

# Modicon TMS

## Expansion Module

### Hardware Guide

10/2019



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

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

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

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

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# Safety Information

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## Important Information

### NOTICE

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



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



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

## **DANGER**

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

## **WARNING**

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

## **CAUTION**

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

## **NOTICE**

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

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## PLEASE NOTE

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

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

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# About the Book

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## At a Glance

### Document Scope

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

### Validity Note

This document has been updated for the release of EcoStruxure™ Machine Expert V1.1 SP1. The technical characteristics of the devices described in the present document also appear online. To access the information online:

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

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

## Related Documents

Title of Documentation	Reference Number
Modicon TMS Expansion Module Configuration - Programming Guide	<a href="#"><i>EIO0000003691 (ENG)</i></a> <a href="#"><i>EIO0000003692 (FRE)</i></a> <a href="#"><i>EIO0000003693 (GER)</i></a> <a href="#"><i>EIO0000003694 (ESP)</i></a> <a href="#"><i>EIO0000003695 (ITA)</i></a> <a href="#"><i>EIO0000003696 (CHS)</i></a> <a href="#"><i>EIO0000003697 (POR)</i></a> <a href="#"><i>EIO0000003698 (TUR)</i></a>
Modicon M262 Logic/Motion Controller - Hardware Guide	<a href="#"><i>EIO0000003659 (ENG)</i></a> <a href="#"><i>EIO0000003660 (FRE)</i></a> <a href="#"><i>EIO0000003661 (GER)</i></a> <a href="#"><i>EIO0000003662 (ESP)</i></a> <a href="#"><i>EIO0000003663 (ITA)</i></a> <a href="#"><i>EIO0000003664 (CHS)</i></a> <a href="#"><i>EIO0000003665 (POR)</i></a> <a href="#"><i>EIO0000003666 (TUR)</i></a>
TMSES4 - Instruction sheet	<a href="#"><i>PHA44907</i></a>
TMSCO1 - Instruction sheet	<a href="#"><i>PHA44909</i></a>

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



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## Product Related Information

### **DANGER**

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

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

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

### **DANGER**

#### **POTENTIAL FOR EXPLOSION**

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

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

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## WARNING

### LOSS OF CONTROL

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

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

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

## WARNING

### UNINTENDED EQUIPMENT OPERATION

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

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

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## Terminology Derived from Standards

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

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

Among others, these standards include:

Standard	Description
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2015	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
IEC 62061:2015	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2016	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

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

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

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

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

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# Part I

## TMS General Overview

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### What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
1	TMS Description	15
2	TMS Installation	17



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# Chapter 1

## TMS Description

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### TMS General Description

#### TMS Expansion Modules

The following table describes the TMS expansion module features:

Module reference	Type	Terminal type
TMSES4	Ethernet communication	RJ45
TMSCO1	CANopen master module	SUB-D 9 pin male

**NOTE:** The TMSES4 is not a standalone Ethernet switch.

#### Accessories

Reference	Description	Use	Quantity
NSYTRAAB35	End brackets	Blocks the TMS module on a top hat section rail (DIN rail).	1

#### Cables

Use one of the cables to connect a TMSES4 module to your system:

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





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# Chapter 2

## TMS Installation

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### What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
2.1	TMS General Rules for Implementing	18
2.2	TMS Expansion Module Installation	23
2.3	TMS Electrical Requirements	37

# Section 2.1

## TMS General Rules for Implementing

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### What Is in This Section?

This section contains the following topics:

Topic	Page
Environmental Characteristics	19
Certifications and Standards	22

## Environmental Characteristics

### Enclosure Requirements

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

### Environmental Characteristics

All the TMS 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	Minimum Specification	Tested Range	
Standard compliance	IEC/EN 61131-2 UL/CSA 61010-1, -2-201	–	
Ambient operating temperature	–	Horizontal installation	–20...60 °C (–4...140 °F)
	–	Vertical installation	–20...50 °C (–4...122 °F)
	–	Flat installation	–20...45 °C (–4...113 °F)
Transport/storage temperature	–	–40...85 °C (–40...185 °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	
Corrosion immunity	–	Atmosphere free from corrosive gases	
Operating altitude	–	0...2000 m (0...6560 ft)	
Storage altitude	–	0...3000 m (0...9843 ft)	
Vibration resistance	IEC/EN 61131-2	Panel mounting or mounted on a top hat section rail (DIN rail)	3.5 mm (0.13 in) fixed amplitude from 5...8.4 Hz 9.8 m/s <sup>2</sup> (32.15 ft/s <sup>2</sup> ) (1 g <sub>n</sub> ) fixed acceleration from 2...200 Hz
Mechanical shock resistance	–	147 m/s <sup>2</sup> (482.28 ft/s <sup>2</sup> ) (15 g <sub>n</sub> ) for a duration of 11 ms	
<b>NOTE:</b> The tested ranges may indicate values beyond that of the IEC Standard. However, our internal standards define what is necessary for industrial environments. In all cases, we uphold the minimum specification if indicated.			

## Electromagnetic Susceptibility

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

Characteristic	Minimum Specification	Tested Range		
Electrostatic discharge	IEC/EN 61000-4-2	8 kV (air discharge) 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 <sup>1</sup> and DM <sup>2</sup>	
		AC/DC Power lines	1 kV	
		Communication line	1 kV	
Surge immunity	IEC/EN 61000-4-5 IEC/EN 61131-2	–	CM <sup>1</sup>	DM <sup>2</sup>
		DC Power lines	1 kV	0.5 kV
		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:		
		<ul style="list-style-type: none"> <li>● 0.15...0.5 MHz: 79 dBμV/m QP / 66 dBμV/m AV</li> <li>● 0.5...300 MHz: 73 dBμV/m QP / 60 dBμV/m AV</li> </ul>		
Radiated emission	IEC/EN 55011 (IEC/CISPR Publication 11)	AC/DC power line:		
		<ul style="list-style-type: none"> <li>● 10...150 kHz: 120...69 dBμV/m QP</li> <li>● 150...1500 kHz: 79...63 dBμV/m QP</li> <li>● 1.5...30 MHz: 63 dBμV/m QP</li> </ul>		
		Class A, 10 m distance:		
		<ul style="list-style-type: none"> <li>● 30...230 MHz: 40 dBμV/m QP</li> <li>● 230...1000 MHz: 47 dBμV/m QP</li> </ul>		
<b>1</b> Common Mode <b>2</b> Differential Mode				
<b>NOTE:</b> The tested ranges may indicate values beyond that of the IEC Standard. However, our internal standards define what is necessary for industrial environments. In all cases, we uphold the minimum specification if indicated.				

## Certifications and Standards

### Introduction

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

- IEC/EN 61131-2
- UL/CSA 61010-1

The TMS expansion modules have obtained the following conformity marks:

- CE
- cULus
- EAC
- RCM

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

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## Section 2.2

### TMS Expansion Module Installation

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#### 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 an Expansion Module	32
Disassembling a Module from a Controller	34
Direct Mounting on a Panel Surface	35

## Installation and Maintenance Requirements

### Before Starting

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

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

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

### Disconnecting Power

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

## DANGER

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

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

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



## Programming Considerations

### WARNING

#### UNINTENDED EQUIPMENT OPERATION

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

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

## Operating Environment

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

### WARNING

#### UNINTENDED EQUIPMENT OPERATION

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

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

## Installation Considerations

### **WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

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

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

**NOTE:** JDYX2 or JDYX8 fuse types are UL-recognized and CSA approved.

## Installation Guidelines

### Introduction

TMS expansion module is assembled by connecting it to a controller.

The controller and the connected expansion modules can be installed on a top hat section rail (DIN rail), or vertical surface.

### Mounting Position and Minimum Clearances

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

## WARNING

### UNINTENDED EQUIPMENT OPERATION

- Place devices dissipating the most heat at the top of the cabinet and ensure adequate ventilation.
- Avoid placing this equipment next to or above devices that might cause overheating.
- Install the equipment in a location providing the minimum clearances from all adjacent structures and equipment as directed in this document.
- Install all equipment in accordance with the specifications in the related documentation.

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

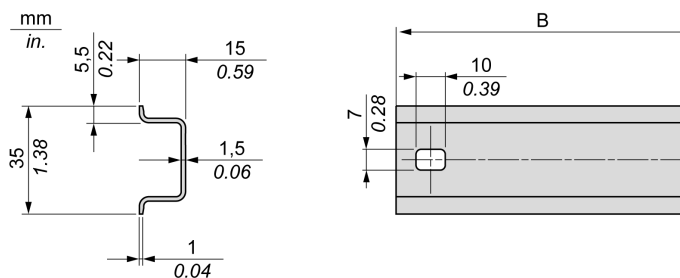
## Top Hat Section Rail (DIN rail)

### Dimensions of Top Hat Section Rail DIN Rail

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

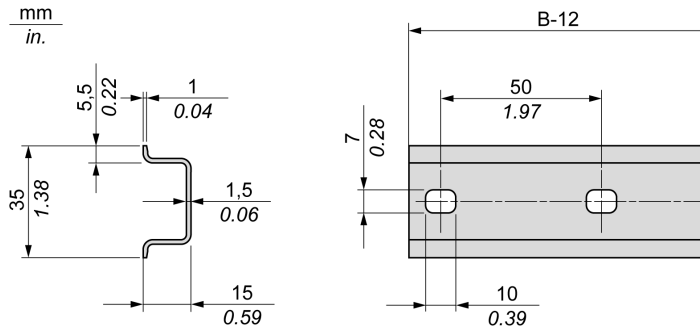
### Symmetric Top Hat Section Rails (DIN Rail)

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



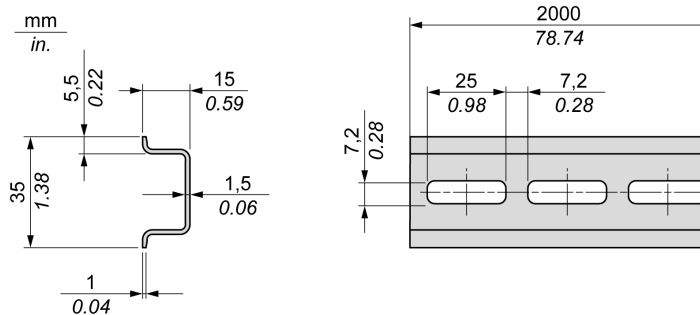
Reference	Type	Rail Length (B)
NSYS DR50A	A	450 mm (17.71 in.)
NSYS DR60A	A	550 mm (21.65 in.)
NSYS DR80A	A	750 mm (29.52 in.)
NSYS DR100A	A	950 mm (37.40 in.)

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



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

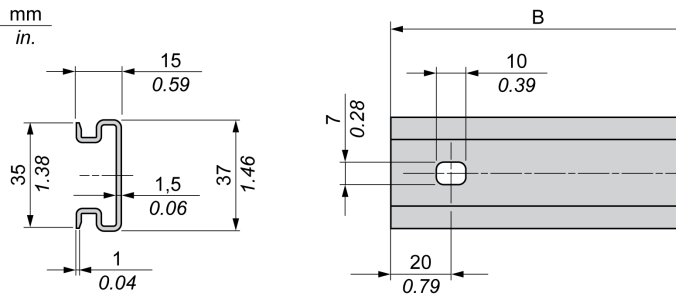
The following illustration and table indicate the references of the symmetric top hat section rails (DIN rail) of 2000 mm (78.74 in.):



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

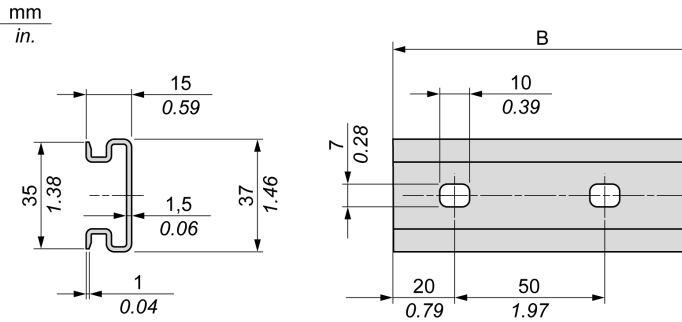
### Double-Profile Top Hat Section Rails (DIN rail)

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



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

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



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

## Assembling a Module to a Controller or an Expansion Module

### 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, download and reinstall your application program before placing the system back in service. If you do not update your application program to reflect the addition of new modules, I/O located on the expansion bus may no longer operate correctly.

#### 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 an Expansion Module

You can assemble the TMS expansion module on or out of the DIN rail.

To assemble a module out of the DIN rail:

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 ( <i>see page 49</i> ) on the TMS expansion module to be added is in the upper position.
4	Align the internal bus connector of the TMS expansion module with the internal bus connector 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.
7	Clip the assembly on the DIN rail.

To assemble a module on the DIN rail:

Step	Action
1	Remove all power.
2	Remove the expansion connector sticker from the controller or the outermost installed expansion module.
3	Verify that the locking device ( <i>see page 49</i> ) on the TMS expansion module to be added is in the upper position.
4	Clip the TMS expansion module to the DIN rail on the left side of the controller or expansion module.
5	Slide the TMS expansion module to the controller or expansion module.
6	Align the internal bus connector of the TMS expansion module with the internal bus connector of the controller or expansion module.
7	Press the new module towards the controller or expansion module until it is securely in place.
8	Push down the locking device on the top of the new module to lock it to the controller or expansion module.

## Disassembling a Module from a Controller

### Introduction

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



#### 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	Pull apart module from the controller.

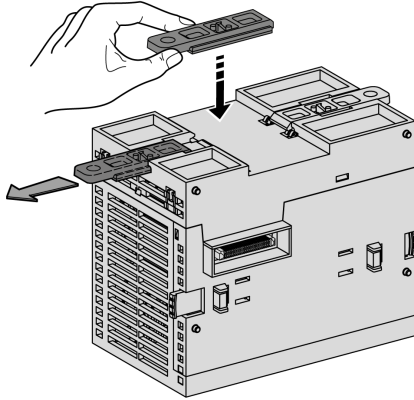
## Direct Mounting on a Panel Surface

### Overview

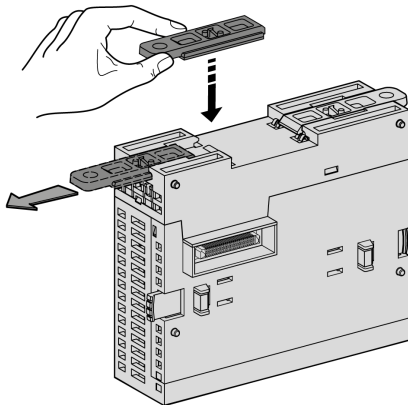
This section shows how to install the TMS expansion modules using the panel attachment kit (included). This section also provides mounting hole layout for all modules.

### Panel Attachment Kit

The following diagrams show the mounting of the panel attachment kit:



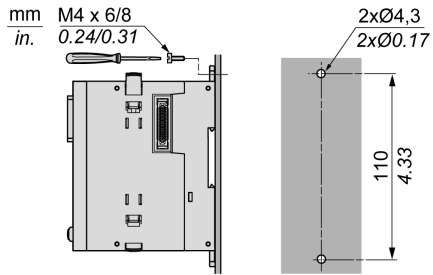
**TMSES4**



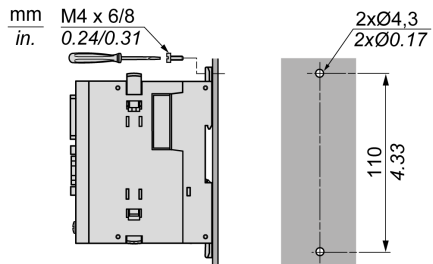
**TMSCO1**

### Mounting Hole Layout

The following diagrams show the mounting holes for the TMS expansion modules:



**TMSES4**



**TMSCO1**

---

## Section 2.3

### TMS Electrical Requirements

---

#### What Is in This Section?

This section contains the following topics:

Topic	Page
Wiring Best Practices	38
Grounding the System	40

## Wiring Best Practices

### Overview

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

### DANGER

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

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

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

### WARNING

#### LOSS OF CONTROL

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

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

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

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

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

#### WARNING

##### UNINTENDED EQUIPMENT OPERATION

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

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

### Protective Ground (PE) on the Backplane

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

### Wiring Guidelines

The following rules must be applied when wiring a TMS system:

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

#### WARNING

##### UNINTENDED EQUIPMENT OPERATION

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

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

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

**NOTE:** Surface temperatures may exceed 60 °C (140 °F).

To conform to IEC 61010 standards, route primary wiring (wires connected to power mains) separately and apart from secondary wiring (extra low voltage wiring coming from intervening power sources). If that is not possible, double insulation is required such as conduit or cable gains.

## Grounding the System

### Introduction

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

### WARNING

#### UNINTENDED EQUIPMENT OPERATION

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

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

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

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

- For protective 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 should have continuous shielding.
- Wherever possible, keep cables carrying one type of signal separate from the cables carrying other types of signals or power.

### Protective Ground (PE) on the Backplane

The protective ground (PE) is connected to the conductive backplane by a heavy-duty wire, usually a braided copper cable with a cross-section of 6 mm<sup>2</sup> (AWG 10) or larger.



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

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

## ⚠ WARNING

### UNINTENDED EQUIPMENT OPERATION

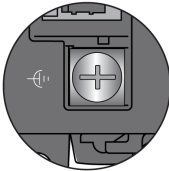
Connect the DIN rail to the functional ground (FE) of your installation.



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

The connection between the functional ground (FE) and your TMS is made by the DIN Rail contacts on the back of the controller and the bus base of the expansion modules.

### Rules for Connection to the Functional Ground

The following illustration and table show the characteristics of the screw to connect to the Functional Earth (FE):



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

## 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.**

### Shielded Cables Connections

Cables carrying the network and field bus communication signals must be shielded. The shielding must be securely connected to ground. The field bus communication cable shields must be connected to the protective ground (PE) with a connecting clamp secured to the conductive backplane of your installation.

## DANGER

### HAZARD OF ELECTRIC SHOCK

Ensure that communication cables are securely connected to the protective ground (PE).

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

## WARNING

### ACCIDENTAL DISCONNECTION FROM PROTECTIVE GROUND (PE)

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

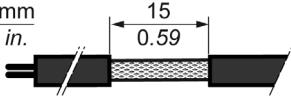
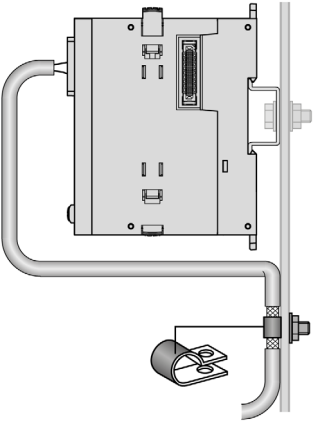
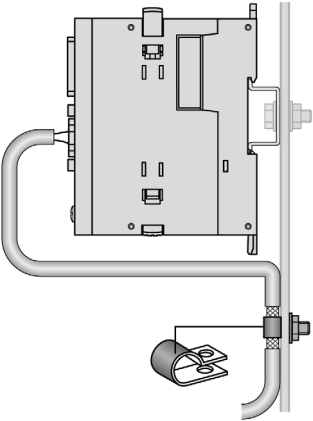
**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

**NOTE:** The functional ground of the Ethernet connection is internal.

The shielding of the cables must be connected to the protective ground (PE).

## Protective Ground (PE) Cable Shielding

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

Step	Action	Illustration
1	Strip the shielding for a length of 15 mm (0.59 in.)	
2	Attach the cable to the conductive backplane plate by attaching the grounding clamp to the stripped part of the shielding as close as possible to the TMS base.	<p data-bbox="765 418 911 440">On a TMSES4:</p>  <p data-bbox="765 922 911 943">On a TMSCO1:</p> 

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



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# Part II

## TMS Expansion Modules

---

### What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
3	TMSES4 Ethernet Module	47
4	TMSCO1 CANopen Module	57



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# Chapter 3

## TMSES4 Ethernet Module

---

### Overview

This chapter describes the TMSES4 Ethernet module, its characteristics, and its connection to the different devices.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TMSES4 Presentation	48
TMSES4 Characteristics	52
TMSES4 Wiring Diagram	54

## TMSES4 Presentation

### Overview

The TMSES4 Ethernet module provides an additional Ethernet interface to the controller. Only one TMSES4 module can be configured in the system.

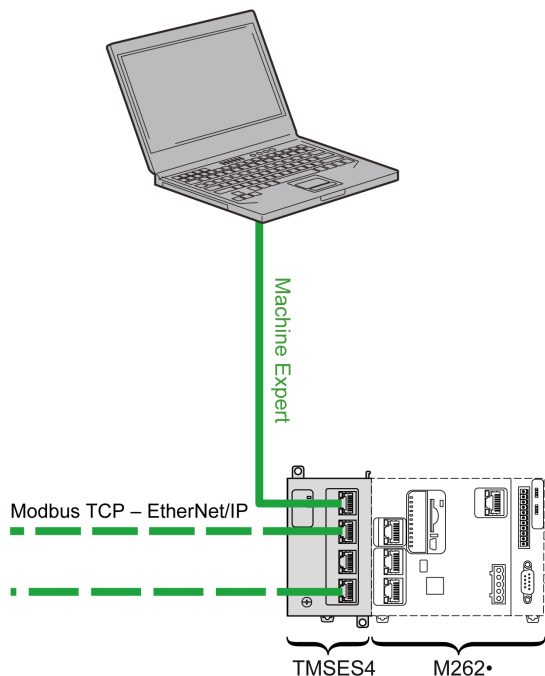
### Main Characteristics

The table describes the main characteristics of the TMSES4 Ethernet communication module:

Main Characteristics	
Standard	Ethernet
Connector type	4 RJ45 connectors for Ethernet communication
Transfer rate	1 Gbit/s maximum

### Connection

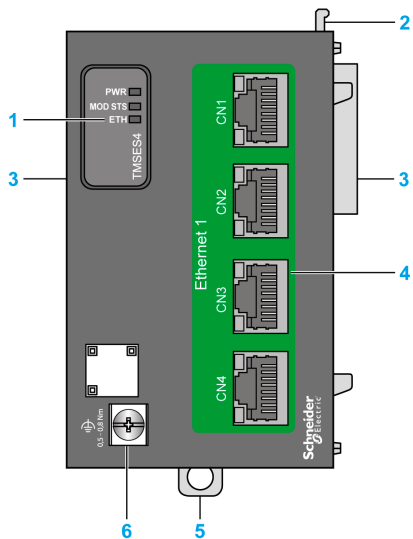
The following illustration shows the connection of a controller to an Ethernet network:





## Elements

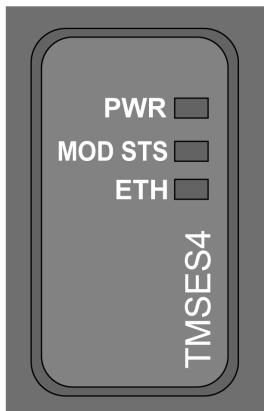
The following illustration shows the main elements of the TMSES4 module:



Label	Description
1	Status LEDs
2	Locking device
3	TMS bus connector
4	4 Ethernet ports
5	Clip-on lock for 35 mm (1.38 in.) top hat section rail (DIN rail) ( <i>see page 28</i> )
6	Functional ground screw ( <i>see page 41</i> )

### Module Status LED

The illustration shows the TMSES4 status LEDs:

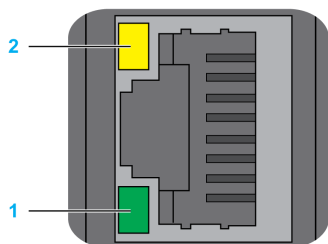


The table describes the TMSES4 status LED:

LED	Color	Status	Description	
<b>PWR</b>	Green	On	Power is applied.	
		Off	Power is removed.	
<b>MOD STS</b>	Green	On	The module is running.	
		Red	On	The module is not running.
		Flashing	A connection error is detected.	
<b>ETH</b>	Green	On	The module is running and one port is connected.	
		Flashing	If flashing: <ul style="list-style-type: none"> <li>● 3 times: no ports are connected.</li> <li>● 4 times: IP address is duplicated.</li> <li>● 5 times: IP address is awaiting.</li> <li>● 6 times: default IP address is applied.</li> </ul>	
		Off	The module is initializing.	

### RJ45 Connector Status LEDs

The illustration 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
			Yellow	Link at 10 or 100 Mbit/s
			Green	Link at 1 Gbit/s

## TMSES4 Characteristics

### Introduction

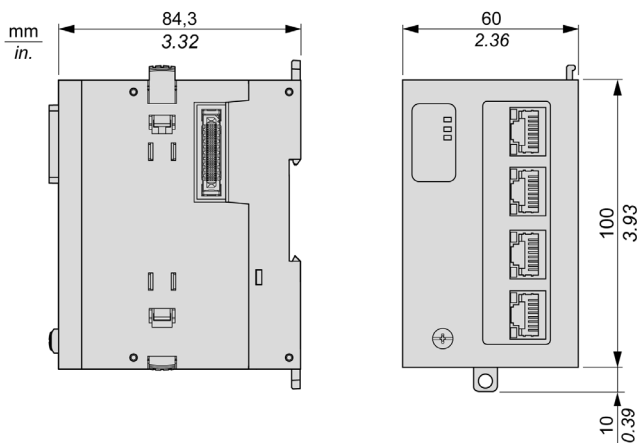
These are the general characteristics of the TMSES4 module.

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

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

### Dimensions

The following diagrams show the dimensions of the TMSES4 module:



### General Characteristics

The table describes the general characteristics of the TMSES4 module:

Characteristic	Value
Consumption	200 mA
Power dissipation	7.85 W
Weight	403 g (14.22 oz)

## Characteristics

The table describes the characteristics of the TMSES4 module:

Characteristics	Description
Standards	Ethernet
Connector type	RJ45
Baud rate	Supports Ethernet "10BaseT", "100BaseTX" and "1000BaseT" with auto-negotiation
Auto-crossover	MDIO <sup>(1)</sup>
Bus connectors	1 right connector to controller, male 1 left connector to next expansion, female
Installation	Any position on the left of the controller or after another TMS expansion module.
<b>(1)</b> The controller supports MDIO auto-crossover cable function. It is not necessary to use special Ethernet crossover cables to connect devices directly to this port (connection without an Ethernet hub or switch.)	

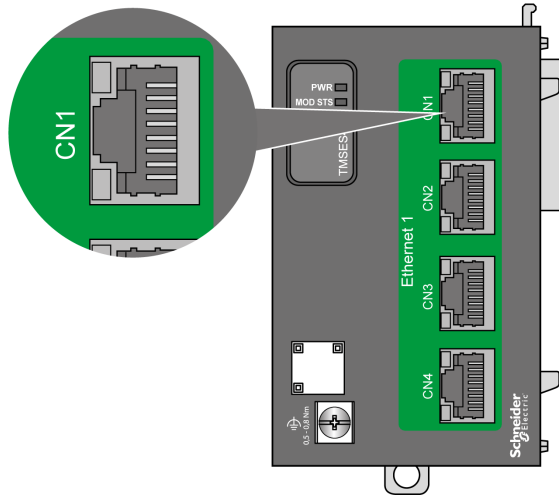
## TMSES4 Wiring Diagram

### Wiring Rules

See Wiring Best Practices (*see page 38*).

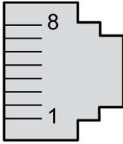
### RJ45 Connector

The TMSES4 module is equipped with four Ethernet RJ45 connectors:



## Pin Assignment

The following illustration shows the Ethernet RJ45 connector pin assignment:



The following table describes the Ethernet connector pin assignment:

Pin N°	100BASE-T	1000BASE-T
1	TD+	DA+
2	TD-	DA-
3	RD+	DB+
4	N.C.	DC+
5	N.C.	DC-
6	RD-	DB-
7	N.C.	DD+
8	N.C.	DD-

**NOTE:** The controller supports the MDIO 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).

**NOTE:** Ethernet cable disconnection is detected every second. In case of disconnection of a short duration (< 1 second), the network status may not indicate the disconnection.





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# Chapter 4

## TMSCO1 CANopen Module

---

### Overview

This chapter describes the TMSCO1 CANopen module, its characteristics, and its connection to the different devices.

### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
TMSCO1 Presentation	58
TMSCO1 Characteristics	61
TMSCO1 Wiring Diagram	63

## TMSCO1 Presentation

### Overview

The TMSCO1 provides an additional communication module to the controller. Only one TMSCO1 can be configured in the system.

The TMSCO1 must always be the first module on the left.

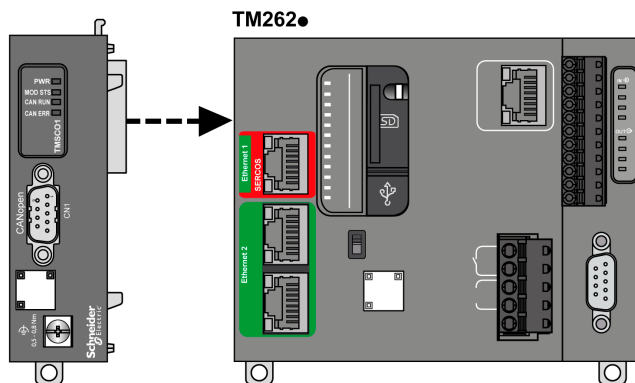
### Main Characteristics

The table describes the main characteristics of the TMSCO1 communication module:

Main Characteristics	Value
Interface type	CANopen
Connector type	1 SUB-D 9 pin male connector

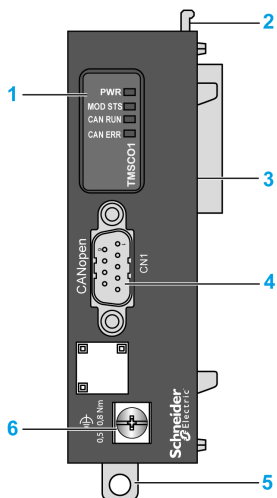
### Connection

The following illustration shows the connection of a TMSCO1 module to a controller:



## Description

The following illustration shows the elements of the TMSCO1 module:

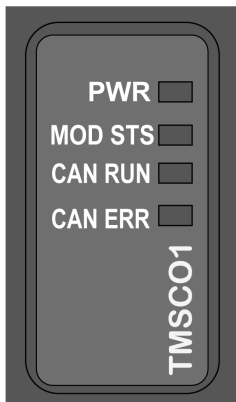


The table shows the elements of the TMSCO1 interface module:

Label	Elements
1	Status LEDs
2	Locking device
3	TMS bus connector
4	CANopen port
5	Clip-on lock for 35 mm (1.38 in.) top hat section rail (DIN-rail) ( <a href="#">see page 28</a> )
6	Functional ground screw ( <a href="#">see page 41</a> )

### Module Status LED

The following illustration shows the TMSCO1 interface module status LEDs:



The table describes the TMSCO1 status LEDs:

LED	Color	Status	Description
<b>PWR</b>	Green	On	Power is applied.
		Off	Power is removed.
<b>MOD STS</b>	Green	On	The module is running.
	Red	On	The module is not running.
		Flashing	A connection error is detected.
<b>CAN RUN</b>	Green	On	The CANopen bus is operational.
		Flashing	The CANopen bus is being initialized.
		1 flash per second	The CANopen bus is stopped.
		Off	The CANopen master is configured.
<b>CAN ERR</b>	Red	On	The CANopen bus is stopped (BUS OFF).
		Flashing	The CANopen configuration is invalid.
		1 flash per second	The module has detected that the maximum number of error frames has been reached or exceeded.
		2 flashes per second	The module has detected either a Node Guarding or Heartbeat event.
		Off	The CANopen master is configured.

## TMSCO1 Characteristics

### Introduction

These are the general characteristics of the TMSCO1 module.

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

## ⚠ WARNING

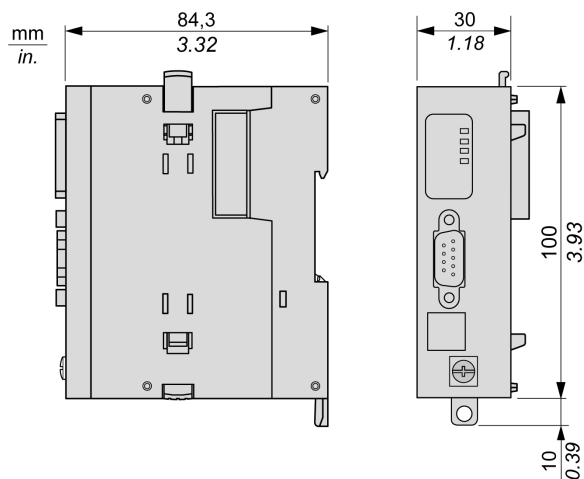
### UNINTENDED EQUIPMENT OPERATION

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 diagram shows the dimensions of the TMSCO1 module:



### General Characteristics

The table describes the general characteristics of the TMSCO1 module:

Characteristic	Value
Consumption	50 mA
Power dissipation	1.2 W
Weight	150 g (5.29 oz)

**CAN Characteristics**

The following table provides the CAN characteristics of the TMSCO1 module:

<b>Characteristics</b>	<b>Value</b>
Standards	CAN-CIA (ISO 11898-2:2002 Part 2) <sup>(1)</sup>
Connector type	SUB-D 9, male
Protocol supported	CANopen
CAN power distribution	No
Isolation between CAN bus and ground	550 Vac RMS, 780 Vdc
Bus connectors	1 right connector to CPU, male No connector on the left.
Installation	Last position on the TMS bus.
<b>(1)</b> Part 1 and Part 2 of ISO 11898:20020 are equivalent to ISO 11898:1993.	

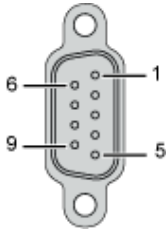
## TMSCO1 Wiring Diagram

### Wiring Rules

See Wiring Best Practices (*see page 38*).

### SUB-D9 Connector

The following figure shows the pins on the CANopen bus connector:



**NOTE:** Use an external CANopen line termination in your system wiring.

### Pin Assignment

The table describes the pins of the CANOpen bus connector:

Pin	Designation	Description
1	N.C.	Reserved
2	CAN_L	CAN_L bus line (Low)
3	CAN_GND	CAN 0 Vdc
4	N.C.	Reserved
5	CAN_SHLD	Optional CAN shield
6	CAN_GND	CAN 0 Vdc
7	CAN_H	CAN_H bus line (High)
8	N.C.	Reserved
9	N.C.	Reserved
N.C.: Not Connected.		

Although the cable shield is connected to pin 6 (ground), it is still necessary to properly and externally ground the cable shield to your functional ground (FE).

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

### Transmission Speed and Cable Length

Transmission speed is limited by the bus length and the type of cable used.

The following table describes the relationship between the maximum transmission speed and the bus length (on a single CAN segment without a repeater):

Maximum transmission baud rate	Bus length
1000 Kbps	20 m (65 ft)
800 Kbps	40 m (131 ft)
500 Kbps	100 m (328 ft)
250 Kbps	250 m (820 ft)
125 Kbps	500 m (1,640 ft)
50 Kbps	1000 m (3280 ft)
20 Kbps	2500 m (16,400 ft)



---

# Glossary

---



## A

### **AWG**

(*American wire gauge*) The standard that specifies wire section sizes in North America.

## C

### **CANopen**

An open industry-standard communication protocol and device profile specification (EN 50325-4).

## E

### **EIA rack**

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

### **EN**

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

### **Ethernet**

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

### **expansion connector**

A connector to attach expansion I/O modules.

## F

### **FE**

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

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

## I

### I/O

*(input/output)*

### IEC

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

### 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

### 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

### RJ45

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



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