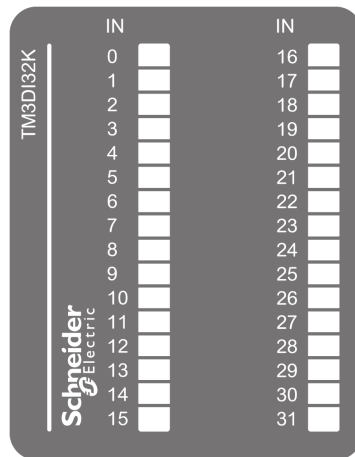
- 32 channels
- 24 Vdc digital input
- 2 common lines
- Sink/source
- HE10 (MIL 20) connector

### Main Characteristics

Characteristic		Value
Number of input channels		32
Input type		Type 1 (IEC/EN 61131-2)
Logic type		Sink/Source
Rated input voltage		24 Vdc
Connection type		HE10 (MIL 20) connectors
Cable type and length	Type	Unshielded
	Length	Max. 30 m (98 ft)
Weight		100 g (3.52 oz)

## Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...31	Green	On	The input channel is activated
		Off	The input channel is deactivated

## TM3DI32K Characteristics

### Introduction

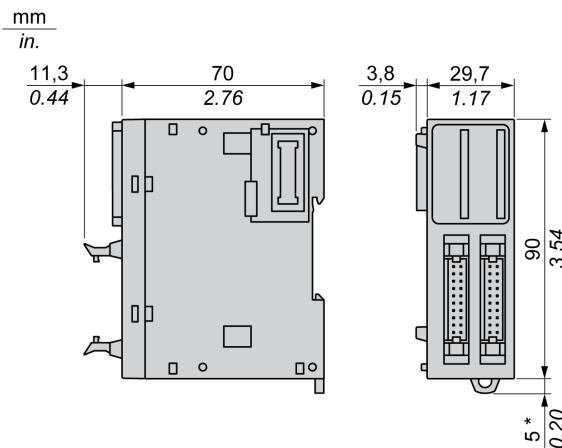
This section provides a description of the input characteristics of the TM3DI32K expansion module.

See also *Environmental Characteristics*, page 22.

<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 TM3DI32K expansion module:



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

## Input Characteristics

The table below describes the inputs characteristics of the TM3DI32K:

Characteristic		Value
Number of input channels		32 inputs
Number of channels groups		2 groups of 16, 1 common line each on 2 pins
Input type		Type 1 (IEC/EN 61131-2)
Logic type		Sink/Source
Rated input voltage		24 Vdc
Input voltage range		19.2...28.8 Vdc
Rated input current		5 mA
Input impedance		4.4 kΩ
Input limit values	Voltage at state 1	> 15 Vdc (15...28.8 Vdc)
	Voltage at state 0	< 5 Vdc (0...5 Vdc)
	Current at state 1	> 2.5 mA
	Current at state 0	<1 mA
Turn on time		SV <sup>(1)</sup> < 2.0: 4 ms
Turn off time		SV <sup>(1)</sup> ≥ 2.0: 100 μs <sup>(2)</sup>
Isolation	Between input and internal logic	500 Vac
	Between input groups	500 Vac
Connection type		HE10 (MIL 20) connectors
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		46 mA (all inputs on)
		5 mA (all inputs off)

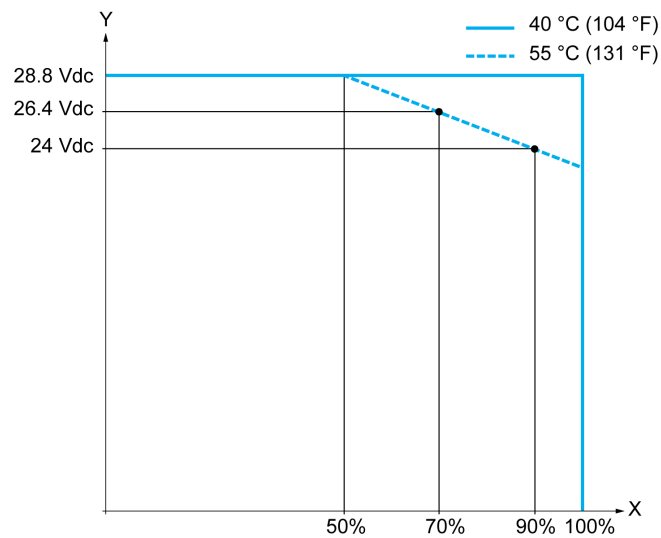
Characteristic	Value
Current draw on 24 Vdc internal bus	0 mA (all inputs on)
	0 mA (all inputs off)

(1) SV refers to the version and is printed on the product label.

(2) The range depends on the configured filter value. If you use EcoStruxure Machine Expert - Basic, refer to the Modicon TM3 (EcoStruxure Machine Expert - Basic) Expansion Modules Configuration - Programming Guide. If you use EcoStruxure Machine Expert, refer to the Modicon TM3 Expansion Modules - Programming Guide.

## I/O Re-rating

When using TM3DI32K:



X Input simultaneous ON ratio

Y Input voltage

## TM3DI32K Wiring Diagram

### Introduction

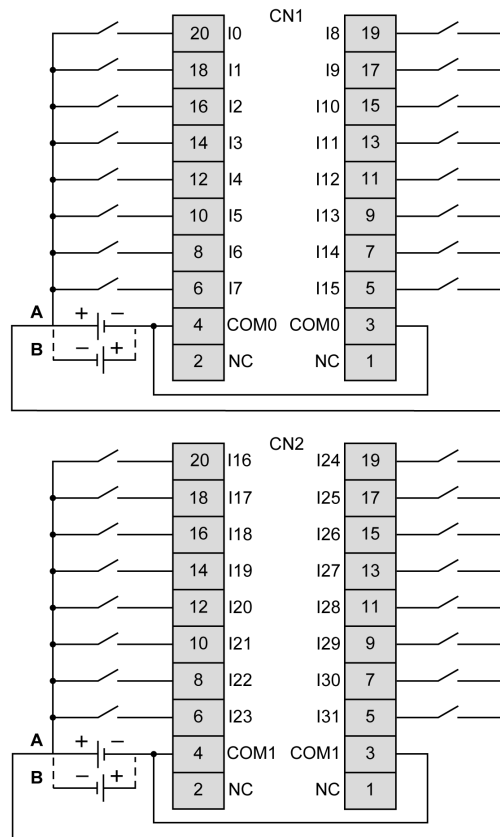
This expansion module has a built-in HE10 (MIL 20) connector for the connection of inputs and power supply.

### Wiring Rules

See Wiring Best Practices, page 32.

### Wiring Diagram with Free-Wire Cables

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



The COM0 and COM1 terminals are **not** connected internally

**A** Sink wiring (positive logic)

**B** Source wiring (negative logic)

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

For more information on the cable color for TWDFCW30K/TWDFCW50K, refer to TWDFCW••K Cable Description.

# TM3 Digital Output Modules

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# TM3DQ8R / TM3DQ8RG Module 8 Relay Outputs 2A 24 Vdc/240 Vac

## What's in This Chapter

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## Overview

This chapter describes the TM3DQ8R / TM3DQ8RG expansion modules, its characteristics and its connection to the different actuators.

## TM3DQ8R / TM3DQ8RG Presentation

### Overview

TM3DQ8R (screw) and TM3DQ8RG (spring) digital expansion module:

- 8 channels
- 2 A relay outputs
- 1 common line
- Removable screw or spring terminal block

### Main Characteristics

Characteristic		Value
Number of output channels		8 outputs
Contact type		NO (Normally Open)
Output type		Relay
Rated output voltage		24 Vdc / 240 Vac
Rated output current		2 A
Connection type	TM3DQ8R	Removable screw terminal block
	TM3DQ8RG	Removable spring terminal block
Cable type and length	Type	Unshielded
	Length	Max. 30 m (98 ft)
Weight		110 g (3.90 oz)



## Status LEDs

The following figure shows the status LEDs:



This table describes the status LED:

LED	Color	Status	Description
0...7	Green	On	The output channel is activated.
		Off	The output channel is deactivated.

## TM3DQ8R / TM3DQ8RG Characteristics

### Introduction

This section provides a description of the power limitation and the output characteristics of the TM3DQ8R / TM3DQ8RG expansion modules.

See also Environmental Characteristics, page 22.

### **⚠ DANGER**

#### **FIRE HAZARD**

- Use only the correct wire sizes for the maximum 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.**

### **⚠ WARNING**

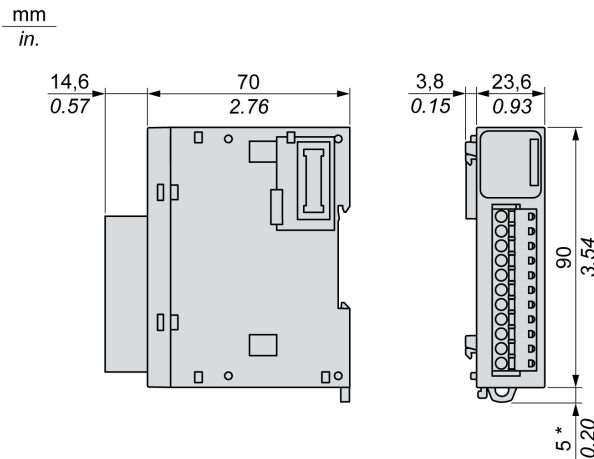
#### **UNINTENDED EQUIPMENT OPERATION**

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 TM3DQ8R / TM3DQ8RG expansion modules:



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

## Output Characteristics

The table below describes the outputs characteristics of the TM3DQ8R / TM3DQ8RG:

Characteristic		Value
Number of output channels		8
Number of channel groups		2 common lines, one for each group of 4 channels
Output type		Relay
Contact type		NO (Normally Open)
Rated output voltage		24 Vdc, 240 Vac
Maximum voltage		30 Vdc, 264 Vac
Minimum switching load		5 Vdc at 10 mA
Rated output current		2 A
Maximum output current		2 A per output
		7 A per common
Maximum output frequency with maximum load		20 operations per minute
Turn on time		Max. 10 ms
De-rating	-10...55 °C (14...131 °F)	No de-rating
Turn off time		Max. 10 ms
Contact resistance		30 mΩ max
Mechanical life		20 million operations
Electrical life	Under resistive load	See Power limitation, page 67
	Under inductive load	
Protection against short circuit		No
Isolation	Between output and internal logic	500 Vac
	Between channel groups	1500 Vac

Characteristic		Value
Connection type	TM3DQ8R	Removable screw terminal block
	TM3DQ8RG	Removable spring terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		25 mA (all outputs on) 5 mA (all outputs off)
Current draw on 24 Vdc internal bus		40 mA (all outputs on) 0 mA (all outputs off)
<p><b>NOTE:</b> Refer to Protecting Outputs from Inductive Load Damage, page 36 for additional information concerning output protection.</p>		

## Power Limitation

This table describes the power limitations of the TM3DQ8R / TM3DQ8RG expansion module depending on the voltage, the type of load, and the number of operations required.

These expansion modules do not support capacitive loads.

<b>⚠ WARNING</b>
<p><b>RELAY OUTPUTS WELDED CLOSED</b></p> <ul style="list-style-type: none"> <li>Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.</li> <li>Do not connect relay outputs to capacitive loads.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

Power Limitations				
Voltage	24 Vdc	120 Vac	240 Vac	Number of operations
Power of resistive loads AC-12	–	240 VA	480 VA	100,000
		80 VA	160 VA	300,000
Power of inductive loads AC-15 (cos $\phi$ = 0.35)	–	60 VA	120 VA	100,000
		18 VA	36 VA	300,000
Power of inductive loads AC-14 (cos $\phi$ = 0.7)	–	120 VA	240 VA	100,000
		36 VA	72 VA	300,000
Power of resistive loads DC-12	48 W	–	–	100,000
	16 W	–	–	300,000
Power of inductive loads DC-13 L/R = 7 ms	24 W	–	–	100,000
	7.2 W	–	–	300,000

## TM3DQ8R / TM3DQ8RG Wiring Diagram

### Introduction

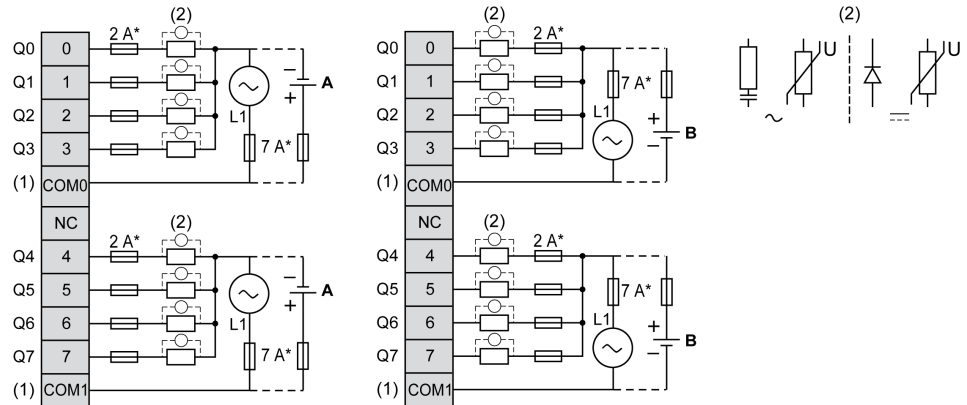
These expansion modules have a built-in removable screw or spring terminal block for the connection of outputs and power supply.

## Wiring Rules

See Wiring Best Practices, page 32.

## Wiring Diagram

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



\* Type T fuse

(1) The COM0 and COM1 terminals are not connected internally

(2) To improve the life time of the contacts, and to protect from potential inductive load damage, connect a free wheeling diode in parallel to each inductive DC load or an RC snubber in parallel of each inductive AC load, or a varistor on either type of load.

**A** Source wiring (positive logic)

**B** Sink wiring (negative logic)

**NOTE:** When you use the TM3 expansion module with a TM3 Ethernet bus coupler, you must connect an RC snubber in parallel of each inductive AC load.

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

### ⚠ 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.**

# TM3DQ8T / TM3DQ8TG Module 8 Regular Transistor Source Outputs 0.5A 24 Vdc

## What's in This Chapter

TM3DQ8T / TM3DQ8TG Presentation ..... 69  
 TM3DQ8T / TM3DQ8TG Characteristics ..... 70  
 TM3DQ8T / TM3DQ8TG Wiring Diagram ..... 71

## Overview

This chapter describes the TM3DQ8T / TM3DQ8TG module, its characteristics, and its connection to the different actuators.

## TM3DQ8T / TM3DQ8TG Presentation

### Overview

TM3DQ8T (screw) and TM3DQ8TG (spring) digital expansion module:

- 8 channels
- 0.5 A source outputs
- 1 common line
- removable screw or spring terminal block

### Main Characteristics

Characteristic		Value
Number of output channels		8
Logic type		Source
Rated output voltage		24 Vdc
Rated output current		0.5 A
Connection type	TM3DQ8T	Removable screw terminal block
	TM3DQ8TG	Removable spring terminal block
Cable type and length	Type	Unshielded
	Length	Max. 30 m (98 ft)
Weight		76 g (2.7 oz)

### Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...7	Green	On	The output channel is activated
		Off	The output channel is deactivated

## TM3DQ8T / TM3DQ8TG Characteristics

### Introduction

This section provides a description of the output characteristics of the TM3DQ8T / TM3DQ8TG expansion modules.

See also Environmental Characteristics, page 22.

### ⚠ WARNING

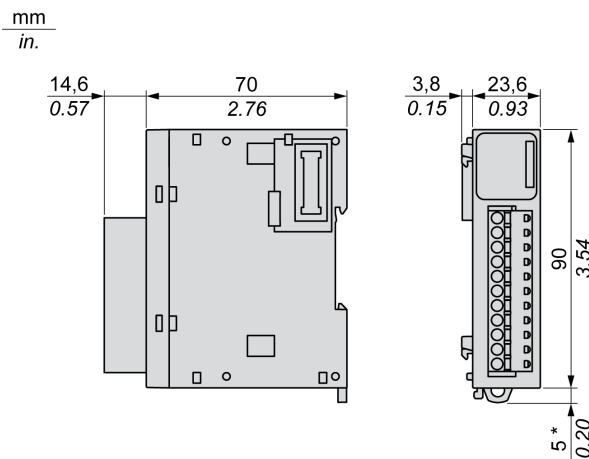
#### UNINTENDED EQUIPMENT OPERATION

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 TM3DQ8T / TM3DQ8TG expansion modules:



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

### Output Characteristics

The table below describes the outputs characteristics of the TM3DQ8T / TM3DQ8TG:

Characteristic	Value
Number of output channels	8
Number of channel groups	1 common line for 8 channels
Output type	Transistor
Logic type	Source
Rated output voltage	24 Vdc

Characteristic		Value
Output voltage range		19.2...28.8 Vdc
Rated output current		0.5 A max. per channel
Total output current per group		4 A
Voltage drop		0.4 Vdc max.
Leakage current when switched off		0.1 mA max.
Maximum power of filament lamp		12 W
Inductive load		L/R = 10 ms
De-rating	- 10...55 °C (14...131 °F)	No de-rating
Turn on time		450 µs
Turn off time		450 µs
Protection against short circuit		Yes
Short circuit output peak current		1 A typically
Automatic rearming after short circuit or overload		Yes, time depending on the expansion module temperature
Protection against reverse polarity		Yes
Clamping voltage		Typically 50 Vdc
Switching frequency	Under resistive load	100 Hz max.
Isolation	Between output and internal logic	500 Vac
	Between channel group	N/A
Connection type	TM3DQ8T	Removable screw terminal block
	TM3DQ8TG	Removable spring terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		17 mA (all outputs on) 5 mA (all outputs off)
Current draw on 24 Vdc internal bus		8 mA (all outputs on) 0 mA (all outputs off)
<p><b>NOTE:</b> Refer to Protecting Outputs from Inductive Load Damage, page 36 for additional information concerning output protection.</p>		

## TM3DQ8T / TM3DQ8TG Wiring Diagram

### Introduction

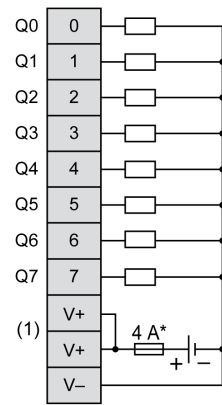
These expansion modules have a built-in removable screw or spring terminal block for the connection of outputs and power supply.

### Wiring Rules

See Wiring Best Practices, page 32.

## Wiring Diagram

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



\* Type T fuse

**(1)** The V+ terminals are connected internally.

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.



# TM3DQ8U / TM3DQ8UG Module 8 Regular Transistor Sink Outputs 0.5A 24 Vdc

## What's in This Chapter

TM3DQ8U / TM3DQ8UG Presentation .....	73
TM3DQ8U / TM3DQ8UG Characteristics .....	74
TM3DQ8U / TM3DQ8UG Wiring Diagram .....	75

## Overview

This chapter describes the TM3DQ8U / TM3DQ8UG module, its characteristics, and its connection to the different actuators.

## TM3DQ8U / TM3DQ8UG Presentation

### Overview

TM3DQ8U (screw) and TM3DQ8UG (spring) digital expansion module:

- 8-channels
- 0.5 A sink outputs
- 1 common line
- removable screw or spring terminal block

### Main Characteristics

Characteristic		Value
Number of output channels		8
Logic type		Sink
Rated output voltage		24 Vdc
Rated output current		0.5 A
Connection type	TM3DQ8U	Removable screw terminal block
	TM3DQ8UG	Removable spring terminal block
Cable type and length	Type	Unshielded
	Length	Max. 30 m (98 ft)
Weight		76 g (2.7 oz)

### Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...7	Green	On	The output channel is activated.
		Off	The output channel is deactivated.

## TM3DQ8U / TM3DQ8UG Characteristics

### Introduction

This section provides a description of the electrical and output characteristics of the TM3DQ8U / TM3DQ8UG expansion modules.

See also Environmental Characteristics, page 22.

### ⚠ WARNING

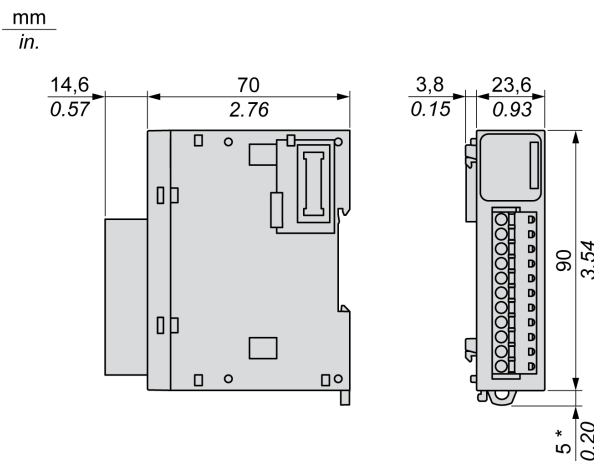
#### UNINTENDED EQUIPMENT OPERATION

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 TM3DQ8U / TM3DQ8UG expansion modules:



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

### Output Characteristics

The table below describes the outputs characteristics of the TM3DQ8U / TM3DQ8UG:

Characteristic	Value
Number of output channels	8
Number of channel groups	1 common line for 8 channels
Output type	Transistor
Logic type	Sink
Rated output voltage	24 Vdc

Characteristic		Value
Output voltage range		19.2...28.8 Vdc
Rated output current		0.5 A max. per channel
Total output current per group		4 A
Voltage drop		0.4 V max.
Leakage current when switched off		0.1 mA max.
Maximum power of filament lamp		12 W
Inductive load		L/R = 10 ms
De-rating	- 10...55 °C (14...131 °F)	No de-rating
Turn on time		450 µs
Turn off time		450 µs
Protection against short circuit		No Fast external fuse required
Short circuit output peak current		N/A
Automatic rearming after short circuit or overload		N/A
Protection against reverse polarity		No
Clamping voltage		Typically 50 Vdc
Switching frequency	Under resistive load	100 Hz max.
Isolation	Between output and internal logic	500 Vac
	Between channel group	N/A
Connection type	TM3DQ8U	Removable screw terminal block
	TM3DQ8UG	Removable spring terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		17 mA (all outputs on) 5 mA (all outputs off)
Current draw on 24 Vdc internal bus		8 mA (all outputs on) 0 mA (all outputs off)
<p><b>NOTE:</b> Refer to Protecting Outputs from Inductive Load Damage, page 36 for additional information concerning output protection.</p>		

## TM3DQ8U / TM3DQ8UG Wiring Diagram

### Introduction

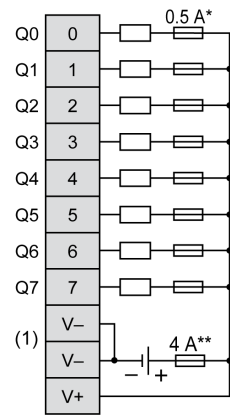
These expansion modules have a built-in removable screw or spring terminal block for the connection of outputs and power supply.

### Wiring Rules

See Wiring Best Practices, page 32.

## Wiring Diagram

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



\* Type T fuse

\*\* Type F fuse

(1) The V- terminals are connected internally.

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

# TM3DQ16R / TM3DQ16RG Module 16 Relay Outputs 2A 24 Vdc/240 Vac

## What's in This Chapter

TM3DQ16R / TM3DQ16RG Presentation.....77  
 TM3DQ16R / TM3DQ16RG Characteristics .....78  
 TM3DQ16R / TM3DQ16RG Wiring Diagram.....80

## Overview

This chapter describes the TM3DQ16R / TM3DQ16RG expansion modules, its characteristics, and its connection to the different actuators.

## TM3DQ16R / TM3DQ16RG Presentation

### Overview

TM3DQ16R (screw) and TM3DQ16RG (spring) digital expansion module:

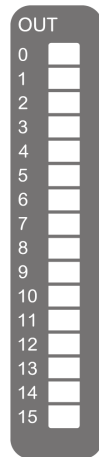
- 16 channels
- 2 A relay outputs
- 2 common lines
- removable screw or spring terminal blocks

### Main Characteristics

Characteristic		Value
Number of output channels		16 outputs
Contact type		NO (Normally Open)
Output type		Relay
Rated output voltage		24 Vdc, 240 Vac
Rated output current		2 A
Connection type	TM3DQ16R	Removable screw terminal blocks
	TM3DQ16RG	Removable spring terminal blocks
Cable type and length	Type	Unshielded
	Length	Max. 30 m (98 ft)
Weight		145 g (5.11 oz)

## Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...15	Green	On	The output channel is activated
		Off	The output channel is deactivated

## TM3DQ16R / TM3DQ16RG Characteristics

### Introduction

This section provides a description of the electrical and the output characteristics of the TM3DQ16R / TM3DQ16RG expansion modules.

See also Environmental Characteristics, page 22.

### **⚠ WARNING**

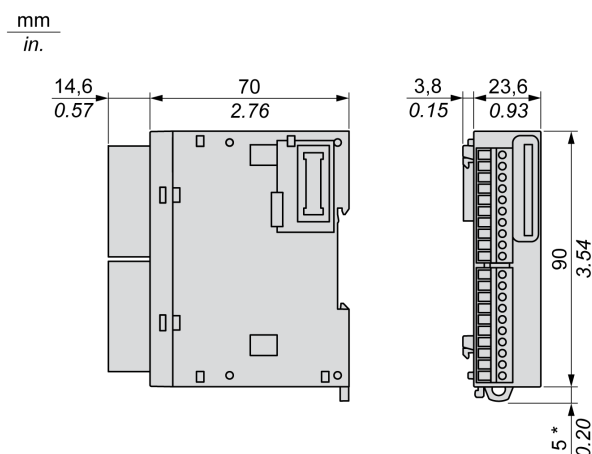
#### **UNINTENDED EQUIPMENT OPERATION**

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 TM3DQ16R / TM3DQ16RG expansion modules:



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

## Output Characteristics

The table below describes the outputs characteristics of the TM3DQ16R / TM3DQ16RG:

Characteristic		Value
Number of output channels		8
Number of channel groups		2 common lines, one on 2 terminals for each group of 8 channels
Output type		Relay
Contact type		NO (Normally Open)
Rated output voltage		24 Vdc, 240 Vac
Maximum voltage		30 Vdc, 264 Vac
Minimum switching load		5 Vdc at 10 mA
Rated output current		2 A
Maximum output current		2 A per output 8 A per common
Maximum output frequency	with maximum load	20 operations per minute
De-rating	-10...55 °C (14...131 °F)	No de-rating
Turn on time		Maximum 10 ms
Turn off time		Maximum 10 ms
Contact resistance		30 mΩ max
Mechanical life		20 million operations
Electrical life	Under resistive load	See Power limitation, page 80
	Under inductive load	
Protection against short circuit		No
Isolation	Between output and internal logic	500 Vac

Characteristic		Value
	Between channel groups	1500 Vac
Connection type	TM3DQ16R	Removable screw terminal block
	TM3DQ16RG	Removable spring terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		37 mA (all outputs on) 5 mA (all outputs off)
Current draw on 24 Vdc internal bus		77 mA (all outputs on) 0 mA (all outputs off)
<b>NOTE:</b> Refer to Protecting Outputs from Inductive Load Damage, page 36 for additional information concerning output protection.		

## Power Limitation

This table describes the power limitation of the TM3DQ16R / TM3DQ16RG expansion modules depending on the voltage, the type of load, and the number of operations required.

These expansion modules do not support capacitive loads.

### ⚠ WARNING

#### RELAY OUTPUTS WELDED CLOSED

- Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.
- Do not connect relay outputs to capacitive loads.

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

#### Power Limitations

Voltage	24 Vdc	120 Vac	240 Vac	Number of operations
Power of resistive loads	–	240 VA	480 VA	100,000
AC-12		80 VA	160 VA	300,000
Power of inductive loads	–	60 VA	120 VA	100,000
AC-15 (cos $\phi$ = 0.35)		18 VA	36 VA	300,000
Power of inductive loads	–	120 VA	240 VA	100,000
AC-14 (cos $\phi$ = 0.7)		36 VA	72 VA	300,000
Power of resistive loads	48 W	–	–	100,000
DC-12	16 W			300,000
Power of inductive loads	24 W	–	–	100,000
DC-13 L/R = 7 ms	7.2 W			300,000

## TM3DQ16R / TM3DQ16RG Wiring Diagram

### Introduction

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

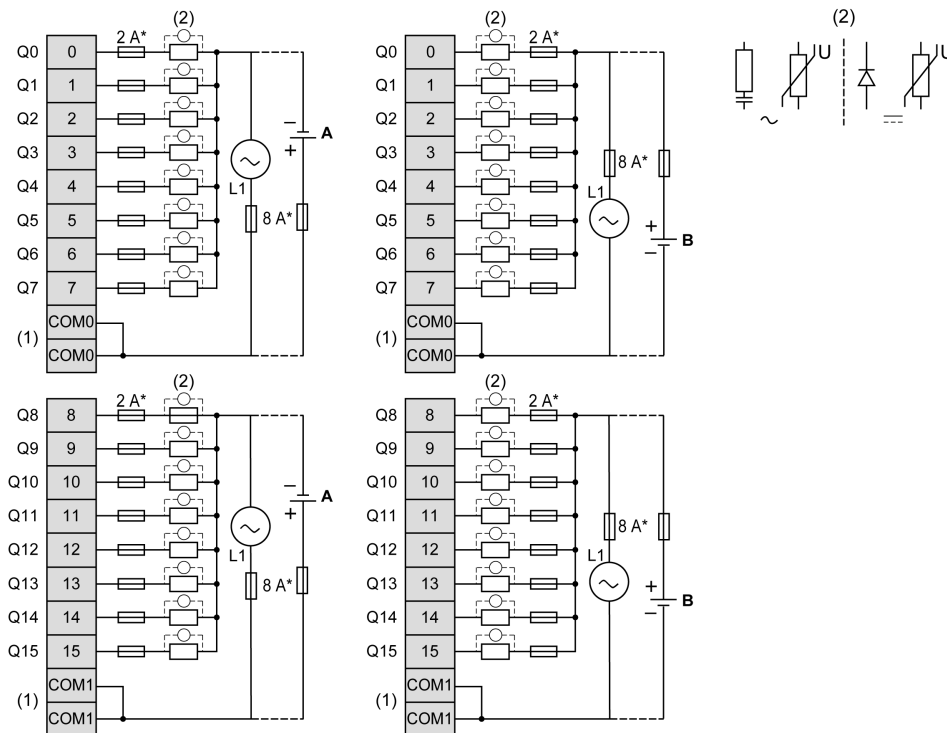


## Wiring Rules

See Wiring Best Practices, page 32.

## Wiring Diagram

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



\* Type T fuse

(1) The COM0 and COM1 terminals are **not** connected internally.

(2) To improve the life time of the contacts, and to protect from potential inductive load damage, connect a free wheeling diode in parallel to each inductive DC load or an RC snubber in parallel of each inductive AC load, or a varistor on either type of load.

**A** Source wiring (positive logic)

**B** Sink wiring (negative logic)

**NOTE:** When you use the TM3 expansion module with a TM3 Ethernet bus coupler, you must connect an RC snubber in parallel of each inductive AC load.

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

# TM3DQ16T / TM3DQ16TG Module 16 Regular Transistor Source Outputs 0.5A 24 Vdc

## What's in This Chapter

TM3DQ16T / TM3DQ16TG Presentation .....	82
TM3DQ16T / TM3DQ16TG Characteristics .....	83
TM3DQ16T / TM3DQ16TG Wiring Diagram .....	85

## Overview

This chapter describes the TM3DQ16T / TM3DQ16TG expansion module, its characteristics, and its connection to the different actuators.

## TM3DQ16T / TM3DQ16TG Presentation

### Overview

TM3DQ16T (screw), TM3DQ16TG (spring) digital expansion module:

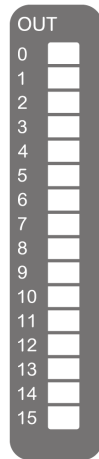
- 16 channels
- 0.5 A source outputs
- 1 common line
- Removable screw or spring terminal block

### Main Characteristics

Characteristic		Value
Number of output channels		16
Logic type		Source
Rated output voltage		24 Vdc
Rated output current		0.5 A
Connection type	TM3DQ16T	Removable screw terminal blocks
	TM3DQ16TG	Removable spring terminal blocks
Cable type and length	Type	Unshielded
	length	Max. 30 m (98 ft)
Weight		110 g (3.90 oz)

## Status LEDs

The following figures show the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...15	Green	On	The output channel is activated
		Off	The output channel is deactivated

## TM3DQ16T / TM3DQ16TG Characteristics

### Introduction

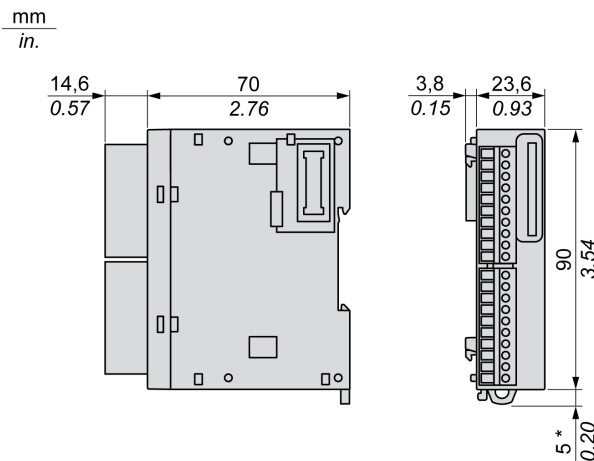
This section provides a description of the electrical and the output characteristics of the TM3DQ16T / TM3DQ16TG expansion modules.

See also Environmental Characteristics, page 22.

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

## Dimensions

The following diagrams show the external dimensions for the TM3DQ16T / TM3DQ16TG expansion modules:



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

## Output Characteristics

The table below describes the outputs characteristics of the TM3DQ16T and TM3DQ16TG

Characteristic		Value
Number of output channels		16
Number of channel groups		1 common line on 2 terminals for 16 channels
Output type		Transistor
Logic type		Source
Rated output voltage		24 Vdc
Output voltage range		19.2...28.8 Vdc
Rated output current		0.5 A
Total output current per group		8 A
Voltage drop		0.4 Vdc max.
Leakage current when switched off		0.1 mA max.
Maximum power of filament lamp		3 W
Inductive load		L/R = 10 ms
De-rating	- 10...55 °C (14...131 °F)	No de-rating
Turn on time		450 µs
Turn off time		450 µs
Protection against short circuit		Yes
Short circuit output peak current		1 A typically
Automatic rearming after short circuit or overload		Yes, time depending on component temperature
Protection against reverse polarity		Yes
Clamping voltage		Typically 50 Vdc
Switching frequency	Under resistive load	100 Hz max.
Isolation	Between output and internal logic	500 Vac

Characteristic		Value
	Between channel group	N/A
Connection type	TM3DQ16T	Removable screw terminal blocks
	TM3DQ16TG	Removable spring terminal blocks
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		20 mA (all outputs on) 5 mA (all outputs off)
Current draw on 24 Vdc internal bus		16 mA (all outputs on) 0 mA (all outputs off)
<p><b>NOTE:</b> Refer to <i>Protecting Outputs from Inductive Load Damage</i>, page 36 for additional information concerning output protection.</p>		

## TM3DQ16T / TM3DQ16TG Wiring Diagram

### Introduction

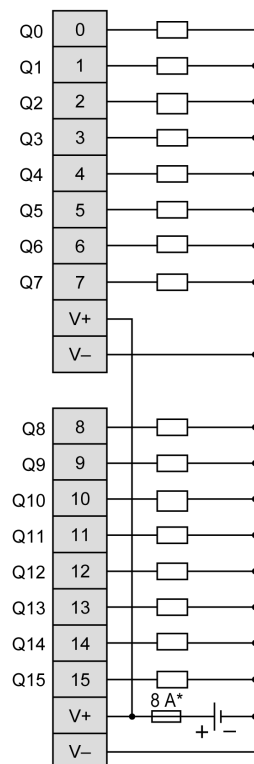
These expansion modules have a built-in removable screw or spring terminal block for the connection of outputs and power supply.

### Wiring Rules

See *Wiring Best Practices*, page 32.

### Wiring Diagram

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



\* Type T fuse

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

# TM3DQ16TK Module 16 Regular Transistor Source Outputs 0.1A 24 Vdc

## What's in This Chapter

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TM3DQ16TK Characteristics.....	88
TM3DQ16TK Wiring Diagram.....	90

## Overview

This chapter describes the TM3DQ16TK expansion module, its characteristics, and its connection to the different actuators.

## TM3DQ16TK Presentation

### Overview

TM3DQ16TK (HE10) digital expansion module:

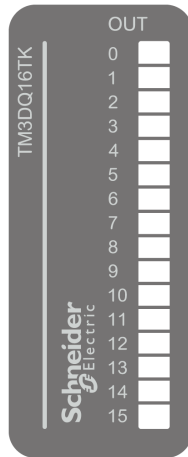
- 16 channels
- 0.1 A source outputs
- 1 common line
- HE10 (MIL 20) connector

### Main Characteristics

Characteristic		Value
Number of output channels		16
Logic type		Source
Rated output voltage		24 Vdc
Rated output current		0.1 A
Connection type	TM3DQ16TK	HE10 (MIL 20) connector
Cable type and length	Type	Unshielded
	length	Max. 5 m (16 ft)
Weight		72 g (2.54 oz)

## Status LEDs

The following figures show the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...15	Green	On	The output channel is activated
		Off	The output channel is deactivated

## TM3DQ16TK Characteristics

### Introduction

This section provides a description of the electrical and the output characteristics of the TM3DQ16TK expansion module.

See also Environmental Characteristics, page 22.

### **⚠ WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

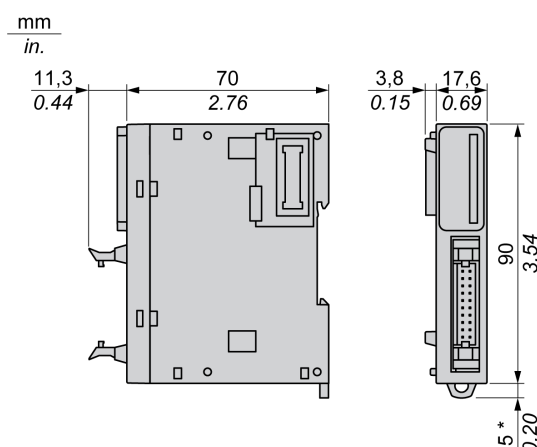
Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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



## Dimensions

The following diagrams show the external dimensions for the TM3DQ16TK expansion module:



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

## Output Characteristics

The table below describes the outputs characteristics of the TM3DQ16TK:

Characteristic		Value
Number of output channels		16
Number of channel groups		1 common line on 2 pins for 16 channels
Output type		Transistor
Logic type		Source
Rated output voltage		24 Vdc
Output voltage range		19.2...28.8 Vdc
Rated output current		0.1 A max. per channel
Total output current per group		2 A
Voltage drop		0.4 Vdc max.
Leakage current when switched off		0.1 mA max.
Maximum power of filament lamp		9.6 W
Inductive load		L/R = 10 ms
De-rating	- 10...55 °C (14...131 °F)	No de-rating
Turn on time		450 µs
Turn off time		450 µs
Protection against short circuit		Yes
Short circuit output peak current		1 A typically
Automatic rearming after short circuit or overload		Yes, time depending on component temperature
Protection against reverse polarity		Yes
Clamping voltage		Typically 50 Vdc
Switching frequency	Under resistive load	100 Hz max.
Isolation	Between output and internal logic	500 Vac

Characteristic		Value
	Between channel group	N/A
Connection type		HE10 (MIL 20) connector
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		20 mA (all outputs on) 5 mA (all outputs off)
Current draw on 24 Vdc internal bus		16 mA (all outputs on) 0 mA (all outputs off)
<p><b>NOTE:</b> Refer to <i>Protecting Outputs from Inductive Load Damage</i>, page 36 for additional information concerning output protection.</p>		

## TM3DQ16TK Wiring Diagram

### Introduction

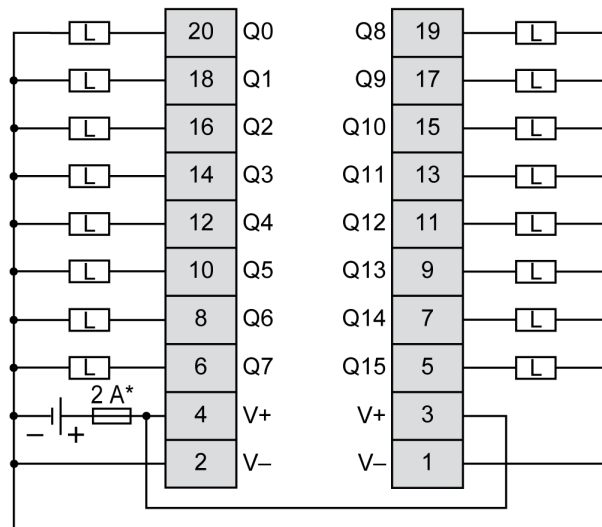
This expansion module has a built-in HE10 (MIL 20) connector for the connection of outputs and power supply.

### Wiring Rules

See *Wiring Best Practices*, page 32.

### Wiring Diagram with Free-Wire Cables

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



\* Type T fuse

For information about 24 Vdc power supply, refer to *DC Power Supply Characteristics*, page 37.

For more information on the cable color for TWDFCW30K/TWDFCW50K, refer to *TWDFCW••K Cable Description*.

# TM3DQ16U / TM3DQ16UG Module 16 Regular Transistor Sink Outputs 0.5A 24 Vdc

## What's in This Chapter

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TM3DQ16U / TM3DQ16UG Characteristics .....	92
TM3DQ16U / TM3DQ16UG Wiring Diagram.....	94

## Overview

This chapter describes the TM3DQ16U / TM3DQ16UG expansion module, its characteristics, and its connection to the different actuators.

## TM3DQ16U / TM3DQ16UG Presentation

### Overview

TM3DQ16U (screw) and TM3DQ16UG (spring) digital expansion module:

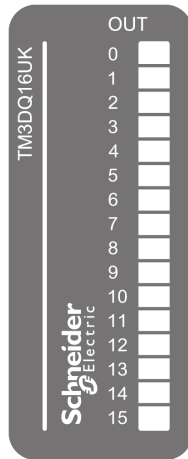
- 16 channels
- 0.5 A sink outputs
- 1 common line
- Removable screw or spring terminal block

### Main Characteristics

Characteristic		Value
Number of output channels		16
Logic type		Sink
Rated output voltage		24 Vdc
Rated output current		0.5 A
Connection type	TM3DQ16U	Removable screw terminal blocks
	TM3DQ16UG	Removable spring terminal blocks
Cable type and length	Type	Unshielded
	length	Max. 30 m (98 ft)
Weight		76 g (2.70 oz)

## Status LEDs

The following figures show the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...15	Green	On	The output channel is activated
		Off	The output channel is deactivated

## TM3DQ16U / TM3DQ16UG Characteristics

### Introduction

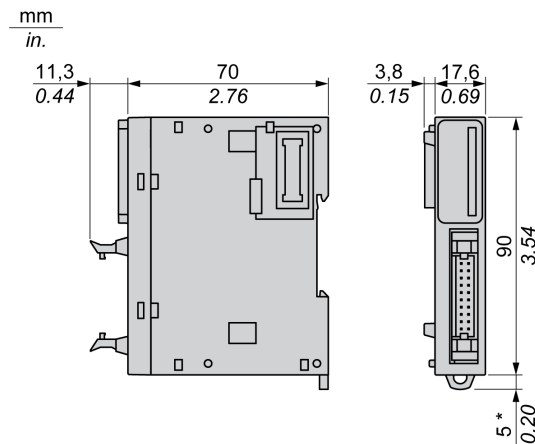
This section provides a description of the electrical and the output characteristics of the TM3DQ16U / TM3DQ16UG expansion modules.

See also Environmental Characteristics, page 22.

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

## Dimensions

The following diagrams show the external dimensions for the TM3DQ16U / TM3DQ16UG expansion modules:



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

## Output Characteristics

The table below describes the outputs characteristics of the TM3DQ16U and TM3DQ16UG:

Characteristic		Value
Number of output channels		16
Number of channel groups		1 common line on 2 pins for 16 channels
Output type		Transistor
Logic type		Sink
Rated output voltage		24 Vdc
Output voltage range		19.2...28.8 Vdc
Rated output current		0.5 A
Total output current		8 A
Voltage drop		0.4 Vdc max.
Leakage current when switched off		0.1 mA max.
Maximum power of filament lamp		12 W
Inductive load		L/R = 10 ms
De-rating	- 10...55 °C (14...131 °F)	No de-rating
Turn on time		450 µs
Turn off time		450 µs
Protection against short circuit		No fast external fuse required
Short circuit output peak current		N/A
Automatic rearming after short circuit or overload		N/A
Protection against reverse polarity		No
Clamping voltage		Typically 50 Vdc
Switching frequency	Under resistive load	100 Hz max.
Isolation	Between output and internal logic	500 Vac

Characteristic		Value
	Between channel group	N/A
Connection type	TM3DQ16U	Removable screw terminal blocks
	TM3DQ16UG	Removable spring terminal blocks
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		20 mA (all outputs on) 5 mA (all outputs off)
Current draw on 24 Vdc internal bus		16 mA (all outputs on) 0 mA (all outputs off)
<p><b>NOTE:</b> Refer to Protecting Outputs from Inductive Load Damage, page 36 for additional information concerning output protection.</p>		

## TM3DQ16U / TM3DQ16UG Wiring Diagram

### Introduction

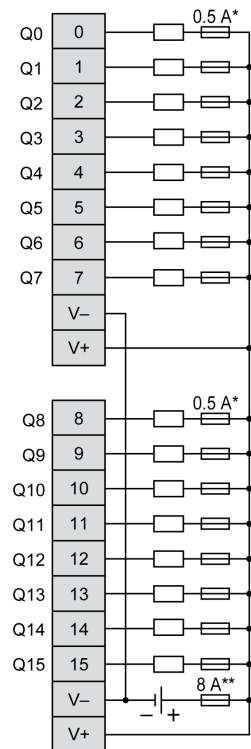
These expansion modules have a built-in removable screw or spring terminal block connector for the connection of outputs and power supply.

### Wiring Rules

See Wiring Best Practices , page 32.

### Wiring Diagram

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



\* Type T fuse

\*\* Type F fuse

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

# TM3DQ16UK Module 16 Regular Transistor Sink Outputs 0.1A 24 Vdc

## What's in This Chapter

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TM3DQ16UK Wiring Diagram .....	99

## Overview

This chapter describes the TM3DQ16UK expansion module, its characteristics, and its connection to the different actuators.

## TM3DQ16UK Presentation

### Overview

TM3DQ16UK (HE10) digital expansion module:

- 16 channels
- 0.1 A sink outputs
- 1 common line
- HE10 (MIL 20) connector

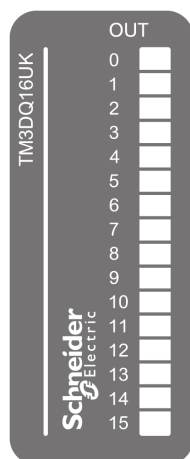
### Main Characteristics

Characteristic		Value
Number of output channels		16
Logic type		Sink
Rated output voltage		24 Vdc
Rated output current		0.1 A
Connection type		HE10 (MIL 20) connector
Cable type and length	Type	Unshielded
	length	Max. 5 m (16 ft)
Weight		111 g (3.90 oz)



## Status LEDs

The following figures show the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...15	Green	On	The output channel is activated
		Off	The output channel is deactivated

## TM3DQ16UK Characteristics

### Introduction

This section provides a description of the electrical and the output characteristics of the TM3DQ16UK expansion module.

See also Environmental Characteristics, page 22.

### **⚠ WARNING**

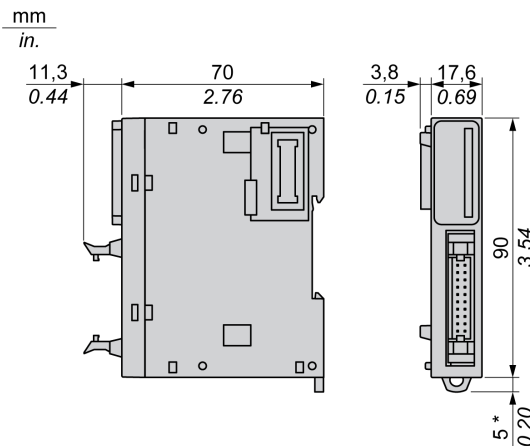
#### **UNINTENDED EQUIPMENT OPERATION**

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 TM3DQ16UK expansion module:



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

## Output Characteristics

The table below describes the outputs characteristics of the TM3DQ16UK:

Characteristic		Value
Number of output channels		16
Number of channel groups		1 common line on 2 pins for 16 channels
Output type		Transistor
Logic type		Sink
Rated output voltage		24 Vdc
Output voltage range		19.2...28.8 Vdc
Rated output current		0.1 A
Total output current per group		2 A
Voltage drop		0.4 Vdc max.
Leakage current when switched off		0.1 mA max.
Maximum power of filament lamp		2.4 W
Inductive load		L/R = 10 ms
De-rating	- 10...55 °C (14...131 °F)	No de-rating
Turn on time		450 µs
Turn off time		450 µs
Protection against short circuit		No fast external fuse required
Short circuit output peak current		N/A
Automatic rearming after short circuit or overload		N/A
Protection against reverse polarity		No
Clamping voltage		Typically 50 Vdc
Switching frequency	Under resistive load	100 Hz max.
Isolation	Between output and internal logic	500 Vac

Characteristic		Value
	Between channel group	N/A
Connection type		HE10 (MIL 20) connector
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		20 mA (all outputs on) 5 mA (all outputs off)
Current draw on 24 Vdc internal bus		16 mA (all outputs on) 0 mA (all outputs off)
<p><b>NOTE:</b> Refer to Protecting Outputs from Inductive Load Damage, page 36 for additional information concerning output protection.</p>		

## TM3DQ16UK Wiring Diagram

### Introduction

These expansion modules have a built-in HE10 (MIL 20) connector for the connection of outputs and power supply.

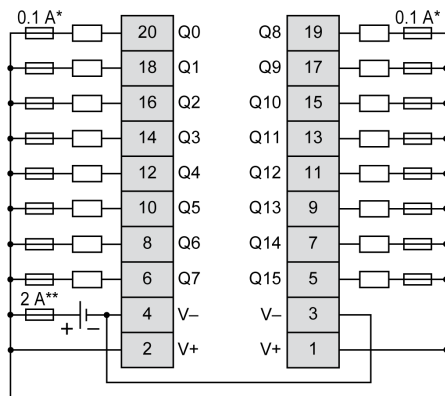
Telefast sub-bases are not compatible with this module.

### Wiring Rules

See Wiring Best Practices, page 32.

### Wiring Diagram

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



\* Type T fuse

\*\* Type F fuse

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

# TM3DQ32TK Module 32 Regular Transistor Outputs 0.1A 24 Vdc

## What's in This Chapter

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TM3DQ32TK Wiring Diagram.....	103

## Overview

This chapter describes the TM3DQ32TK expansion module, its characteristics, and its connection to the different actuators.

## TM3DQ32TK Presentation

### Overview

TM3DQ32TK (HE10) digital expansion module:

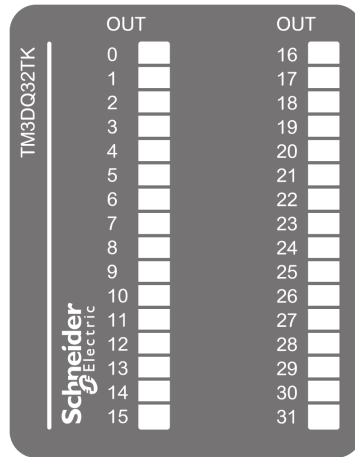
- 32 channels
- 0.1 A source outputs
- 2 common lines
- HE10 (MIL 20) connector

### Main Characteristics

Characteristic		Value
Number of output channels		32
Logic type		Source
Rated output voltage		24 Vdc
Rated output current		0.1 A
Connection type		HE10 (MIL 20) connectors
Cable type and length	Type	Unshielded
	Length	Max. 5 m (16 ft)
Weight		112 g (3.90 oz)

## Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...31	Green	On	The output channel is activated
		Off	The output channel is deactivated

## TM3DQ32TK Characteristics

### Introduction

This section provides a description of the electrical and output characteristics of the TM3DQ32TK expansion module.

See also *Environmental Characteristics*, page 22.

### **⚠ WARNING**

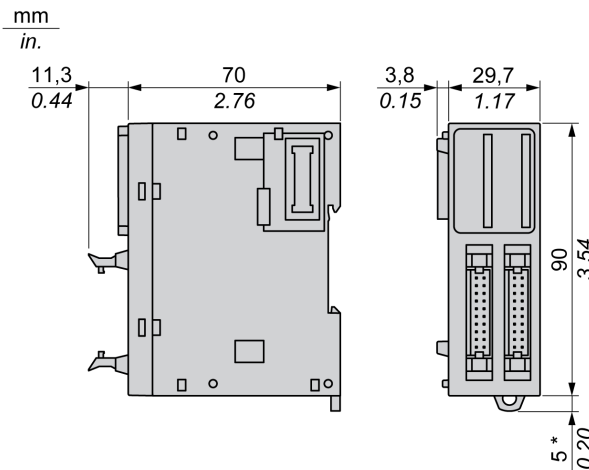
#### **UNINTENDED EQUIPMENT OPERATION**

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 TM3DQ32TK expansion modules:



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

## Output Characteristics

The table below describes the outputs characteristics of the TM3DQ32TK:

Characteristic		Value
Number of output channels		32
Number of channel groups		2 groups of 16 channels, 1 common line each on 2 pins
Output type		Transistor
Logic type		Source
Rated output voltage		24 Vdc
Output voltage range		19.2...28.8 Vdc
Rated output current		0.1 A
Total output current per group		2 A
Voltage drop		0.4 Vdc max.
Leakage current when switched off		0.1 mA max.
Maximum power of filament lamp		2.4 W
Inductive load		L/R = 10 ms
De-rating	- 10...55 °C (14...131 °F)	No de-rating
Turn on time		450 μs
Turn off time		450 μs
Protection against short circuit		yes
Short circuit output peak current		1 A typically
Automatic rearming after short circuit or overload		Yes, time depending on component temperature
Protection against reverse polarity		yes
Clamping voltage		Typically 50 Vdc
Switching frequency	Under resistive load	100 Hz max.
Isolation	Between output and internal logic	500 Vac

Characteristic	Value
Connection type	HE10 (MIL 20) connectors
Connector insertion/removal durability	Over 100 times
Current draw on 5 Vdc internal bus	27 mA (all outputs on) 5 mA (all outputs off)
Current draw on 24 Vdc internal bus	31 mA (all outputs on) 0 mA (all outputs off)
<p><b>NOTE:</b> Refer to <i>Protecting Outputs from Inductive Load Damage</i>, page 36 for additional information concerning output protection.</p>	

## TM3DQ32TK Wiring Diagram

### Introduction

These expansion modules have two built-in HE10 (MIL 20) connectors for the connection of outputs and power supply.

### Wiring Rules

See *Wiring Best Practices*, page 32.





# TM3DQ32UK Module 32 Regular Transistor Outputs 0.1A 24 Vdc

## What's in This Chapter

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 TM3DQ32UK Characteristics ..... 106  
 TM3DQ32UK Wiring Diagram ..... 108

## Overview

This chapter describes the TM3DQ32UK expansion module, its characteristics, and its connection to the different actuators.

## TM3DQ32UK Presentation

### Overview

TM3DQ32UK (HE10) digital expansion module:

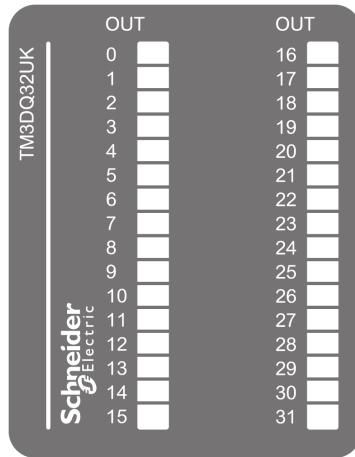
- 32 channels
- 0.1 A sink outputs
- 2 common lines
- HE10 (MIL 20) connector

### Main Characteristics

Characteristic		Value
Number of output channels		32
Logic type		Sink
Rated output voltage		24 Vdc
Rated output current		0.1 A
Connection type		HE10 (MIL 20) connectors
Cable type and length	Type	Unshielded
	Length	Max. 5 m (16 ft)
Weight		112 g (3.90 oz)

## Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
0...31	Green	On	The output channel is activated
		Off	The output channel is deactivated

## TM3DQ32UK Characteristics

### Introduction

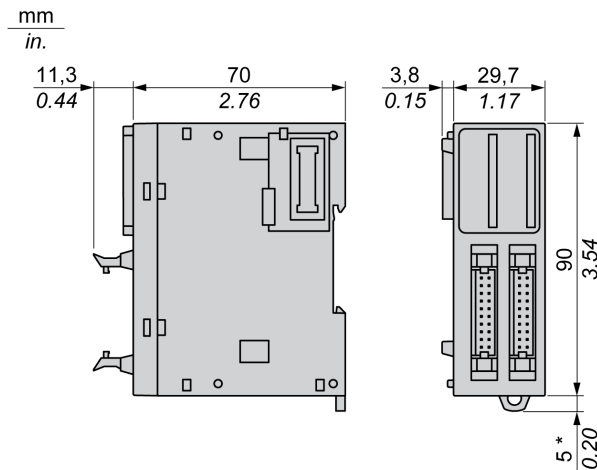
This section provides a description of the electrical and output characteristics of the TM3DQ32UK expansion module.

See also Environmental Characteristics, page 22.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
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 TM3DQ32UK expansion module:



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

## Output Characteristics

The table below describes the outputs characteristics of the TM3DQ32UK:

Characteristic		Value
Number of output channels		32
Number of channel groups		2 groups of 16 channels, 1 common line each on 2 pins
Output type		Transistor
Logic type		Sink
Rated output voltage		24 Vdc
Output voltage range		19.2...28.8 Vdc
Rated output current		0.1 A
Total output current per group		2 A
Voltage drop		0.4 Vdc max.
Leakage current when switched off		0.1 mA max.
Maximum power of filament lamp		2.4 W
Inductive load		L/R = 10 ms
De-rating	- 10...55 °C (14...131 °F)	No de-rating
Turn on time		450 µs
Turn off time		450 µs
Protection against short circuit		No fast external fuse required
Short circuit output peak current		N/A
Automatic rearming after short circuit or overload		N/A
Protection against reverse polarity		yes
Clamping voltage		Typically 50 Vdc
Switching frequency	Under resistive load	100 Hz max.
Isolation	Between output and internal logic	500 Vac

Characteristic	Value
Connection type	HE10 (MIL 20) connectors
Connector insertion/removal durability	Over 100 times
Current draw on 5 Vdc internal bus	27 mA (all outputs on) 5 mA (all outputs off)
Current draw on 24 Vdc internal bus	31 mA (all outputs on) 0 mA (all outputs off)
<b>NOTE:</b> Refer to Protecting Outputs from Inductive Load Damage, page 36 for additional information concerning output protection.	

## TM3DQ32UK Wiring Diagram

### Introduction

These expansion modules have two built-in HE10 (MIL 20) connectors for the connection of outputs and power supply.

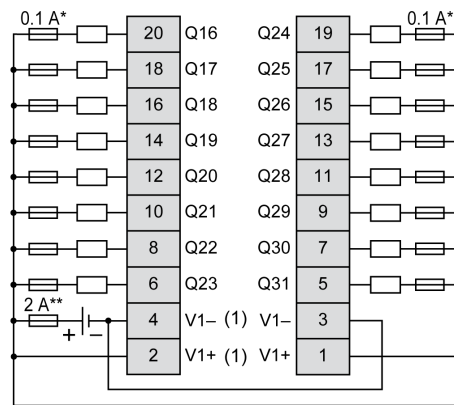
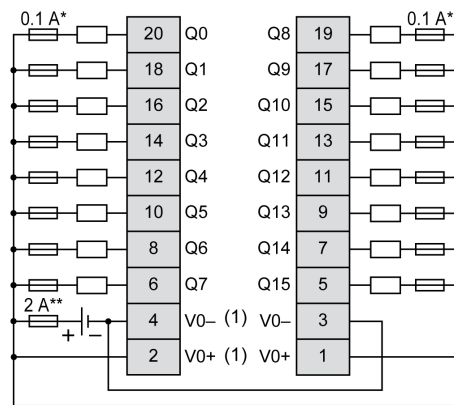
Telefast sub-bases are not compatible with this module.

### Wiring Rules

See Wiring Best Practices, page 32.

## Wiring Diagram

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



\* Type T fuse

\*\* Type F fuse

(1) The V0+ terminals are connected internally.

The V0- terminals are connected internally.

The V1+ terminals are connected internally.

The V1- terminals are connected internally.

The V0+ and V1+ terminals are not connected internally.

The V0- and V1- terminals are not connected internally.

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

# TM3 Digital Mixed Input/Output Modules

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# TM3DM8R / TM3DM8RG Mixed I/O Module 4 Inputs/4 Outputs

## What's in This Chapter

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 TM3DM8R / TM3DM8RG Characteristics ..... 112  
 TM3DM8R / TM3DM8RG Wiring Diagram ..... 116

## Overview

This chapter describes the TM3DM8R / TM3DM8RG expansion module, its characteristics, and its connection to the different sensors and actuators.

## TM3DM8R / TM3DM8RG Presentation

### Overview

TM3DM8R (screw) and TM3DM8RG (spring) digital expansion module:

- 4 channel 24 Vdc sink/source inputs
- 1 common line for inputs
- 4 channel 2 A relay outputs
- 1 common line for outputs
- Removable screw or spring terminal block

### Main Characteristics

Characteristic		Value
<b>Input</b>		
Number of input channels		4 inputs
Input type		Type 1 (IEC/EN 61131-2)
Input Logic type		Sink/source
Rated input voltage		24 Vdc
<b>Output</b>		
Number of output channels		4 outputs
Output type		Relay
Contact type		NO (Normally Open)
Rated output voltage		24 Vdc / 240 Vac
Rated output current		2 A
<b>Connection and cable types</b>		
Connection type	TM3DM8R	Removable screw terminal block
	TM3DM8RG	Removable spring terminal block
Cable type and length	Type	Unshielded
	Length	Max. 30 m (98 ft)
Weight		95 g (3.35 oz)

## Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Type	Description
0...3	Green	On	Input	The channel is activated
		Off		The channel is deactivated
0...3	Green	On	Output	The channel is activated
		Off		The channel is deactivated

## TM3DM8R / TM3DM8RG Characteristics

### Introduction

This section describes the general characteristics of the TM3DM8R / TM3DM8RG expansion module.

See also Environmental Characteristics, page 22.

**⚠ DANGER**

**FIRE HAZARD**

- Use only the correct wire sizes for the maximum 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.**

**⚠ WARNING**

**UNINTENDED EQUIPMENT OPERATION**

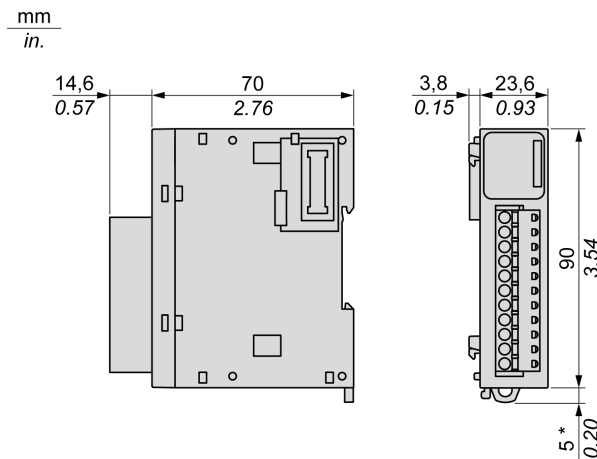
Do not exceed any of the rated values specified in the environmental and electrical characteristics tables.

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



## Dimensions

The following diagrams show the external dimensions for the TM3DM8R / TM3DM8RG expansion modules:



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

## Input Characteristics

The table below describes the inputs characteristics of the TM3DM8R / TM3DM8RG:

Characteristic		Value
Number of input channels		4 inputs
Number of channels groups		1 common line for 4 channels
Input type		Type 1 (IEC/EN 61131-2)
Logic type		Sink/source
Rated input voltage		24 Vdc
Input voltage range		0...28.8 Vdc
Rated input current		7 mA
Input impedance		3.4 kΩ
Input limit values	Voltage at state 1	> 15 Vdc (15..28.8Vdc)
	Voltage at state 0	< 5 Vdc (0..5 Vdc)
	Current at state 1	> 2.5 mA
	Current at state 0	< 1.0 mA
Turn on time		SV <sup>(1)</sup> < 2.0: 4 ms
Turn off time		SV <sup>(1)</sup> ≥ 2.0: 100 μs <sup>(2)</sup>
Isolation	Between input and internal logic	500 Vac
	Between input group and output group	1500 Vac
	Between input groups	N/A
Connection type	TM3DM8R	Removable screw terminal block
	TM3DM8RG	Removable spring terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		24 mA (all inputs and outputs on)
		5 mA (all inputs and outputs off)

Characteristic	Value
Current draw on 24 Vdc internal bus	20 mA (all inputs and outputs on)
	0 mA (all inputs and outputs off)
(1) SV refers to the version and is printed on the product label.	
(2) The range depends on the configured filter value. If you use EcoStruxure Machine Expert - Basic, refer to the Modicon TM3 (EcoStruxure Machine Expert - Basic) Expansion Modules Configuration - Programming Guide. If you use EcoStruxure Machine Expert, refer to the Modicon TM3 Expansion Modules - Programming Guide.	

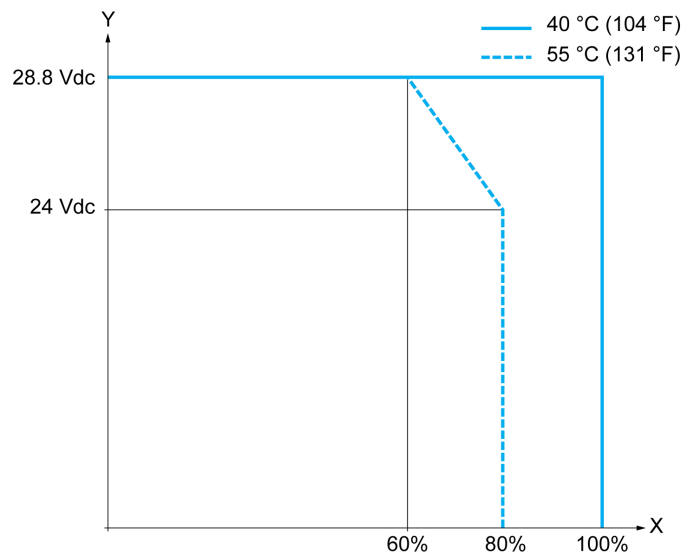
## Output Characteristics

The table below describes the outputs characteristics of the TM3DM8R / TM3DM8RG:

Characteristic	Value	
Number of output channels	4 outputs	
Number of channel groups	1 common line for 4 channels	
Output type	Relay	
Contact type	NO (Normally Open)	
Rated output voltage	24 Vdc, 240 Vac	
Maximum voltage	30 Vdc, 264 Vac	
Minimum switching load	5 Vdc at 10 mA	
Rated output current	2 A	
Maximum output current	2 A per output	
	7 A per common	
Maximum output frequency	20 operations per minute	
Turn on time	Max. 10 ms	
Turn off time	Max. 10 ms	
Contact resistance	30 mΩ max	
Mechanical life	20 million operations	
Electrical life	Under resistive load	See Power Limitation, page 115
	Under inductive load	
Protection against short circuit	No	
Isolation	Between input and internal logic	500 Vac
	Between input group and output group	1500 Vac
	Between input groups	N/A
Connection type	TM3DM8R	Removable screw terminal block
	TM3DM8RG	Removable spring terminal block
Connector insertion/removal durability	Over 100 times	
Current draw on 5 Vdc internal bus	24 mA (all inputs and outputs on)	
	5 mA (all inputs and outputs off)	
Current draw on 24 Vdc internal bus	20 mA (all inputs and outputs on)	
	0 mA (all inputs and outputs off)	
<b>NOTE:</b> Refer to Protecting Outputs from Inductive Load Damage, page 32 for additional information on this topic.		

## I/O De-rating

When using TM3DM8R / TM3DM8RG:



At an ambient temperature of 55 °C (131 °F) in the horizontal mounting direction, limit the inputs and outputs, respectively, which turn on simultaneously as indicated by the X axis.

At 40 °C (104 °F), all inputs and outputs can be turned on simultaneously at 28.8 Vdc.

## Power Limitation

This table describes the power limitation of the TM3DM8R / TM3DM8RG expansion module depending on the voltage, the type of load, and the number of operations required.

These expansion modules do not support capacitive loads.

### ⚠ WARNING

#### RELAY OUTPUTS WELDED CLOSED

- Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.
- Do not connect relay outputs to capacitive loads.

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

Power Limitations				
Voltage	24 Vdc	120 Vac	240 Vac	Number of operations
Power of resistive loads	–	240 VA	480 VA	100,000
AC-12		80 VA	160 VA	300,000
Power of inductive loads	–	60 VA	120 VA	100,000
AC-15 (cos $\phi$ = 0.35)		18 VA	36 VA	300,000
Power of inductive loads	–	120 VA	240 VA	100,000
AC-14 (cos $\phi$ = 0.7)		36 VA	72 VA	300,000

Power Limitations				
Power of resistive loads	48 W	–	–	100,000
DC-12	16 W			300,000
Power of inductive loads	24 W	–	–	100,000
DC-13 L/R = 7 ms	7.2 W			300,000

## TM3DM8R / TM3DM8RG Wiring Diagram

### Introduction

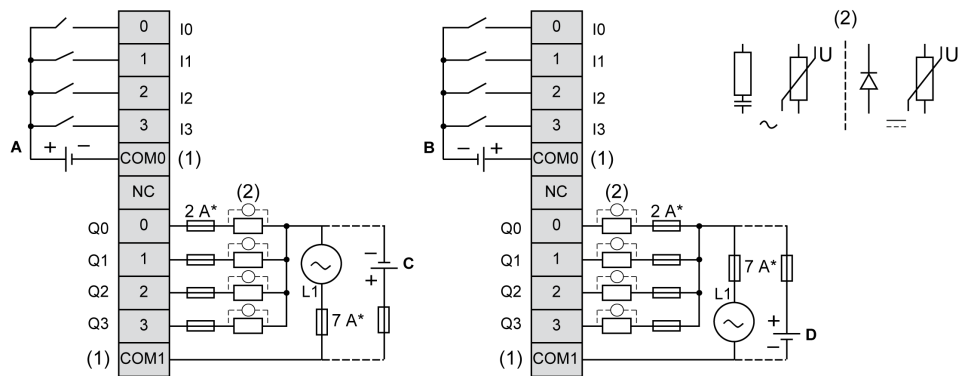
These expansion modules have a built-in removable screw or spring terminal block for the connection of inputs, outputs, and power supply.

### Wiring Rules

See Wiring Best Practices, page 32.

### Wiring Diagram

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



\* Type T Fuse

(1) The COM0 and COM1 terminals are **not** connected internally.

(2) To improve the life time of the contacts, and to protect from potential inductive load damage, connect a free wheeling diode in parallel to each inductive DC load or an RC snubber in parallel of each inductive AC load, or a varistor on either type of load.

C Source wiring (positive logic)

D Sink wiring (negative logic)

**NOTE:** When you use the TM3 expansion module with a TM3 Ethernet bus coupler, you must connect an RC snubber in parallel of each inductive AC load.

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

**▲ 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.**

# TM3DM16R Mixed I/O Module 8 Inputs/8 Outputs

## What's in This Chapter

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TM3DM16R Characteristics .....	119
TM3DM16R Wiring Diagram .....	123

## Overview

This chapter describes the TM3DM16R expansion module, its characteristics, and its connection to the different sensors and actuators.

## TM3DM16R Presentation

### Overview

TM3DM16R digital expansion module:

- 8 channel 24 Vdc sink/source inputs
- 1 common line for inputs
- 8 channel 2 A relay outputs
- 2 common lines for outputs
- Removable screw terminal block

### Main Characteristics

Characteristic		Value
<b>Input</b>		
Number of input channels		8 inputs
Input type		Type 1 (IEC/EN 61131-2)
Input Logic type		Sink/source
Rated input voltage		24 Vdc
<b>Output</b>		
Number of output channels		8 outputs
Output type		Relay
Contact type		NO (Normally Open)
Rated output voltage		24 Vdc / 240 Vac
Rated output current		2 A
<b>Connection and cable types</b>		
Connection type		Removable screw terminal block
Cable type and length	Type	Unshielded
	Length	Input: max. 50 m (164 ft) Output: max. 150 m (492 ft)
Weight		118 g (4.16 oz)

## Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Type	Description
0...7	Green	On	Input	The channel is activated
		Off		The channel is deactivated
0...7	Green	On	Output	The channel is activated
		Off		The channel is deactivated

## TM3DM16R Characteristics

### Introduction

This section describes the general characteristics of the TM3DM16R expansion module.

See also Environmental Characteristics, page 22.

### ⚠ DANGER

**FIRE HAZARD**

- Use only the correct wire sizes for the maximum 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.**

### ⚠ WARNING

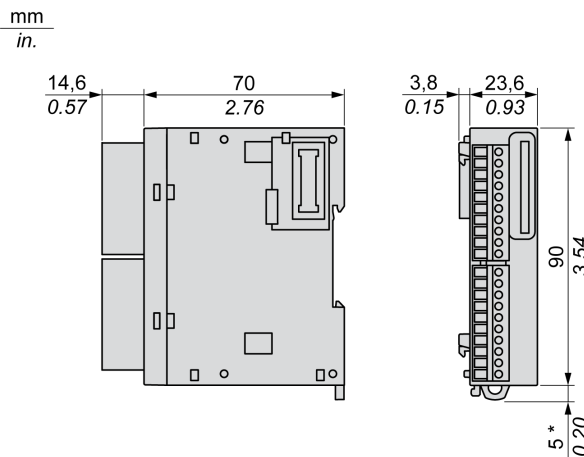
**UNINTENDED EQUIPMENT OPERATION**

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 TM3DM16R expansion modules:



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

## Input Characteristics

The table below describes the input characteristics of the TM3DM16R:

Characteristic		Value
Number of input channels		8 inputs
Number of channels groups		1 common line for 8 channels
Input type		Type 1 (IEC/EN 61131-2)
Logic type		Sink/source
Rated input voltage		24 Vdc
Input voltage range		0...28.8 Vdc
Rated input current		5 mA
Input impedance		4.7 kΩ
Input limit values	Voltage at state 1	> 15 Vdc (15..28.8 Vdc)
	Voltage at state 0	< 5 Vdc (0..5 Vdc)
	Current at state 1	> 2.5 mA
	Current at state 0	< 1.5 mA
Turn on time		4 ms
Turn off time		4 ms
De-rating	0...55 °C (32...131 °F)	See Input de-rating, page 122
Isolation	Between input and internal logic	500 Vac / 800 Vdc
	Between input group and output group	1500 Vac / 2500 Vdc
	Between input groups	N/A
Connection type		Removable screw terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		70 mA
Current draw on 24 Vdc internal bus		40 mA



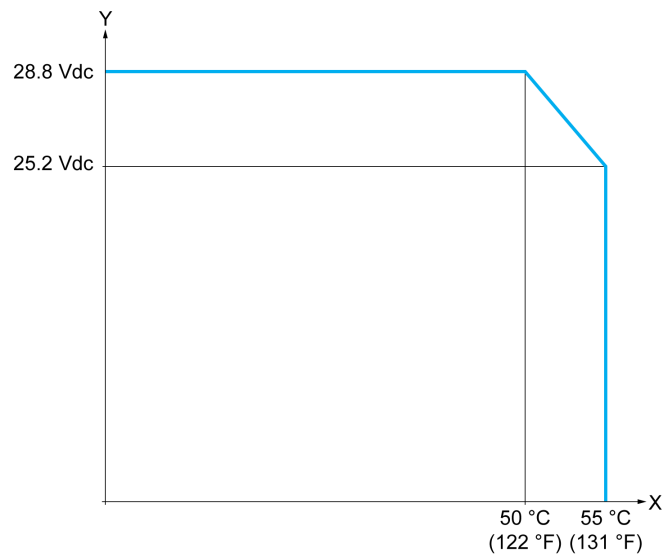
## Output Characteristics

The table below describes the outputs characteristics of the TM3DM16R:

Characteristic		Value
Number of output channels		8 outputs
Number of channel groups		2 common lines for 8 channels
Output type		Relay
Contact type		NO (Normally Open)
Rated output voltage		24 Vdc, 220 Vac
Maximum voltage		30 Vdc, 250 Vac
Rated output current		2 A per output
Maximum output current		2 A per output 4 A per common
Maximum output frequency	With max. load	0.1 Hz
	Without load	5 Hz
Turn on time		Max. 10 ms
Turn off time		Max. 10 ms
De-rating	0...55 °C (32...131 °F)	See Output de-rating, page 122
Mechanical life		20 million operations
Electrical life under resistive load 2 A		100,000 switching cycles at 45 °C (113 °F)
Protection against short circuit		No
Isolation	Between output and internal logic	1500 Vac / 2500 Vdc
	Between input group and output group	1500 Vac / 2500 Vdc
	Between output groups	1500 Vac / 2500 Vdc
Connection type		Removable screw terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		70 mA
Current draw on 24 Vdc internal bus		40 mA
<p><b>NOTE:</b> Refer to Protecting Outputs from Inductive Load Damage, page 32 for additional information on this topic.</p>		

### Input De-rating

When using TM3DM16R:



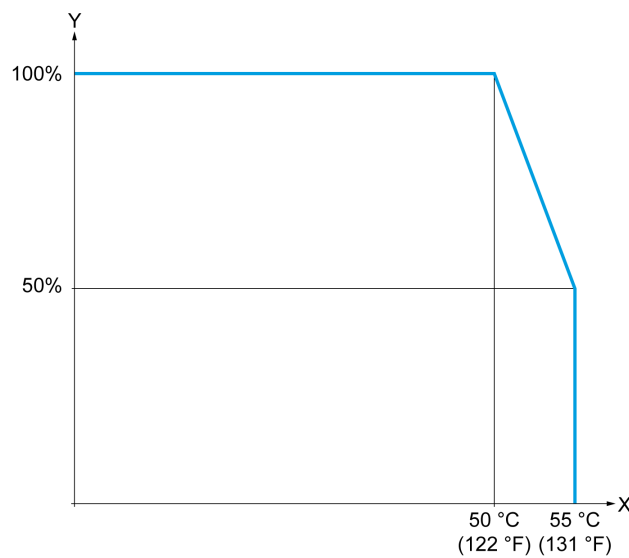
**X** Ambient temperature (°C / °F)

**Y** Input voltage (V)

At an ambient temperature of 55 °C (131 °F) in the horizontal mounting direction, limit the inputs and outputs, respectively, which turn on simultaneously as indicated by the X axis.

### Output De-rating

When using TM3DM16R:



**X** Ambient temperature (°C / °F)

**Y** Output load current (%)

### Power Limitation

This table describes the power limitation of the TM3DM16R expansion module depending on the voltage, the type of load, and the number of operations required.

These expansion modules do not support capacitive loads.

## ⚠ WARNING

### RELAY OUTPUTS WELDED CLOSED

- Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.
- Do not connect relay outputs to capacitive loads.

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

Power Limitations				
Voltage	24 Vdc	120 Vac	240 Vac	Number of operations
Power of resistive loads	–	240 VA	480 VA	100,000
AC-12		80 VA	160 VA	300,000
Power of inductive loads	–	60 VA	120 VA	100,000
AC-15 (cos $\phi$ = 0.35)		18 VA	36 VA	300,000
Power of inductive loads	–	120 VA	240 VA	100,000
AC-14 (cos $\phi$ = 0.7)		36 VA	72 VA	300,000
Power of resistive loads	48 W	–	–	100,000
DC-12	16 W			300,000
Power of inductive loads	24 W	–	–	100,000
DC-13 L/R = 7 ms	7.2 W			300,000

## TM3DM16R Wiring Diagram

### Introduction

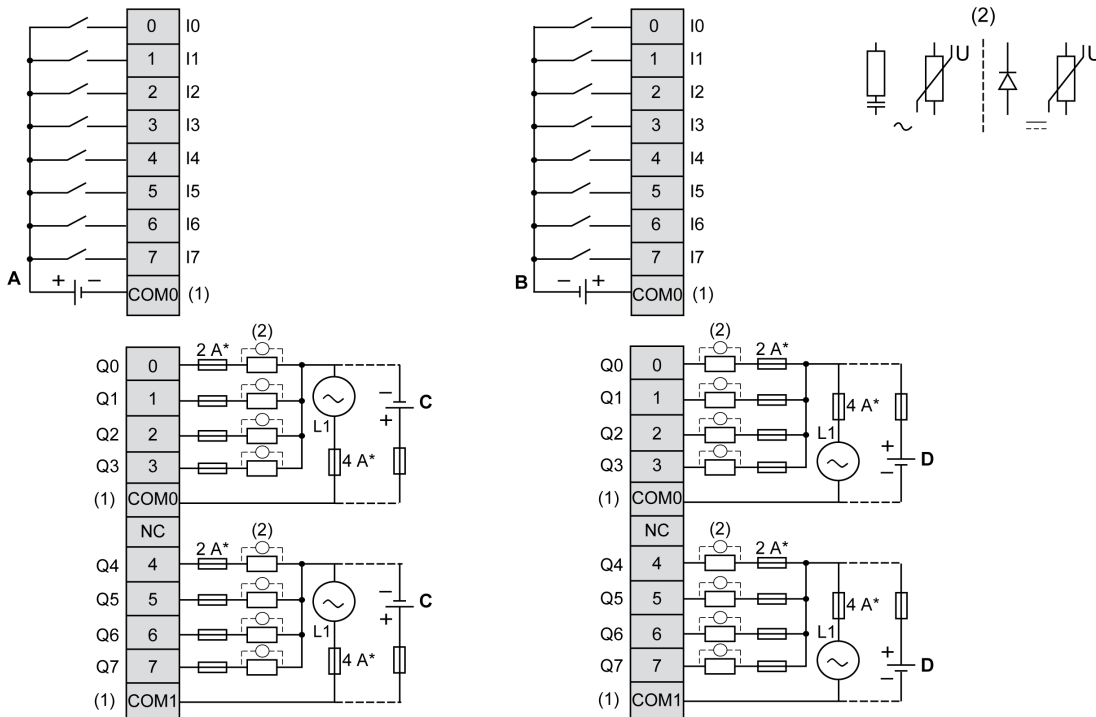
These expansion modules have a built-in removable screw terminal block for the connection of inputs, outputs, and power supply.

### Wiring Rules

See Wiring Best Practices, page 32.

## Wiring Diagram

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



\* Type T Fuse

**(1)** The inputs COM0, outputs COM0 and COM1 terminals are **not** connected internally.

**(2)** To improve the life time of the contacts, and to protect from potential inductive load damage, connect a free wheeling diode in parallel to each inductive DC load or an RC snubber in parallel of each inductive AC load.

**A** Sink wiring (positive logic)

**B** Source wiring (negative logic)

**C** Source wiring (positive logic)

**D** Sink wiring (negative logic)

**NOTE:** When you use the TM3 expansion module with a TM3 Ethernet bus coupler, you must connect an RC snubber in parallel of each inductive AC load.

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

### ⚠ 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.**

# TM3DM24R / TM3DM24RG Mixed I/O Module 16 Inputs/8 Outputs

## What's in This Chapter

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TM3DM24R / TM3DM24RG Characteristics .....	126
TM3DM24R / TM3DM24RG Wiring Diagram .....	130

## Overview

This chapter describes the TM3DM24R / TM3DM24RG expansion modules, its characteristics, and its connection to the different sensors and actuators.

## TM3DM24R / TM3DM24RG Presentation

### Overview

TM3DM24R (screw) and TM3DM24RG (spring) digital expansion module:

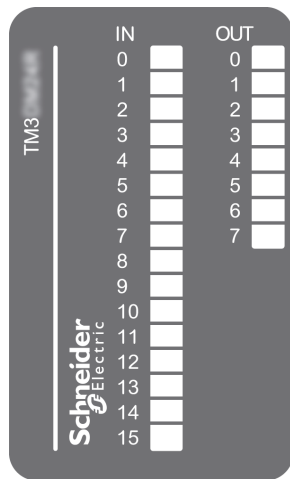
- 16 channel 24 Vdc sink/source inputs
- 1 common line for inputs
- 8 channel 2 A relay outputs
- 2 common line for outputs
- Removable screw or spring terminal block

### Main Characteristics

Characteristic	Value	
<b>Input</b>		
Number of input channels	16 inputs	
Input type	Type 1 (IEC/EN 61131-2)	
Input Logic type	Sink/Source	
Rated input voltage	24 Vdc	
<b>Output</b>		
Number of output channels	8 outputs	
Contact type	NO (Normally Open)	
Rated output voltage	24 Vdc / 240 Vdc	
Rated output current	2 A	
<b>Connection and cable types</b>		
Connection type	TM3DM24R	Removable screw terminal blocks
	TM3DM24RG	Removable spring terminal blocks
Cable type and length	Type	Unshielded
	Length	Max. 30 m (98 ft)
Weight	140 g (4.94 oz)	

## Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Type	Description
0...15	Green	On	Input	The channel is activated
		Off		The channel is deactivated
0...7	Green	On	Output	The channel is activated
		Off		The channel is deactivated

## TM3DM24R / TM3DM24RG Characteristics

### Introduction

This section provides a description of the electrical and input/output characteristics of the TM3DM24R / TM3DM24RG expansion modules.

See also Environmental Characteristics, page 22.

### **⚠ DANGER**

#### **FIRE HAZARD**

- Use only the correct wire sizes for the maximum 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.**

### **⚠ WARNING**

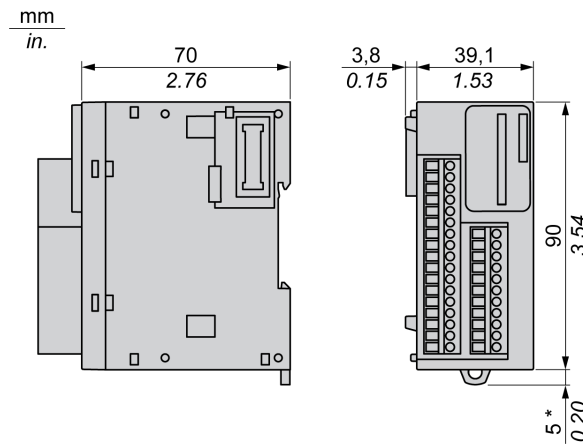
#### **UNINTENDED EQUIPMENT OPERATION**

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 TM3DM24R / TM3DM24RG expansion modules:



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

## Input Characteristics

The table below describes the inputs characteristics of the TM3DM24R / TM3DM24RG:

Characteristic		Value
Number of input channels		16 inputs
Number of channels groups		1 common line for 16 channels
Input type		Type 1 (IEC/EN 61131-2)
Logic type		Sink/source
Rated input voltage		24 Vdc
Input voltage range		0...28.8 Vdc
Rated input current		7 mA
Input impedance		3.4 kΩ
Input limit values	Voltage at state 1	> 15 Vdc (15...28.8 Vdc)
	Voltage at state 0	< 5 Vdc (0...5 Vdc)
	Current at state 1	> 2.5 mA
	Current at state 0	< 1.0 mA
Turn on time		SV <sup>(1)</sup> < 2.0: 4 ms
Turn off time		SV <sup>(1)</sup> ≥ 2.0: 100 μs <sup>(2)</sup>
Isolation	Between input and internal logic	500 Vac
	Between input group and output group	1500 Vac
	Between input groups	N/A
Connection type	TM3DM24R	Removable screw terminal block
	TM3DM24RG	Removable spring terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		42 mA (all inputs and outputs on)
		5 mA (all inputs and outputs off)

Characteristic	Value
Current draw on 24 Vdc internal bus	39 mA (all inputs and outputs on)
	0 mA (all inputs and outputs off)
<p>(1) SV refers to the version and is printed on the product label.</p> <p>(2) The range depends on the configured filter value. If you use EcoStruxure Machine Expert - Basic, refer to the Modicon TM3 (EcoStruxure Machine Expert - Basic) Expansion Modules Configuration - Programming Guide. If you use EcoStruxure Machine Expert, refer to the Modicon TM3 Expansion Modules - Programming Guide.</p>	

## Output Characteristics

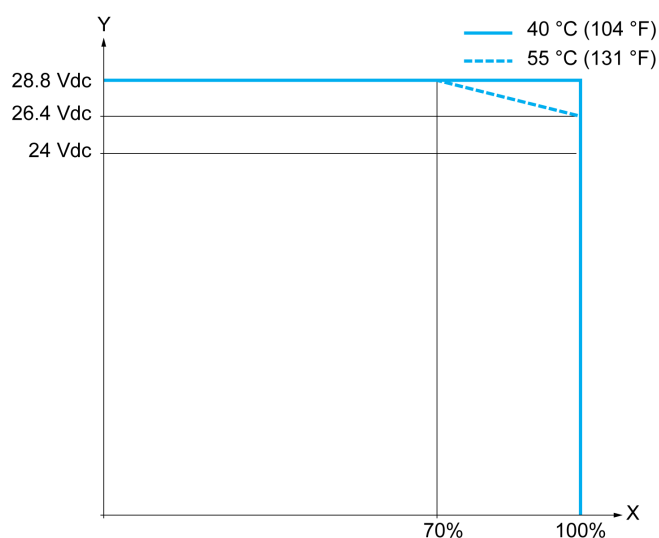
The table below describes the outputs characteristics of the TM3DM24R / TM3DM24RG:

Characteristic	Value	
Number of output channels	8	
Number of channel groups	2 common line for 8 channels	
Output type	Relay	
Contact type	NO (Normally Open)	
Rated output voltage	24 Vdc, 240 Vac	
Maximum voltage	30 Vdc, 264 Vac	
Minimum switching load	5 Vdc at 10 mA	
Rated output current	2 A	
Maximum output current	2 A per channels	
	7 A per commons	
Maximum output frequency	with maximum load 20 operations per minute	
Turn on time	Max. 10 ms	
Turn off time	Max. 10 ms	
Contact resistance	30 mW	
Mechanical life	20 million operations	
Electrical life	Under resistive load	See Power limitation, page 67
	Under inductive load	
Protection against short circuit	No	
Isolation	Between input and internal logic	500 Vac
	Between input group and output group	1500 Vac
	Between input groups	N/A
Connection type	TM3DM24R	Removable screw terminal block
	TM3DM24RG	Removable spring terminal block
Connector insertion/removal durability	Over 100 times	
Current draw on 5 Vdc internal bus	42 mA (all inputs and outputs on)	
	5 mA (all inputs and outputs off)	
Current draw on 24 Vdc internal bus	39 mA (all inputs and outputs on)	
	0 mA (all inputs and outputs off)	
<p><b>NOTE:</b> Refer to Protecting Outputs from Inductive Load Damage, page 32 for additional information on this topic.</p>		



## I/O De-rating

When using TM3DM24R / TM3DM24RG:



**X** Input simultaneous ON ratio

**Y** Input voltage

## Power Limitation

This table describes the power limitation of the TM3DM24R / TM3DM24RG expansion modules depending on the voltage, the type of load, and the number of operations required.

These expansion modules do not support capacitive loads.

### ⚠ WARNING

#### RELAY OUTPUTS WELDED CLOSED

- Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.
- Do not connect relay outputs to capacitive loads.

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

Power Limitations				
Voltage	24 Vdc	120 Vac	240 Vac	Number of operations
Power of resistive loads	–	240 VA	480 VA	100,000
AC-12		80 VA	160 VA	300,000
Power of inductive loads	–	60 VA	120 VA	100,000
AC-15 (cos $\phi$ = 0.35)		18 VA	36 VA	300,000
Power of inductive loads	–	120 VA	240 VA	100,000
AC-14 (cos $\phi$ = 0.7)		36 VA	72 VA	300,000
Power of resistive loads	48 W	–	–	100,000
DC-12	16 W			300,000
Power of inductive loads	24 W	–	–	100,000
DC-13 L/R = 7 ms	7.2 W			300,000

# TM3DM24R / TM3DM24RG Wiring Diagram

## Introduction

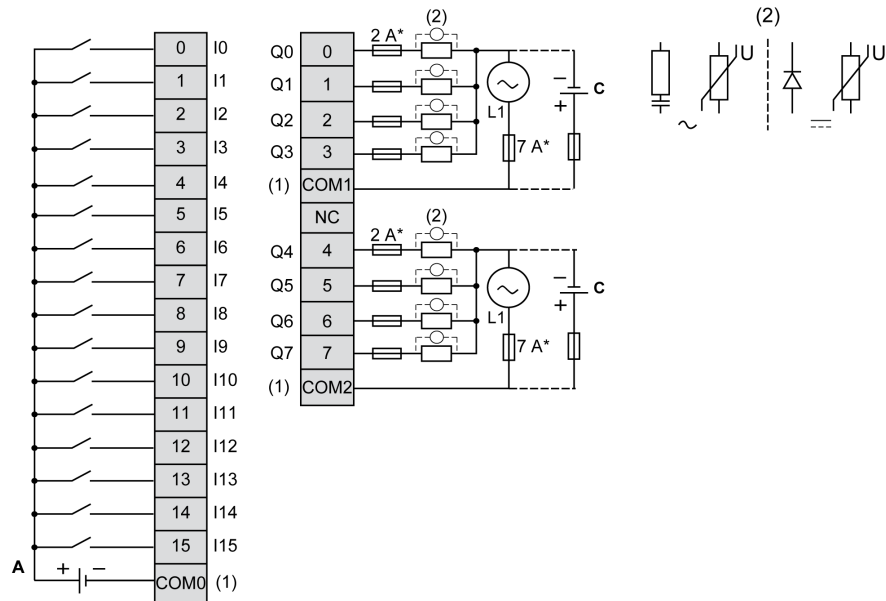
These expansion modules have a built-in removable screw or spring terminal block for the connection of inputs, outputs, and power supply.

## Wiring Rules

See Wiring Best Practices, page 32.

## Wiring Diagram

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



\* Type T Fuse

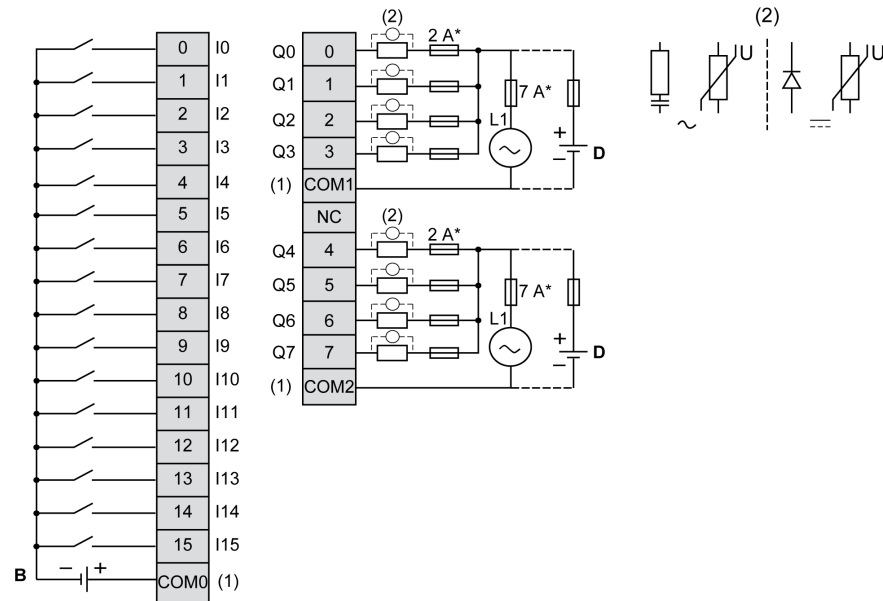
(1) The COM0, COM1 and COM2 terminals are **not** connected internally.

(2) To improve the life time of the contacts, and to protect from potential inductive load damage, connect a free wheeling diode in parallel to each inductive DC load or an RC snubber in parallel of each inductive AC load, or a varistor on either type of load.

C Source wiring (positive logic)

**NOTE:** When you use the TM3 expansion module with a TM3 Ethernet bus coupler, you must connect an RC snubber in parallel of each inductive AC load.

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



\* Type T Fuse

(1) The COM0, COM1 and COM2 terminals are **not** connected internally.

(2) To improve the life time of the contacts, and to protect from potential inductive load damage, connect a free wheeling diode in parallel to each inductive DC load or an RC snubber in parallel of each inductive AC load, or a varistor on either type of load.

D Sink wiring (negative logic)

**NOTE:** When you use the TM3 expansion module with a TM3 Ethernet bus coupler, you must connect an RC snubber in parallel of each inductive AC load.

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

<b>⚠ WARNING</b>
<b>UNINTENDED EQUIPMENT OPERATION</b>
Do not connect wires to unused terminals and/or terminals indicated as “No Connection (N.C.)”.
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

# TM3DM32R Mixed I/O Module 16 Inputs/16 Outputs

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## Overview

This chapter describes the TM3DM32R expansion module, its characteristics, and its connection to the different sensors and actuators.

## TM3DM32R Presentation

### Overview

TM3DM32R digital expansion module:

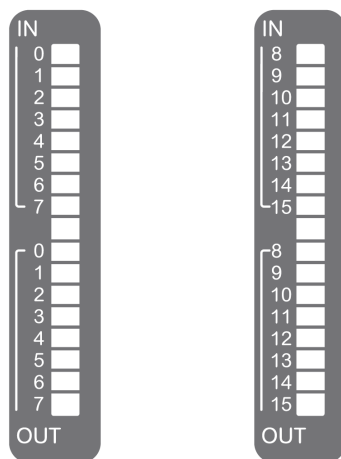
- 16 channel 24 Vdc sink/source inputs
- 2 common lines for inputs
- 16 channel 2 A relay outputs
- 4 common lines for outputs
- Removable screw terminal block

### Main Characteristics

Characteristic		Value
<b>Input</b>		
Number of input channels		16 inputs
Input type		Type 1 (IEC/EN 61131-2)
Input Logic type		Sink/Source
Rated input voltage		24 Vdc
<b>Output</b>		
Number of output channels		16 outputs
Contact type		NO (Normally Open)
Rated output voltage		24 Vdc / 220 Vdc
Rated output current		2 A
<b>Connection and cable types</b>		
Connection type		Removable screw terminal blocks
Cable type and length	Type	Unshielded
	Length	Input: max. 50 m (164 ft) Output: max. 150 m (490 ft)
Weight		208 g (7.34 oz)

## Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Type	Description
0...15	Green	On	Input	The channel is activated
		Off		The channel is deactivated
0...15	Green	On	Output	The channel is activated
		Off		The channel is deactivated

## TM3DM32R Characteristics

### Introduction

This section provides a description of the electrical and input/output characteristics of the TM3DM32R expansion modules.

See also Environmental Characteristics, page 22.

**⚠ DANGER**

**FIRE HAZARD**

- Use only the correct wire sizes for the maximum 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.**

**⚠ WARNING**

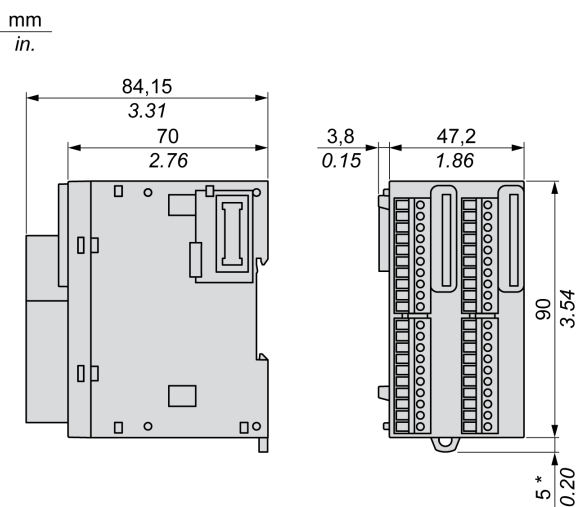
**UNINTENDED EQUIPMENT OPERATION**

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 TM3DM32R expansion modules:



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

## Input Characteristics

The table below describes the input characteristics of the TM3DM32R:

Characteristic		Value
Number of input channels		16 inputs
Number of channels groups		2 common lines for 16 channels
Input type		Type 1 (IEC/EN 61131-2)
Logic type		Sink/source
Rated input voltage		24 Vdc
Input voltage range		0...28.8 Vdc
Rated input current		5 mA
Input impedance		4.7 kΩ
Input limit values	Voltage at state 1	> 15 Vdc (15...28.8 Vdc)
	Voltage at state 0	< 5 Vdc (0..5 Vdc)
	Current at state 1	> 2.5 mA
	Current at state 0	< 1.5 mA
Turn on time		4 ms
Turn off time		4 ms
De-rating	0...55 °C (32...131 °F)	See Input de-rating, page 136
Isolation	Between input and internal logic	500 Vac / 800 Vdc
	Between input group and output group	1500 Vac / 2500 Vdc
	Between input groups	500 Vac / 800 Vdc
Connection type		Removable screw terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		95 mA
Current draw on 24 Vdc internal bus		80 mA

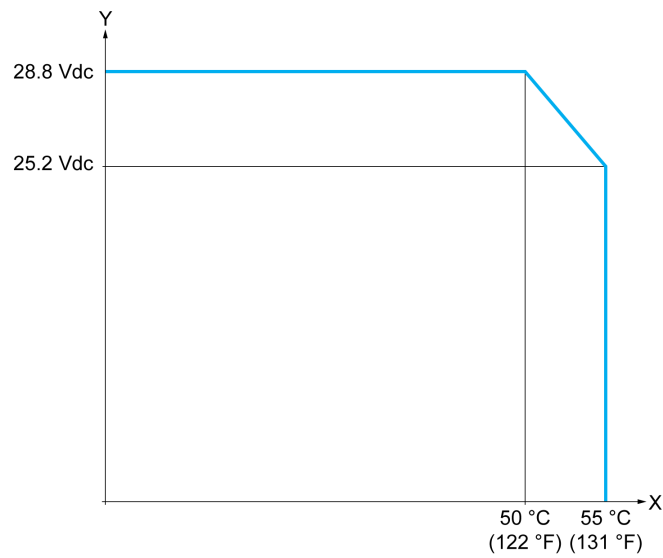
## Output Characteristics

The table below describes the output characteristics of the TM3DM32R:

Characteristic		Value
Number of output channels		16
Number of channel groups		4 common line for 16 channels
Output type		Relay
Contact type		NO (Normally Open)
Rated output current		2 A per output
Maximum output current		2 A per output 4 A per common
Maximum output frequency	With max. load	0.1 Hz
	Without load	5 Hz
Turn on time		Max. 10 ms
Turn off time		Max. 10 ms
De-rating	0...55 °C (32...131 °F)	See Output de-rating, page 136
Mechanical life		20 million operations
Electrical life under resistive load 2 A		100,000 switching cycles at 45 °C (113 °F)
Protection against short circuit		No
Isolation	Between output and internal logic	1500 Vac / 2500 Vdc
	Between input group and output group	1500 Vac / 2500 Vdc
	Between output groups	1500 Vac / 2500 Vdc
Connection type		Removable screw terminal block
Connector insertion/removal durability		Over 100 times
Current draw on 5 Vdc internal bus		95 mA
Current draw on 24 Vdc internal bus		80 mA
<p><b>NOTE:</b> Refer to Protecting Outputs from Inductive Load Damage, page 32 for additional information on this topic.</p>		

### Input De-rating

When using TM3DM32R:

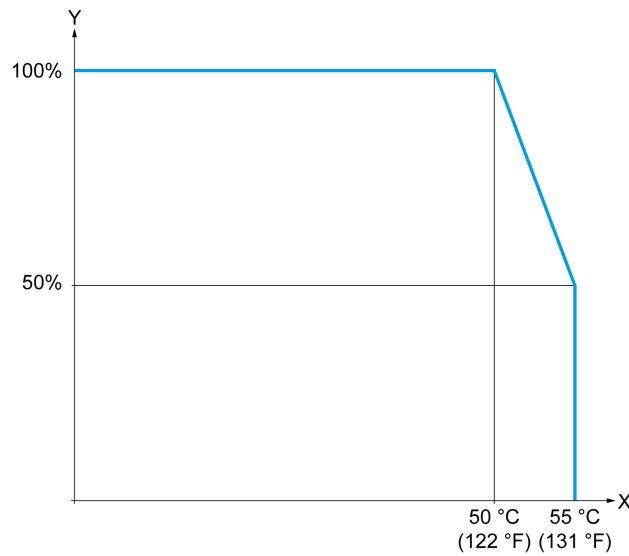


**X** Ambient temperature (°C / °F)

**Y** Input voltage

### Output De-rating

When using TM3DM32R:



**X** Ambient temperature (°C / °F)

**Y** Output load current (%)

### Power Limitation

This table describes the power limitation of the TM3DM32R expansion modules depending on the voltage, the type of load, and the number of operations required.

These expansion modules do not support capacitive loads.



**⚠ WARNING****RELAY OUTPUTS WELDED CLOSED**

- Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.
- Do not connect relay outputs to capacitive loads.

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

**Power Limitations**

Voltage	24 Vdc	120 Vac	240 Vac	Number of operations
Power of resistive loads	–	240 VA	480 VA	100,000
AC-12		80 VA	160 VA	300,000
Power of inductive loads	–	60 VA	120 VA	100,000
AC-15 (cos $\phi$ = 0.35)		18 VA	36 VA	300,000
Power of inductive loads	–	120 VA	240 VA	100,000
AC-14 (cos $\phi$ = 0.7)		36 VA	72 VA	300,000
Power of resistive loads	48 W	–	–	100,000
DC-12	16 W			300,000
Power of inductive loads	24 W	–	–	100,000
DC-13 L/R = 7 ms	7.2 W			300,000

## TM3DM32R Wiring Diagram

### Introduction

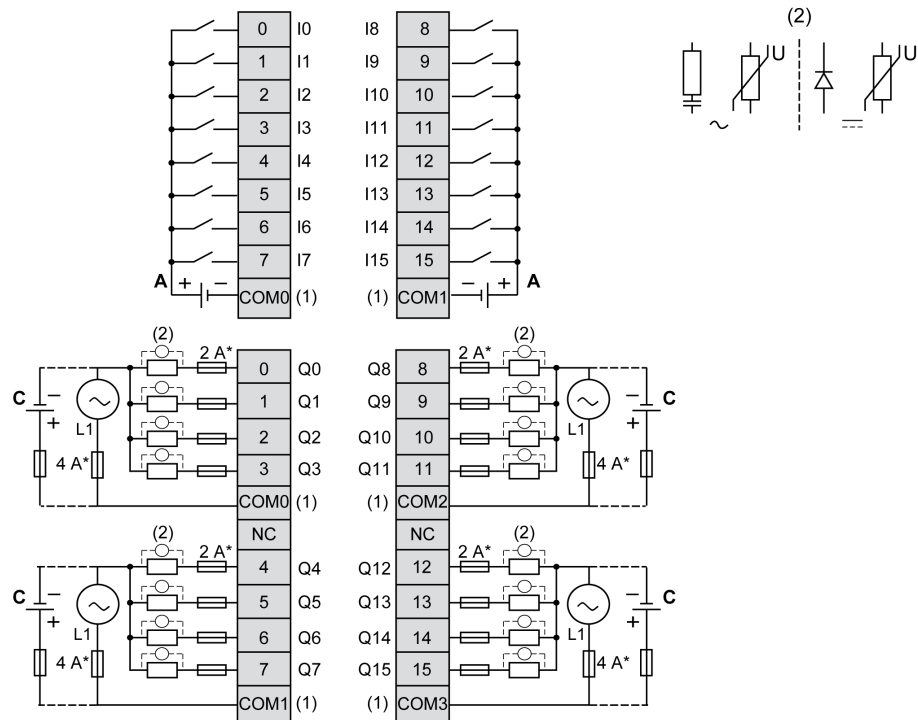
These expansion modules have a built-in removable screw terminal block for the connection of inputs, outputs, and power supply.

### Wiring Rules

See Wiring Best Practices, page 32.

## Wiring Diagram

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



\* Type T Fuse

(1) The inputs COM0, COM1, outputs COM0, COM1, COM2, and COM3 terminals are **not** connected internally.

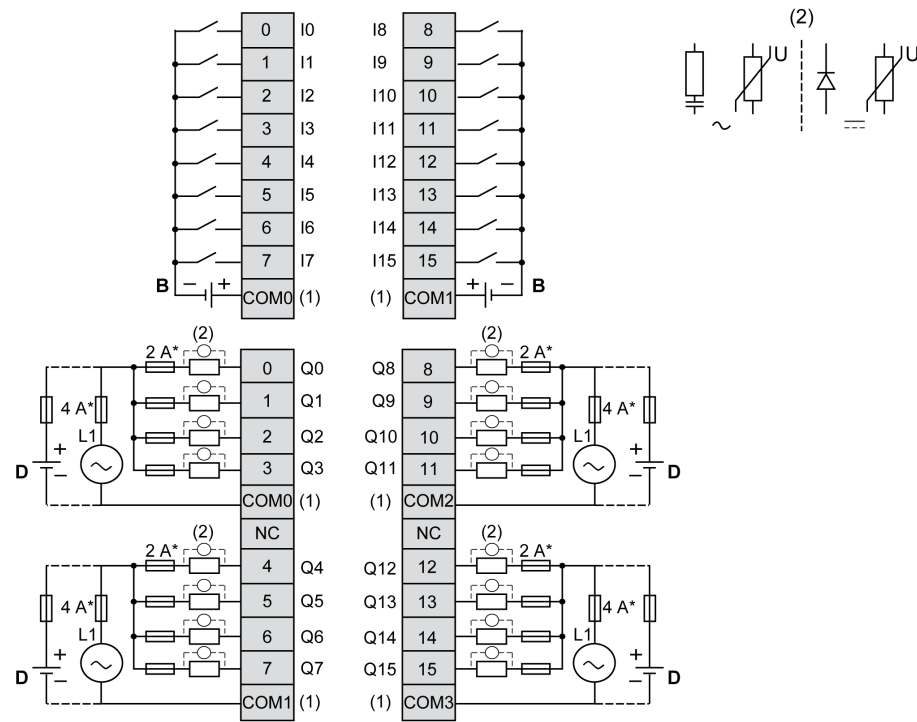
(2) To improve the life time of the contacts, and to protect from potential inductive load damage, connect a free wheeling diode in parallel to each inductive DC load or an RC snubber in parallel of each inductive AC load.

**A** Sink wiring (positive logic)

**C** Source wiring (positive logic)

**NOTE:** When you use the TM3 expansion module with a TM3 Ethernet bus coupler, you must connect an RC snubber in parallel of each inductive AC load.

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



\* Type T Fuse

(1) The inputs COM0, COM1 and outputs COM0, COM1, COM2, and COM3 terminals are **not** connected internally.

(2) To improve the life time of the contacts, and to protect from potential inductive load damage, connect a free wheeling diode in parallel to each inductive DC load or an RC snubber in parallel of each inductive AC load.

**B** Source wiring (negative logic)

**D** Sink wiring (negative logic)

**NOTE:** When you use the TM3 expansion module with a TM3 Ethernet bus coupler, you must connect an RC snubber in parallel of each inductive AC load.

For information about 24 Vdc power supply, refer to DC Power Supply Characteristics, page 37.

<b>⚠ WARNING</b>
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# Glossary

## 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 or bus coupler.

### 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

### 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.

### I/O:

(*input/output*)

### 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

### **N/O:**

*(normally open)* A contact pair that opens when the actuator is de-energized (no power is applied) and closes when the actuator is energized (power is applied).

### **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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