Modicon TM4
Expansion Modules
Hardware Guide

04/2014

EIO0000001796.01

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

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

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

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

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

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Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, 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 safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

PLEASE NOTE

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

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

About the Book

At a Glance

Document Scope

This guide describes the hardware implementation of TM4 expansion modules. It provides the parts description, characteristics, wiring diagrams, and installation details for TM4 expansion modules.

Validity Note

This document has been updated with the release of SoMachine V4.1.

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

Step	Action
1	Go to the Schneider Electric home page *www.schneider-electric.com*.
2	In the **Search** box type the reference of a product or the name of a product range. ● Do not include blank spaces in the model number/product range. ● To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the **Product datasheets** search results and click on the reference that interests you. If you entered the name of a product range, go to the **Product Ranges** search results and click on the product range that interests you.
4	If more than one reference appears in the **Products** search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the data sheet.
6	To save or print a data sheet as a .pdf file, click **Download XXX product datasheet**.

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

Related Documents

Title of Documentation	Reference Number
Modicon TM4 Expansion Modules Configuration - Programming Guide	EIO0000001802 (ENG) EIO0000001803 (FRA) EIO0000001804 (GER) EIO0000001805 (SPA) EIO0000001806 (ITA) EIO0000001807 (CHS) EIO000000xxxx (POR) EIO000000xxxx (TUR)
Modicon M241 Logic Controller - Hardware Guide	EIO0000001456 (ENG) EIO0000001457 (FRA) EIO0000001458 (GER) EIO0000001459 (SPA) EIO0000001460 (ITA) EIO0000001461 (CHS)
Modicon M251 Logic Controller - Hardware Guide	EIO0000001486 (ENG) EIO0000001487 (FRA) EIO0000001488 (GER) EIO0000001489 (SPA) EIO0000001490 (ITA) EIO0000001491 (CHS)
TM4 Expansion Modules - Instruction sheet	EAV47886

You can download these technical publications and other technical information from our website at www.schneider-electric.com.

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.

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠ DANGER

POTENTIAL FOR EXPLOSION

Install and use this equipment in non-hazardous locations only.

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.[1]
- 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.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Part I
TM4 General Overview

What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
1	TM4 Description	13
2	TM4 Installation	17

Chapter 1
TM4 Description

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
General Description	14
TM4 Expansion Modules Compatibility	15

General Description

TM4 Expansion Modules

The following table shows the TM4 expansion module features:

Module reference	Type	Terminal type
TM4ES4 *(see page 41)*	Ethernet communication	4 RJ45 connectors 1 screw for functional ground connection
TM4PDPS1 *(see page 49)*	PROFIBUS DP slave communication	1 SUB-D 9 pins female connector 1 screw for functional ground connection
NOTE: If the controller has more than one embedded Ethernet port, the module works as a standalone Ethernet switch.		

Accessories

Reference	Description	Use	Quantity
AB1AB8P35	End brackets	Blocks the logic controller and expansion modules on a 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

Cables

Use one of the cables to connect a TM4ES4 module to your system:

Reference	Description	Use	Certified
490NTW000••	Standard Ethernet cable Shielded twisted pair 2 RJ45 connectors	Connection to DTE	EC
490NTW000••U			UL
TCSECE3M3M•S4	Rugged Ethernet cable Shielded twisted pair 2 RJ45 connectors		EC
TCSECU3M3M•S4			UL

TM4 Expansion Modules Compatibility

Introduction

The following part describes the compatibility of TM4 expansion modules with controllers.

The TM4 bus supports up to 3 expansion modules.

TM4ES4 Ethernet Module Compatibility

The TM4ES4 module has 2 usages:

- **Expansion** usage: addition of an Ethernet interface to controller without embedded Ethernet interface,
- **Standalone** usage: Ethernet switch (only getting its power supply from the controller).

Only 1 TM4ES4 module can be added to a controller as **expansion**.

3 TM4ES4 modules can be added as **standalone** switches.

NOTE: Standalone usage does not require controller configuration in SoMachine.

The table shows the TM4ES4 Ethernet module compatibility with controllers:

Controller Reference	Expansion Usage Supported	Standalone Usage Supported	Maximum Number of TM4ES4 Module
TM241CE40T	No	Yes	3 standalone
TM241CE40U	No	Yes	3 standalone
TM241CE24T	No	Yes	3 standalone
TM241CE24U	No	Yes	3 standalone
TM241C40T	Yes	Yes	1 expansion 2 standalone
TM241C40U	Yes	Yes	1 expansion 2 standalone
TM241C24T	Yes	Yes	1 expansion 2 standalone
TM241C24U	Yes	Yes	1 expansion 2 standalone
TM241CE40R	No	Yes	3 standalone
TM241CE24R	No	Yes	3 standalone
TM241C40R	Yes	Yes	1 expansion 2 standalone
TM241C24R	Yes	Yes	1 expansion 2 standalone
TM241CEC24T	No	Yes	3 standalone
TM241CEC24U	No	Yes	3 standalone

Controller Reference	Expansion Usage Supported	Standalone Usage Supported	Maximum Number of TM4ES4 Module
TM241CEC24R	No	Yes	3 standalone
TM251MESE	No	Yes	3 standalone
TM251MESC	No	Yes	3 standalone

TM4PDPS1 PROFIBUS DP Expansion Module Compatibility

The TM4PDPS1 module is compatible with all M241 and M251 controllers.

Only 1 TM4PDPS1 module can be added to a controller.

Chapter 2
TM4 Installation

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
2.1	TM4 General Rules for Implementing	18
2.2	TM4 Expansion Module Installation	23
2.3	TM4 Electrical Requirements	35

Section 2.1
TM4 General Rules for Implementing

What Is in This Section?

This section contains the following topics:

Topic	Page
Environmental Characteristics	19
Certifications and Standards	22

Environmental Characteristics

Enclosure Requirements

TM4 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 TM4 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 TM4 expansion module components. Use enclosures with a keyed locking mechanism to minimize unauthorized access.

Environmental Characteristics

All the TM4 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.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

The following table shows the general environmental characteristics:

Characteristic		Specification
Standard compliance	IEC/EN 61131-2 IEC/EN 61010-2-201	
Ambient operating temperature	Horizontal installation	–10...55 °C (14...131 °F)
	Vertical installation	–10...35 °C (14...95 °F)
Storage temperature		–25...70 °C (- 13...158 °F)
Relative humidity	Transport and storage	10...95 % (non-condensing)
	Operation	10...95 % (non-condensing)
Degree of pollution	IEC/EN 60664-1	2
Degree of protection	IEC/EN 61131-2	IP20
Machine Safety conformance	IEC/EN 61010-2-201	Yes
Corrosion immunity		Atmosphere free from corrosive gases
Operating altitude		0...2000 m (0...6560 ft)
Storage altitude		0...3000 m (0...9843 ft)
Vibration resistance	IEC/EN 61131-2 Panel mounting or mounted on a top hat section rail (DIN rail)	3.5 mm (0.13 in) fixed amplitude from 5...8.5 Hz 29.4 m/s^2 or 96.45 ft/s^2 (3 g_n) fixed acceleration from 8.7...150 Hz
Mechanical shock resistance		147 m/s^2 or 482.28 ft/s^2 (15 g_n) for a duration of 11 ms

Electromagnetic Susceptibility

The TM4 expansion module components meets electromagnetic susceptibility specifications as indicated in the following table:

Characteristic	Designed to specification	Range		
Electrostatic discharge	IEC/EN 61000-4-2	8 kV (air discharge) 6 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...2.7 GHz)		
Magnetic field	IEC/EN 61000-4-8	30 A/m 50 Hz, 60 Hz		
Fast transients burst	IEC/EN 61000-4-4	–	CM[1] and DM[2]	
		AC/DC Power lines	1 kV	
		Communication line	1 kV	
Surge immunity	IEC/EN 61000-4-5 IEC/EN 61131-2	–	CM[1]	DM[2]
		DC Power lines	1 kV	0.5 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/EN 55011 (IEC/CISPR Publication 11)	AC power line: ● 0.15...0.5 MHz: 79 dBµV/m QP / 66 dBµV/m AV ● 0.5...300 MHz: 73 dBµV/m QP / 60 dBµV/m AV		
		AC/DC power line: ● 10...150 kHz: 120...69 dBµV/m QP ● 150...1500 kHz: 79...63 dBµV/m QP ● 1.5...30 MHz: 63 dBµV/m QP		
Radiated emission	IEC/EN 55011 (IEC/CISPR Publication 11)	Class A, 10 m distance: ● 30...230 MHz: 40 dBµV/m QP ● 230...1000 MHz: 47 dBµV/m QP		

1 Common Mode
2 Differential Mode

Certifications and Standards

Introduction

The TM4 expansion modules are designed to conform to the main national and international standards concerning electronic industrial control devices:

- IEC/EN 61131-2
- UL 508

The TM4 expansion modules have obtained, or in the process of obtaining, the following conformity marks:

- CE
- cULus pending
- CSA pending

The TM4 expansion modules comply with the main national and international Directives and Regulations concerning electronic industrial control devices:

- Europe RoHS:
  - Exemption annex III 7(a)
  - Exemption annex III 7(c)-I
  - Exemption annex III 34
- China RoHS regulations 
- REACh v9

Section 2.2
TM4 Expansion Module Installation

What Is in This Section?

This section contains the following topics:

Topic	Page
Installation and Maintenance Requirements	24
Installation Guidelines	27
Top Hat Section Rail (DIN rail)	28
Assembling a Module to a Controller	31
Disassembling a Module from a Controller	33
Direct Mounting on a Panel Surface	34

Installation and Maintenance Requirements

Before Starting

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

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

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

Disconnecting Power

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

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

Programming Considerations

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Operating Environment

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠ DANGER

POTENTIAL FOR EXPLOSION

Install and use this equipment in non-hazardous locations only.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Installation Considerations

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use appropriate safety interlocks where personnel and/or equipment hazards exist.
- Install and operate this equipment in an enclosure appropriately rated for its intended environment.
- 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.
- 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

TM4 expansion modules are assembled by connecting them to a logic controller.

The logic controller 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.

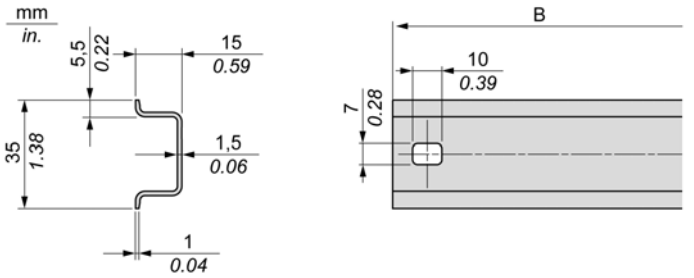
Top Hat Section Rail (DIN rail)

Dimensions of Top Hat Section Rail DIN Rail

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

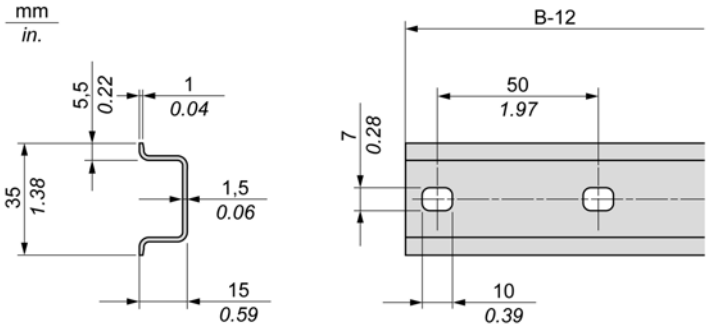
Symmetric Top Hat Section Rails (DIN Rail)

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



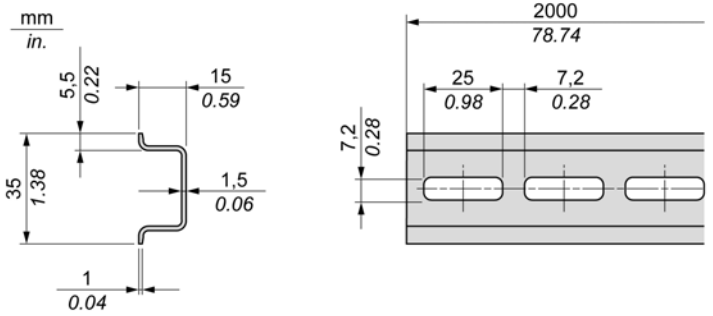
Reference	Type	Rail Length (B)
NSYSDR50A	A	450 mm (17.71 in.)
NSYSDR60A	A	550 mm (21.65 in.)
NSYSDR80A	A	750 mm (29.52 in.)
NSYSDR100A	A	950 mm (37.40 in.)

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



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

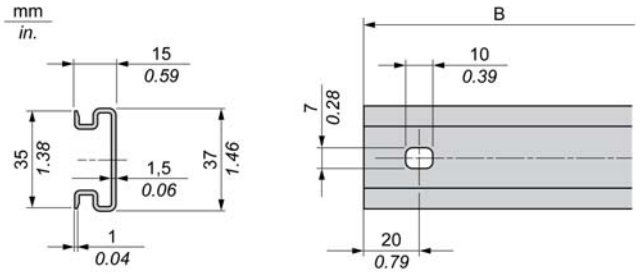
The following illustration and table shows the references of the symmetric top hat section rails (DIN rail) of 2000 mm (78.74 in.):



Reference	Type	Rail Length
NSYSDR200[1]	A	2000 mm (78.74 in.)
NSYSDR200D[2]	A	
1 Unperforated galvanized steel **2** Perforated galvanized steel		

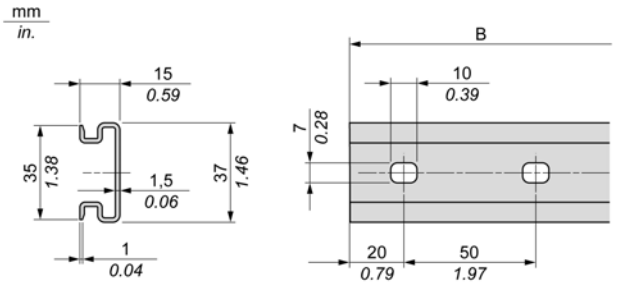
Double-Profile Top Hat Section Rails (DIN rail)

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



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

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



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

Assembling a Module to a Controller

Introduction

This section describes how to assemble an expansion module to a controller 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, update and redownload your application program before placing the system back in service. If you do not revise your application program to reflect the addition of new modules, I/O located on the expansion bus may no longer operate normally.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Assembling a Module to a Controller

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

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

Disassembling a Module from a Controller

Introduction

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

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

Disassembling a Module from a Controller

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

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 from the bottom of the module.
4	Push simultaneously the 2 clips, at the top and the bottom of the module to disengage it from the controller.
5	Pull apart module from the controller.

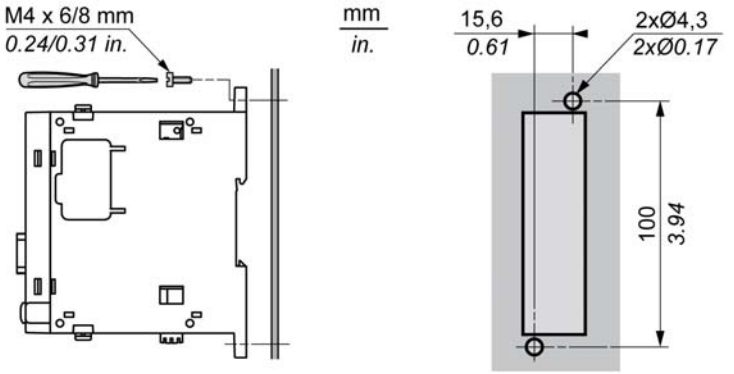
Direct Mounting on a Panel Surface

Overview

This section shows how to install TM4 expansion module using the Panel Mounting Kit. This section also provides mounting hole layout for all modules.

Mounting Hole Layout

The following diagram shows the mounting holes for the TM4 expansion modules:



Section 2.3
TM4 Electrical Requirements

Wiring Best Practices

Overview

This section describes the wiring guidelines and associated best practices to be respected when using the TM4 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.[1]
- 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.

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

Functional Ground (FE) on the DIN Rail

The DIN Rail for your TM4 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 TM4 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 (highly recommended).
- Use twisted-pair, shielded cables for analog, and/or fast I/O.
- Use twisted-pair, shielded cables for networks, and field bus.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use shielded cables for all fast I/O, analog I/O, and communication signals.
- Ground cable shields for all fast I/O, analog I/O, and communication signals at a single point[1].
- Route communications and I/O cables separately from power cables.

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

[1]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. 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.

Part II
TM4 Expansion Modules

What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
3	TM4ES4 Ethernet Module	41
4	TM4PDPS1 PROFIBUS DP Slave Module	49

Chapter 3
TM4ES4 Ethernet Module

Overview

This chapter describes the TM4ES4 Ethernet module, its characteristics, and its connection to the different devices.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM4ES4 Presentation	42
TM4ES4 Characteristics	45
TM4ES4 Wiring Diagram	47

TM4ES4 Presentation

Overview

The TM4ES4 Ethernet module provides an Ethernet interface to controller whithout an embedded Ethernet port. The module is also an Ethernet switch.

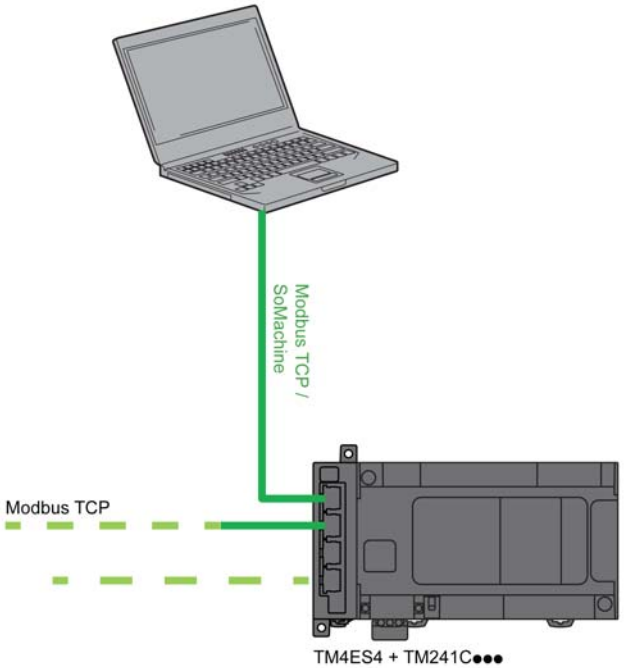
Main Characteristics

The table describes the main characteristics of the TM4ES4 Ethernet communication module:

Main Characteristics	Value
Standard	Ethernet
Connector type	4 RJ45 connectors for Ethernet communication
Grounding	1 screw for functional ground connection
Transfer rate	100 Mbit/s maximum

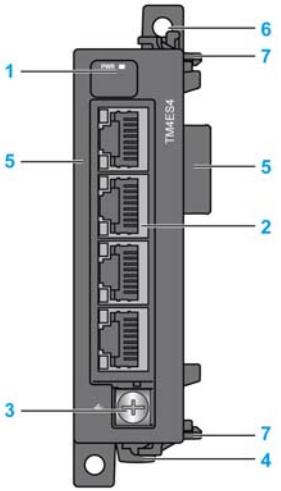
Architecture

The following figure shows an architecture example to connect a M241 controller to an Ethernet network:



Description

The following figure shows the main elements of the TM4ES4 module:



Label	Elements	Refer to …
1	LED that displays the power supply status	–
2	4 Ethernet RJ45 connectors	–
3	Screw for functional ground connection	Rules for the Connection to the Functional Ground *(see page 48)*
4	Clip-on lock for 35 mm (1.38 in.) top hat section rail (DIN-rail)	Top Hat Section Rail (DIN rail) *(see page 28)*
5	Connector for TM4 expansion modules (one on each side)	–
6	Locking device for attachment to the previous module	–
7	Clip for attachment to the previous module or the controller	–

Module Status LED

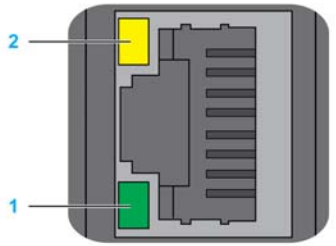
The figure shows the TM4ES4 status LEDs:

The table shows the description the TM4ES4 status LED:

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

RJ45 Connector Status LEDs

The figure shows the RJ45 connector status LEDs:



The table describes the RJ45 connector status LED:

Label	Description	LED		
		Color	**Status**	**Description**
1	Ethernet activity	Green	Off	No activity
			On	Transmitting or receiving data
2	Ethernet link	Green/Yellow	Off	No link
			Solid yellow	Link at 10 Mbit/s
			Solid green	Activity at 100 Mbit/s

TM4ES4 Characteristics

Introduction

These are the general characteristics of the TM4ES4 module.

See also Environmental Characteristics *(see page 19)*.

⚠ WARNING

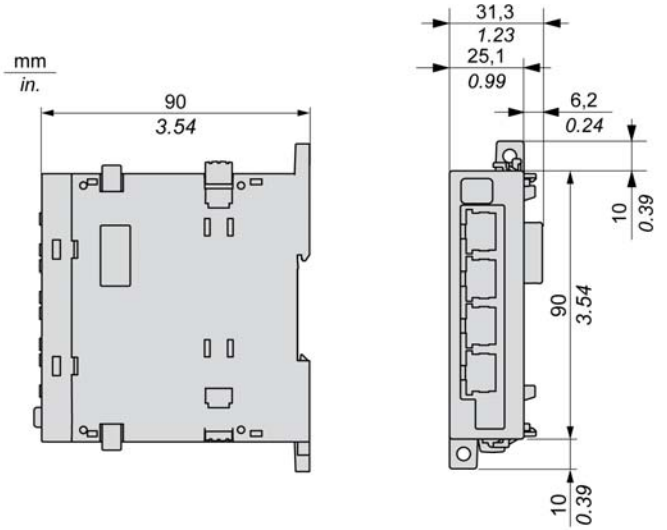
UNINTENDED EQUIPMENT OPERATION

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 dimensions of the TM4ES4 module:



General Characteristics

The table describes the general characteristics of the TM4ES4 module:

Characteristic	Value
Consumption	360 mA
Power dissipation	2.5 W
Weight	125 g (4.41 oz)

Characteristics

The table describes the characteristics of the TM4ES4 module:

Characteristic	Description
Standard	Ethernet
Connector type	RJ45
Baud rate	Supports Ethernet "10BaseT" and "100BaseTX" with auto-negotiation
Auto-crossover	MDI / MDIX

NOTE: The controller supports the MDI/MDIX auto-crossover cable function. It is not necessary to use special Ethernet crossover cables to connect devices directly to this port (connections without an Ethernet hub or switch).

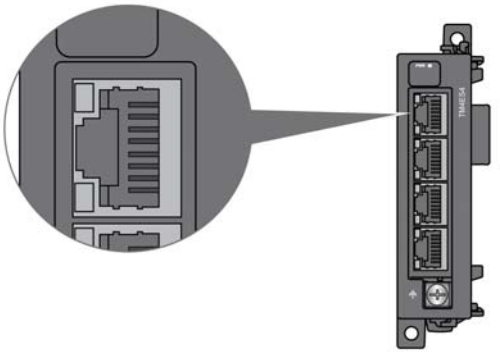
TM4ES4 Wiring Diagram

Wiring Rules

See Wiring Best Practices *(see page 35)*.

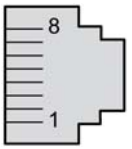
RJ45 Connector

The TM4ES4 module is equipped with 4 Ethernet RJ45 connectors:



Pin Assignment

The figure shows the Ethernet RJ45 connector pins:



The table describes the Ethernet RJ45 connector pins assignment:

Pin N°	Signal
1	TD+
2	TD-
3	RD+
4	–
5	–
6	RD-
7	–
8	–

Rules for Connection to the Functional Ground

The following table shows the characteristics of the screw to be used with the provided Functional Earth (FE) Cable:

 Phillips Ph2	 C	N•m	0,5
		lb-in	*4.4*

Applying torque above the limit may damage the terminal screw or threads.

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

Chapter 4
TM4PDPS1 PROFIBUS DP Slave Module

Overview

This chapter describes the TM4PDPS1 module, its characteristics, and its connection to the different devices.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM4PDPS1 Presentation	50
TM4PDPS1 Characteristics	53
TM4PDPS1 Wiring Diagram	55

TM4PDPS1 Presentation

Overview

The TM4PDPS1 PROFIBUS DP slave module allows you to connect the controller to a PROFIBUS DP fieldbus.

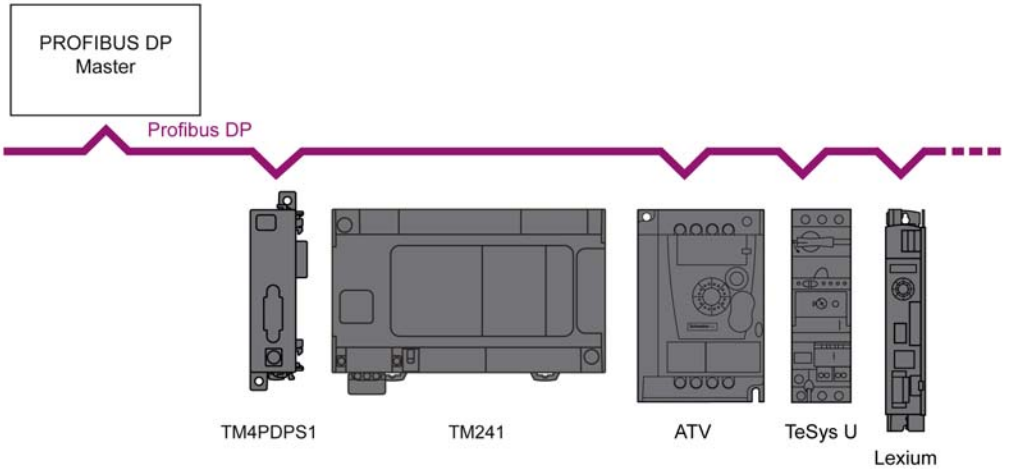
Main Characteristics

The table describes the main characteristics of the TM4PDPS1 PROFIBUS DP slave module:

Main Characteristics	Value
Fieldbus	PROFIBUS DP slave
Interface type	RS-485
Connector type	SUB-D 9, female
Grounding	1 screw for functional ground connection
Transfer rate	12 Mbit/s maximum

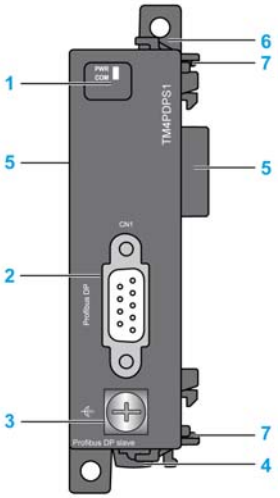
Architecture Example

The following figure shows an architecture example to connect a M241 controller to a PROFIBUS DP fieldbus:



Description

The following figure shows the main elements of the TM4PDPS1 module:



Label	Elements	Refer to …
1	LEDs that display the module status	–
2	1 SUB-D 9, female connector	–
3	Screw for functional ground connection	Rules for tConnection to the Functional Ground *(see page 56)*
4	Clip-on lock for 35 mm (1.38 in.) top hat section rail (DIN-rail)	Top Hat Section Rail (DIN rail) *(see page 28)*
5	Connector for TM4 expansion modules (one on each side)	–
6	Locking device for attachment to the previous module	–
7	Clip for attachment to the previous module or the controller	–

Status LEDs

The figure shows the TM4PDPS1 status LEDs:

The table describes the TM4PDPS1 status LEDs:

LEDs	Color	Status	Description
PWR	Green / Yellow	Off	Indicates that power is removed
	Green	On	Indicates that power is applied
	Green / Yellow	Flashing Green / Yellow	Module start in progress
COM	Green	On	The module is in RUN mode, performing cyclic communication
	Red	Cyclic flashing	The module is in STOP mode, no communication is performed, a connection error has been detected
		Acyclic flashing	The module is not configured

TM4PDPS1 Characteristics

Introduction

These are the general characteristics for the TM4PDPS1 module.

See also Environmental Characteristics *(see page 19)*.

⚠ WARNING

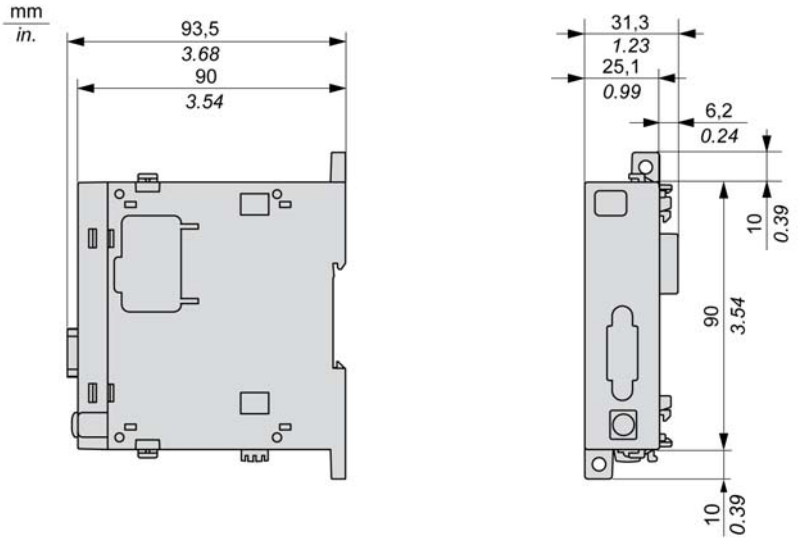
UNINTENDED EQUIPMENT OPERATION

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 dimensions of the TM4PDPS1 module:



General Characteristics

The table describes the general characteristics of the TM4PDPS1 module:

Characteristic	Value
Consumption	290 mA
Power dissipation	1.5 W
Weight	100 g (3.52 oz)

PROFIBUS DP Module Characteristics

The table describes the PROFIBUS DP characteristics of the TM4PDPS1 module:

Characteristic	Value	
Type of interface	Free of potential	
PROFIBUS standards	DP-V0, DP-V1	
PROFIBUS baudrate	3…12 Mbit/s	at 100 m cable length
	1.5 Mbit/s	at 200 m cable length
	500 kBit/s	at 400 m cable length
	187.5 kBit/s	at 1000 m cable length
	9.6…93.75 kBit/s	at 1200 m cable length
Physical	EIA-485	
Isolation between PROFIBUS DP and internal electronics	1.0 kV	
Cable requirements	Impedance	135…165 Ohm at 20 MHz
	Capacitance	< 30 pF per meter
	Lead cross section	> 0.34 mm^2, equates to AWG22
	Cable type	Paired 1 x 2 or 2 x 2 or 1 x 4
	Loop resistance	< 110 Ohm at 1 km
	Signal loss	< 9 dB over the whole bus-segment
	Shielding	Copper shielding

NOTE: Do not connect more than 32 stations per segment without a repeater or more than 127 with a repeater.

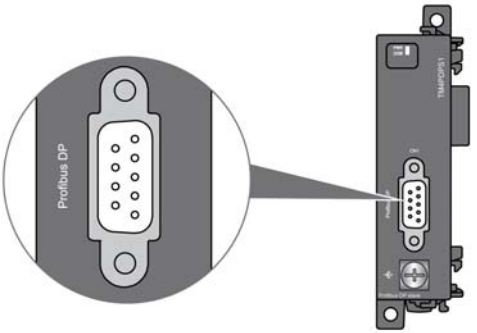
TM4PDPS1 Wiring Diagram

Wiring Rules

See Wiring Best Practices *(see page 35)*.

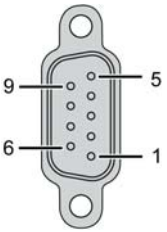
SUB-D 9 Connector

The TM4PDPS1 module is equipped with 1 PROFIBUS DP SUB-D 9 connector:



Pin Assignment

The figure shows the PROFIBUS DP SUB-D 9 connector pins:



The table describes the PROFIBUS DP SUB-D 9 connector pins assignment:

Pin N°	PROFIBUS DP	Description
1	Reserved	–
2	Reserved	–
3	RxD/TxD-P	Transmit/receive data High
4	CNTR-P	Transmit enable High
5	DGND	Signal Ground
6	VP	Voltage 5 V (100 mA)
7	Reserved	–
8	RxD/TxD-N	Transmit/receive data Low
9	Reserved	–

Rules for Connection to the Functional Ground

The following table shows the characteristics of the screw to be used with the provided Functional Earth (FE) Cable:

Phillips Ph2	C	N•m	0,5
		lb-in	*4.4*

Applying torque above the limit may damage the terminal screw or threads.

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

Glossary

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

Ethernet

A physical and data link layer technology for LANs, also known as IEE 802.3.

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.

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.

L

LED

(*light emitting diode*) An indicator that illuminates under a low-level electrical charge.

N

NEMA

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

P

Profibus DP

(*Profibus decentralized peripheral*) An open bus system uses an electrical network based on a shielded 2-wire line or an optical network based on a fiber-optic cable. DP transmission allows for high-speed, cyclic exchange of data between the controller CPU and the distributed I/O devices.

R

RJ-45

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

RS-485

A standard type of serial communication bus, based on 2 wires (also known as EIA RS-485).

run

A command that causes the controller to scan the application program, read the physical inputs, and write to the physical outputs according to solution of the logic of the program.

S

STOP

A command that causes the controller to stop running an application program.

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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