

Modicon TM3

Transmitter and Receiver Modules

Hardware Guide

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

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

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

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

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Safety Information



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 TM3 Transmitter and Receiver modules. It provides the part description, characteristics, wiring diagrams, and installation details for TM3 Transmitter and Receiver modules.

Validity Note

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

This document has been updated with the release of SoMachine Basic V1.1.

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. <ul style="list-style-type: none">• 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 TM3 (SoMachine Basic) Expansion Modules Configuration Programming Guide	EIO0000001396 (ENG) EIO0000001397 (FRA) EIO0000001398 (GER) EIO0000001399 (SPA) EIO0000001400 (ITA) EIO0000001401 (CHS) EIO0000001374 (POR) EIO0000001375 (TUR)
Modicon TM3 Modules Configuration Programming Guide	EIO0000001402 (ENG) EIO0000001403 (FRA) EIO0000001404 (GER) EIO0000001405 (SPA) EIO0000001406 (ITA) EIO0000001407 (CHS)
Modicon M221 Logic Controller Hardware Guide	EIO0000001384 (ENG) EIO0000001385 (FRA) EIO0000001386 (GER) EIO0000001387 (SPA) EIO0000001388 (ITA) EIO0000001389 (CHS) EIO0000001370 (POR) EIO0000001371 (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)
TM3 Transmitter and Receiver Module Instruction Sheet	HRB59607

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

TM3 General Overview

What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
1	TM3 Description	13
2	TM3 Installation	17

Chapter 1

TM3 Description

General Description

Introduction

The TM3 transmitter expansion module is equipped with:

- 1 front connector RJ45
- 1 screw for functional ground connection
- 2 status LEDs (link and power)

The TM3 receiver expansion module is equipped with:

- 1 front connector RJ45
- 1 connector for power supply
- 2 status LEDs (link and power)

The TM3 transmitter module is connected to the logic controller through the TM3 bus. It is connected using a connector at the left side of the module. The TM3 transmitter expansion module is the last physical module of the local configuration (there is no bus connector on the right-hand side of the module).

The TM3 receiver module is connected through the front connector RJ45 to the TM3 transmitter module with an appropriate cable (*see page 15*).

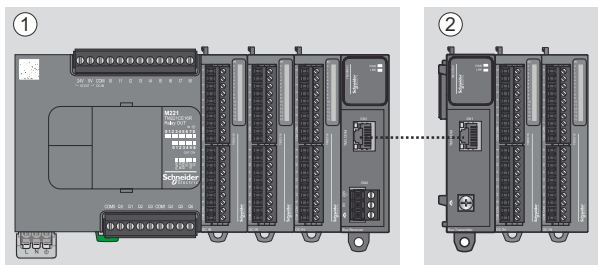
TM3 Transmitter and Receiver Modules

The following table shows the TM3 transmitter and receiver expansion modules:

Reference	Description	Terminal Type / Pitch
TM3XTRA1 (<i>see page 45</i>)	Data transmitter module for remote I/O	1 front connector RJ-45 1 screw for functional ground connection
TM3XREC1 (<i>see page 53</i>)	Data receiver module for remote I/O	1 front connector RJ-45 Power supply connector / 5.08 mm

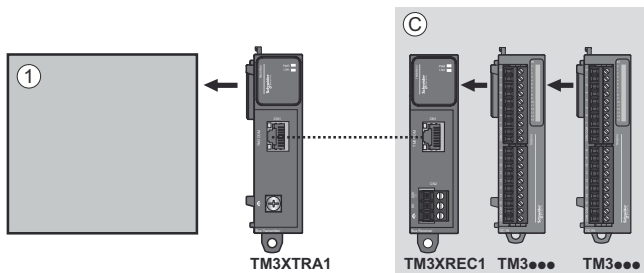
Implementation of TM3 Transmitter and Receiver Modules

The following figure defines the system divided into a local configuration and remote configuration (M221 example):



- 1 Local configuration
- 2 Remote configuration

The following figure represents the components of a remote configuration:



- 1 Controller and modules
- C Expansion modules (7 maximum)

NOTE: Transmitter and receiver modules does not count in the maximum number of expansion modules.

NOTE: You cannot use TM2 modules in configurations that include the TM3 transmitter and receiver modules.

Accessories

Reference	Description	Use	Quantity
TMAT2PSET	Set of 5 removable screw terminal blocks	Connects the 24 Vdc power supply.	1
AB1AB8P35	End brackets	Helps secure the logic controller or receiver module and their expansion modules on a top hat section rail (DIN rail).	1
TM2XMTGB	Grounding Bar	Connects the cable shield and the module to the functional ground.	1

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

Cables

Reference	Description	Use	Quantity	Length
VDIP184546005	Actassi CL-MNC5e Patchcord RJ45 cable	Connects the transmitter to the receiver.	1	0.5 m (1.64 ft)
VDIP184546010				1 m (3.28 ft)
VDIP184546020				2 m (6.56 ft)
VDIP184546030				3 m (9.84 ft)
VDIP184546050				5 m (16.40 ft)
Provided with the TM3XTRA1 module	Functional ground cable	Connect the functional ground (FE) directly to the conductive backplane.	1	0.12 m (0.39 ft)

Chapter 2

TM3 Installation

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
2.1	TM3 General Rules for Implementing	18
2.2	TM3 Expansion Module Installation	23
2.3	TM3 Electrical Requirements	35

Section 2.1

TM3 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

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.

 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

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

Characteristic	Designed to specification	Range		
Electrostatic discharge	IEC/EN 61000-4-2	8 kV (air discharge) 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)		

Characteristic	Designed to specification	Range
Conducted emission	IEC/EN 55011 (IEC/CISPR Publication 11)	AC power line: <ul style="list-style-type: none"> ● 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: <ul style="list-style-type: none"> ● 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: <ul style="list-style-type: none"> ● 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 TM3 expansion modules are designed to conform to the main national and international standards concerning electronic industrial control devices:

- IEC/EN 61131-2
- UL 508

The TM3 have obtained, or in the process of obtaining, the following conformity marks:

- CE
- cULus Listing Mark
- C-Tick

The TM3 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

TM3 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 or Receiver Module	31
Disassembling a Module from a Controller or Receiver Module	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

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.

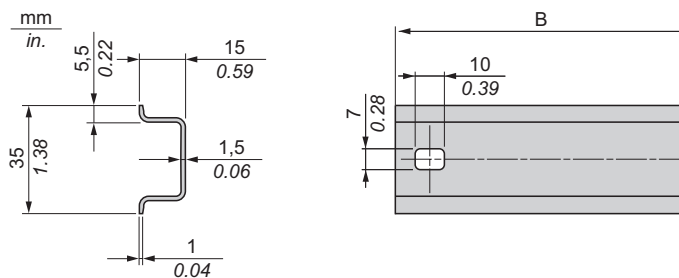
Top Hat Section Rail (DIN rail)

Dimensions of Top Hat Section Rail DIN Rail

You can mount the controller or receiver and 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.

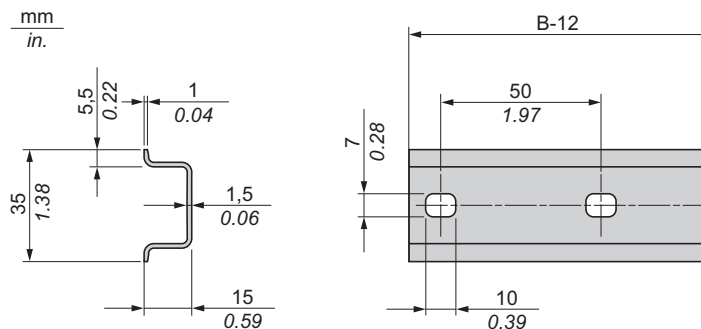
Symmetric Top Hat Section Rails (DIN Rail)

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



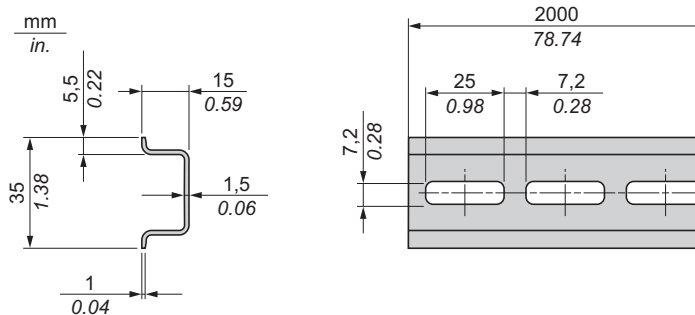
Reference	Type	Rail Length (B)
NSYSDR50A	A	450 mm (17.71 in.)
NSYSDR60A	A	550 mm (21.65 in.)
NSYSDR80A	A	750 mm (29.52 in.)
NSYSDR100A	A	950 mm (37.40 in.)

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.)

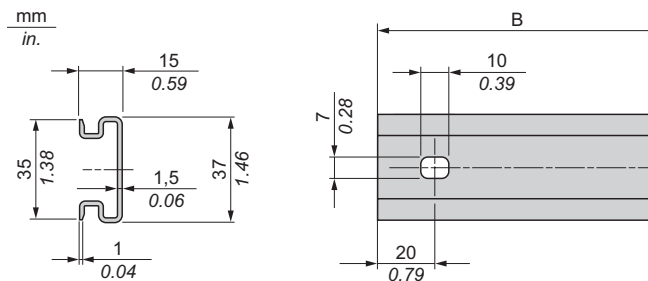
The following illustration and table shows the references of the symmetric top hat section rails (DIN rail) of 2000 mm (78.74 in.):



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

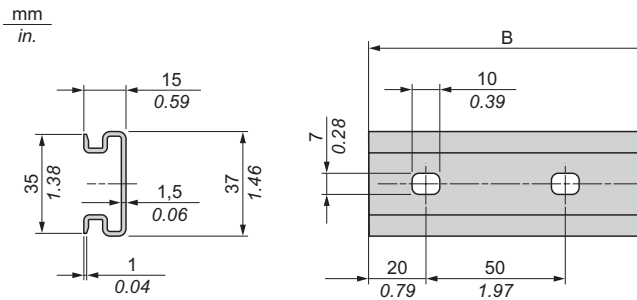
Double-Profile Top Hat Section Rails (DIN rail)

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 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 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 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.

Step	Action
3	Verify that the locking device (<i>see page 46</i>) 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 (<i>see page 46</i>) 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.



HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

Disassembling a Module from a Controller or Receiver Module

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

Step	Action
1	Remove all power from the control system.
2	Dismount the assembled controller and modules from the mounting rail.
3	Push up the locking device from the bottom of the module to disengage it from the controller or receiver module.
4	Pull apart module from the controller or receiver module.

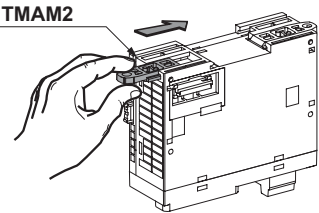
Direct Mounting on a Panel Surface

Overview

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

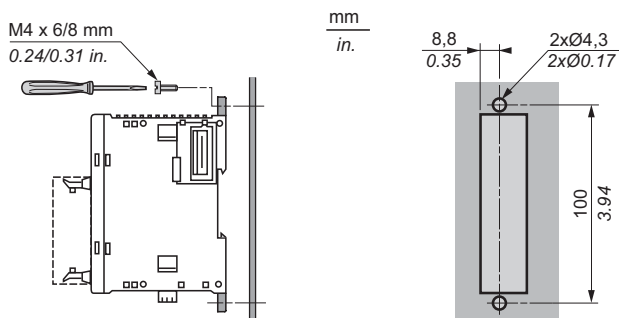
Installing the Panel Mount Kit

The following procedure shows how to install a mounting strip:

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

Mounting Hole Layout

The following diagram shows the mounting holes for TM3XTRA1 and TM3XREC1 expansion modules:



Section 2.3

TM3 Electrical Requirements

What Is in This Section?

This section contains the following topics:

Topic	Page
Wiring Best Practices	36
Grounding the TM3 System	40

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.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 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 (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 point¹.
- Route communications and I/O cables separately from power cables.

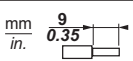








Failure to follow these instructions can result in death, serious injury, or equipment damage.



¹Multipoint grounding is permissible 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.

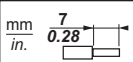








Rules for Removable Screw Terminal Block



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.	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
mm ²	25...16	25...16	23...16	23...20	2 x 25...20	2 x 25...19	2 x 24...22	2 x 20
AWG	25...16	25...16	23...16	23...20	2 x 25...20	2 x 25...19	2 x 24...22	2 x 20

		N•m	0.22...0.25
Ø 2,5 mm (0.1 in.)		lb•in	1.95...2.21

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.	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
mm ²	24...14	24...14	23...14	23...14	2 x 24...17	2 x 24...16	2 x 23...17	2 x 20...16
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	0.5...0.6
Ø 3,5 mm (0.14 in.)		lb•in	4.42...5.31

The use of copper conductors is required.

⚠ DANGER

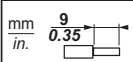




FIRE HAZARD

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

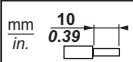





Failure to follow these instructions will result in death or serious injury.

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 ²	0.2...1.5	0.2...1.5	0.25...1.5	0.25...0.75
AWG	24...16	24...16	23...16	23...19

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

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

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

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

⚠ DANGER

LOOSE WIRING CAUSES ELECTRIC SHOCK

Do not insert more than one wire per connector of the terminal block without a double wire cable end.

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

Grounding the TM3 System

Overview

The effects of electromagnetic interference, cables carrying fast I/O, analog I/O, and the fieldbus communication signals must be shielded.

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

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

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

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

Protective Earth Ground (PE) on the Backplane

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

Shielded Cables Connections

Cables carrying fast I/O, analog I/O, and the fieldbus communication signals must be shielded. The shielding must be securely connected to ground. Fast I/O and analog I/O shields may be connected either to the functional ground (FE) or to the protective earth ground (PE) of your TM3 expansion module. The fieldbus communication cable shields must be connected to the protective earth ground (PE) with a connecting clamp secured to the conductive backplane of your installation.

⚠ WARNING

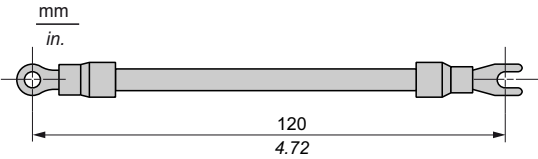
ACCIDENTAL DISCONNECTION FROM PROTECTIVE GROUND (PE)

- Do not use the TM2XMTGB Grounding Bar to provide a protective earth ground (PE).
- Use the TM2XMTGB Grounding Bar only to provide a functional ground (FE).

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

Functional Ground (FE) Cable Shielding

To connect the cable to the conductive back plane:

Step	Description	
1	Connect the functional ground cable from the TM3XTRA1 functional ground screw to the conductive backplane.	

Part II

TM3 Transmitter and Receiver Modules

What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
3	TM3XTRA1 Transmitter Module	45
4	TM3XREC1 Receiver Module	53

Chapter 3

TM3XTRA1 Transmitter Module

Overview

This chapter describes the TM3XTRA1 expansion module, its characteristics, and its connection to the different sensors.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3XTRA1 Presentation	46
TM3XTRA1 Characteristics	48
TM3XTRA1 Wiring Diagram	50

TM3XTRA1 Presentation

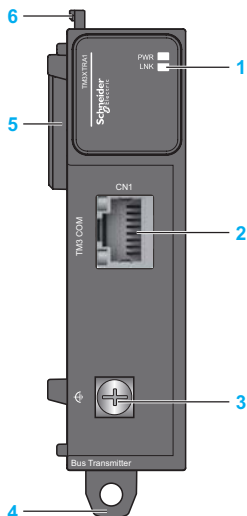
Overview

Transmitter module:

- One RJ45 connector for communication
- Screw for functional ground connection

Description

The following figures show the parts of the TM3 transmitter expansion module:



Label	Elements	Refer to
1	LEDs for displaying the link activity and power supply status.	–
2	TM3 bus port	–
3	Screw for functional ground connection	Wiring Requirement (see page 40)
4	Clip-on lock for 35 mm (1.38 in.) DIN-rail	The DIN rail (see page 28)
5	Expansion connector for I/O bus (left side only).	–
6	Locking device for attachment to the previous module	–

NOTE: The transmitter must be the last module in the local I/O expansion configuration.

Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
Power (PWR)	Green	On	Power supply from TM3 bus is available.
		Off	Power supply from TM3 bus is not available.
Link (LNK)	Green	On	Link/data signal is detected from the receiver.
		Off	No link/data signal is detected from the receiver.

TM3XTRA1 Characteristics

Introduction

This section provides a description of the characteristics of the TM3XTRA1 expansion module. See also Environmental Characteristics ([see page 19](#)).

WARNING

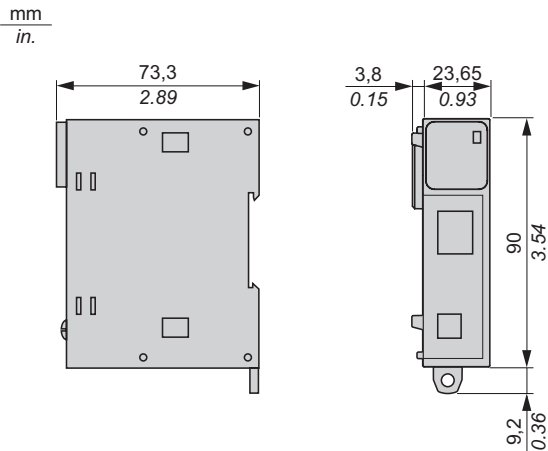
UNINTENDED EQUIPMENT OPERATION

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 for the TM3XTRA1 expansion module:



Main Characteristics

Characteristics	Value
Function	Associated with the receiver forms the remote I/O expansion.
Connector type	RJ45
Communication type	RS485
Current draw on 5 Vdc internal bus	160 mA maximum
Current draw on 24 Vdc internal bus	–
Cable type and length	For more information, refer to VDIP1845460** (<i>see page 15</i>).
Weight	65 g (2.29 oz)

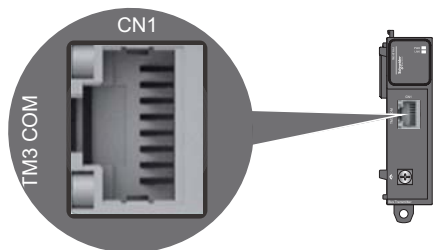
TM3XTRA1 Wiring Diagram

Wiring Rules

See Wiring Best Practices (*see page 36*).

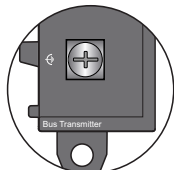
TM3 Bus Port



The TM3XTRA1 is equipped with an RJ45 connector.



Rules for Connection to the Functional Ground

The following table shows the characteristics of the screw to be used with the provided Functional Ground (FE) Cable (*see page 41*):



 Phillips Ph2		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.

NOTE: You must connect the functional ground (FE) of the TM3 transmitter module to the same functional ground connected to your controller. Without the functional ground connection, the TM3 transmitter module may not establish communication with the TM3 receiver module.

NOTICE

INOPERABLE EQUIPMENT

- Ensure that the functional ground cable is securely connected between the functional ground screw of the TM3 transmitter module and the functional ground of the controller.
- Monitor the status of the TM3 bus within your application to determine the correct behavior of the TM3 bus in case of disconnection from the functional ground of the TM3 transmitter module.

Failure to follow these instructions can result in equipment damage.

Chapter 4

TM3XREC1 Receiver Module

Overview

This chapter describes the TM3XREC1 expansion module, its characteristics, and its connection to the different sensors.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TM3XREC1 Presentation	54
TM3XREC1 Characteristics	56
TM3XREC1 Wiring Diagram	58

TM3XREC1 Presentation

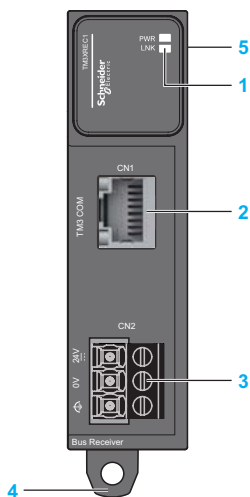
Overview

Receiver module:

- One RJ45 connector for communication
- Removable 24 Vdc power supply terminal block

Description

The following figures show the parts of the TM3 receiver expansion module:



Label	Elements	Refer to
1	LEDs for displaying the link activity and power supply status.	–
2	TM3 bus port	–
3	Power supply screw terminal block.	Power Supply Wiring diagram (see page 58)
4	Clip-on lock for 35 mm (1.38 in.) DIN-rail.	The DIN rail (see page 28)
5	Expansion connector for I/O bus (right side only).	–

Status LEDs

The following figure shows the status LEDs:



This table describes the status LEDs:

LED	Color	Status	Description
Power (PWR)	Green	On	Power supply for TM3 bus is available.
		Off	Power supply for TM3 bus is not available.
Link (LNK)	Green	On	Link/data signal is detected from the transmitter.
		Off	No link/data signal is detected from the transmitter.

TM3XREC1 Characteristics

Introduction

This section provides a description of the characteristics of the TM3XREC1 module.

See also Environmental Characteristics ([see page 19](#)).

DANGER

FIRE HAZARD

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

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

WARNING

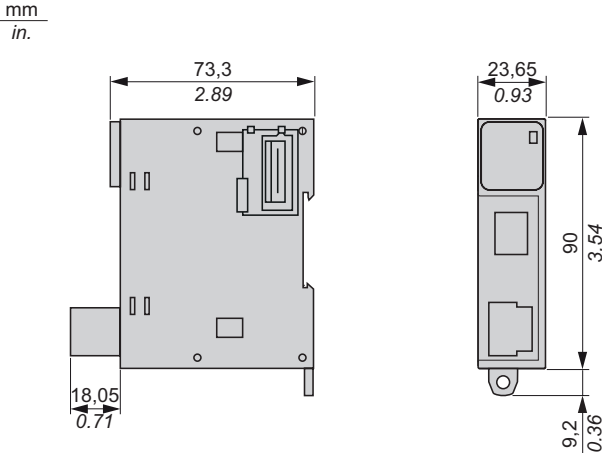
UNINTENDED EQUIPMENT OPERATION

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 for the TM3XREC1 expansion module:



Main Characteristics

Characteristics		Value
Function		Associated with the transmitter forms the remote I/O expansion.
Connector type		RJ45
Communication type		RS485
Power dissipation		1W max.
Receiver module	Current draw on 24 Vdc power supply for the receiver module	40 mA
	The current consumption on 24 Vdc power supply for the internal bus	1A max. (with the max. number of TM3 expansion modules).
Power supplied available for connected inputs and outputs modules.	Current draw on 5 Vdc internal bus	560 mA max.
	Current draw on 24 Vdc internal bus	560 mA max.
Cable type and length		For more information, refer to Cables (see page 15) .
Weight		75 g (2.64 oz)

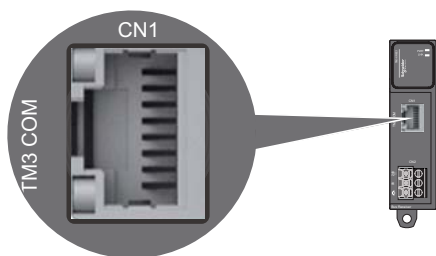
TM3XREC1 Wiring Diagram

Wiring Rules

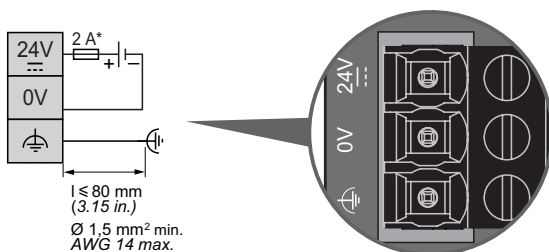
See Wiring Best Practices (*see page 36*).

TM3 Bus Port

The TM3XREC1 is equipped with an RJ45 connector.



DC Power Supply Wiring Diagram



* type T fuse

The controller and associated I/O (TM3 and receiver modules) require power supplies with a nominal voltage of 24 Vdc. The 24 Vdc power supplies must be rated Safety Extra Low Voltage (SELV) or 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 or SELV power supplies to supply power to the equipment¹.

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

¹For compliance to UL (Underwriters Laboratories) requirements, the power supply must also be of a type Class II with a maximum power output availability of less than 100 VA (approximately 4 A at nominal voltage). A Class II circuit requires dry indoor use only in non-hazardous locations, and must be grounded. You must separate Class II circuits from other circuits. If a non-Class II power source is used, either power supply or transformer, you must impose a current limiting device such as a fuse or a circuit breaker with a maximum rating of 4 A, but never exceeding the limits indicated in the electric characteristics and wiring diagrams for this equipment. If the indicated rating of the electrical characteristics or wiring diagrams are greater than 4 A, multiple Class II power supplies may be used.

DC Power Supply Rules

If 2 separate power supplies are used for the receiver and the controller, the TM3 receiver module power supply must be switched on before the controller power supply. If not, the TM3 bus does not start, and all modules are in Reset state (all outputs are forced to 0).

When the TM3 receiver module and the controller are supplied by the same power supply, the whole configuration starts together properly.

If only the TM3 receiver module is powered (controller not supplied), the TM3 modules after the TM3 receiver module are in Reset state (all outputs are forced to 0).

Further, you must connect the functional ground via the power supply, and the functional or protective ground of the power supply to the same equipotential functional ground (FE) of the controller and TM3 transmitter module.

NOTE: You must connect the functional ground (FE) of the TM3 receiver module to the same functional ground connected to your controller and TM3 transmitter module. Without the functional ground connection, the TM3 transmitter module may not establish communication with the TM3 receiver module, or possibly damage your equipment.

NOTICE

INOPERABLE EQUIPMENT

- Ensure that the functional ground power supply connection of the TM3 receiver module is securely connected to the functional ground of the controller system.
- Monitor the status of the TM3 bus within your application to determine the correct behavior of TM3 bus in case of disconnection from the functional ground.

Failure to follow these instructions can result in equipment damage.



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*).

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.

N

NEMA

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

P

PE

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

R

RJ-45

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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