

Modicon TMS

Expansion Module

Hardware Guide

03/2020



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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, 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.

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 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 V1.2.2.

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

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

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



Related Documents

| Title of Documentation | Reference Number |
|--|-------------------------------------|
| Modicon TMS Expansion Module Configuration - Programming Guide | EIO0000003691 (ENG) |
| | EIO0000003692 (FRE) |
| | EIO0000003693 (GER) |
| | EIO0000003694 (ESP) |
| | EIO0000003695 (ITA) |
| | EIO0000003696 (CHS) |
| | EIO0000003697 (POR) |
| | EIO0000003698 (TUR) |

| Title of Documentation | Reference Number |
|---|--|
| Modicon M262 Logic/Motion Controller - Hardware Guide | EIO0000003659 (ENG) EIO0000003660 (FRE) EIO0000003661 (GER) EIO0000003662 (ESP) EIO0000003663 (ITA) EIO0000003664 (CHS) EIO0000003665 (POR) EIO0000003666 (TUR) |
| TMSES4 - Instruction sheet | PHA44907 |
| TMSCO1 - Instruction sheet | PHA44909 |

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


Product Related Information

  **DANGER**

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

 **DANGER**

POTENTIAL FOR EXPLOSION

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

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

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.

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. |

| Standard | Description |
|------------------|---|
| 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 |

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.

Part I

TMS General Overview

What Is in This Part?

This part contains the following chapters:

| Chapter | Chapter Name | Page |
|---------|------------------|------|
| 1 | TMS Description | 13 |
| 2 | TMS Installation | 15 |

Chapter 1

TMS Description

TMS General Description

TMS Expansion Modules

You can connect a maximum of three expansion modules on the TMS bus.

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 |

TMS Description

Chapter 2

TMS Installation

What Is in This Chapter?

This chapter contains the following sections:

| Section | Topic | Page |
|---------|------------------------------------|------|
| 2.1 | TMS General Rules for Implementing | 16 |
| 2.2 | TMS Expansion Module Installation | 21 |
| 2.3 | TMS Electrical Requirements | 34 |

Section 2.1

TMS General Rules for Implementing

What Is in This Section?

This section contains the following topics:

| Topic | Page |
|-------------------------------|------|
| Environmental Characteristics | 17 |
| Certifications and Standards | 20 |

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 ² (32.15 ft/s ²) (1 g _n) fixed acceleration from 2...200 Hz |
| Mechanical shock resistance | – | 147 m/s ² (482.28 ft/s ²) (15 g _n) for a duration of 11 ms | |
| NOTE: 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 ¹ and DM ² | |
| | | AC/DC Power lines | 1 kV | |
| | | Communication line | 1 kV | |
| Surge immunity | IEC/EN 61000-4-5 IEC/EN 61131-2 | – | CM ¹ | DM ² |
| | | DC Power lines | 1 kV | 0.5 kV |
| | | Shielded cable (between shield and ground) | 1 kV | – |
| Induced electromagnetic field | IEC/EN 61000-4-6 | 10 Vrms (0.15...80 MHz) | | |
| Conducted emission | IEC/EN 55011 (IEC/CISPR Publication 11) | AC power line: ● 0.15...0.5 MHz: 79 dB μ V/m QP / 66 dB μ V/m AV ● 0.5...300 MHz: 73 dB μ V/m QP / 60 dB μ V/m AV | | |
| | | AC/DC power line: ● 10...150 kHz: 120...69 dB μ V/m QP ● 150...1500 kHz: 79...63 dB μ V/m QP ● 1.5...30 MHz: 63 dB μ V/m QP | | |
| Radiated emission | IEC/EN 55011 (IEC/CISPR Publication 11) | Class A, 10 m distance: ● 30...230 MHz: 40 dB μ V/m QP ● 230...1000 MHz: 47 dB μ V/m QP | | |
| 1 Common Mode 2 Differential Mode | | | | |
| NOTE: 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, EOLI, etc.), go to www.schneider-electric.com/green-premium.

Section 2.2

TMS Expansion Module Installation

What Is in This Section?

This section contains the following topics:

| Topic | Page |
|--|------|
| Installation and Maintenance Requirements | 22 |
| Installation Guidelines | 25 |
| Top Hat Section Rail (DIN rail) | 26 |
| Assembling a Module to a Controller or an Expansion Module | 29 |
| Disassembling a Module from a Controller | 31 |
| Direct Mounting on a Panel Surface | 32 |

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.

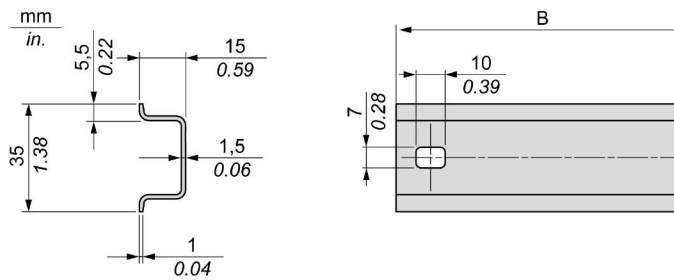
Top Hat Section Rail (DIN rail)

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.

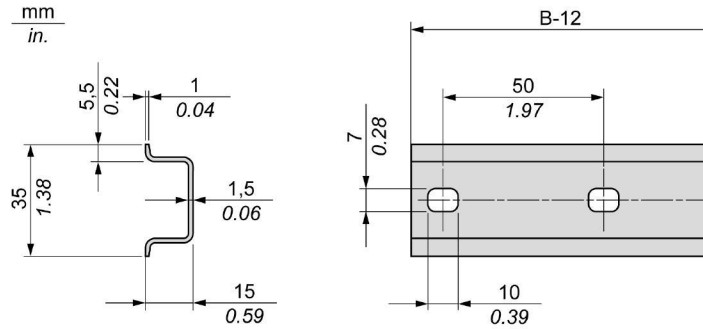
Symmetric Top Hat Section Rails (DIN Rail)

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



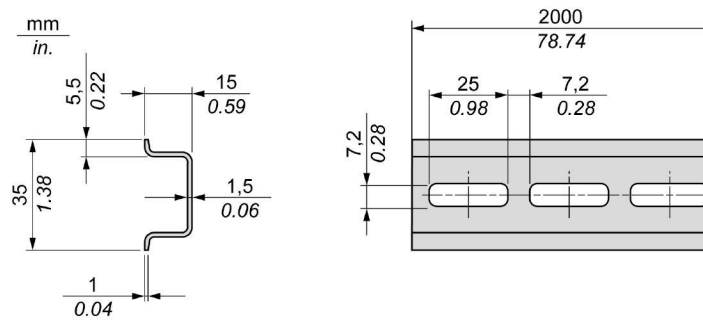
| Reference | Type | Rail Length (B) |
|------------|------|--------------------|
| NSYSDR50A | A | 450 mm (17.71 in.) |
| NSYSDR60A | A | 550 mm (21.65 in.) |
| NSYSDR80A | A | 750 mm (29.52 in.) |
| NSYSDR100A | A | 950 mm (37.40 in.) |

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



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

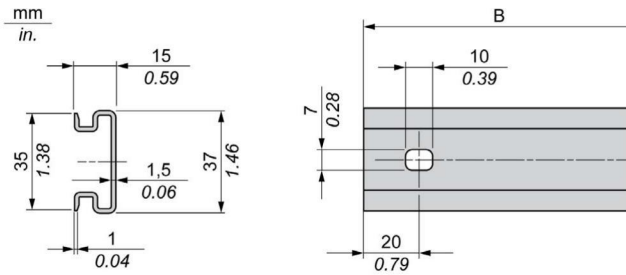
The following illustration and table indicate the references of the symmetric top hat section rails (DIN rail) of 2000 mm (78.74 in.):



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

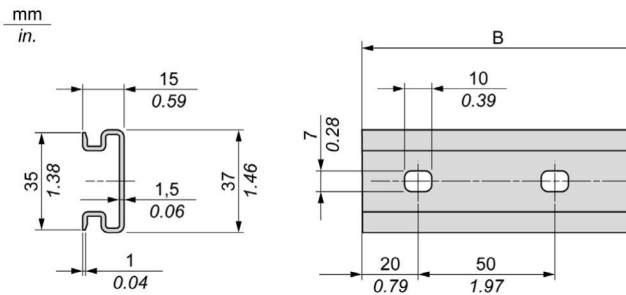
Double-Profile Top Hat Section Rails (DIN rail)

The following illustration and table 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 45</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 45</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.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

Disassembling a Module from a Controller

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

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

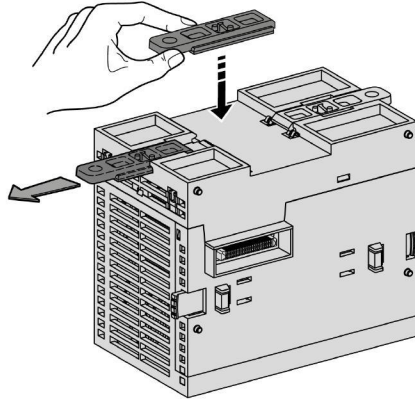
Direct Mounting on a Panel Surface

Overview

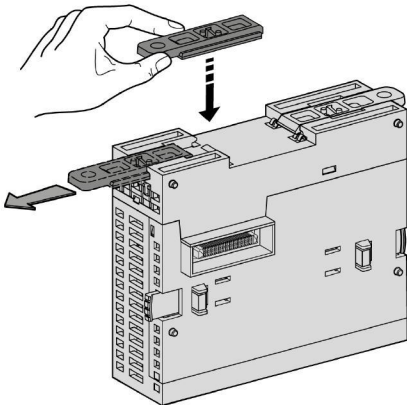
This section shows how to install the TMS expansion modules using the panel attachment kit (included). This section also provides mounting hole layout for all modules.

Panel Attachment Kit

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



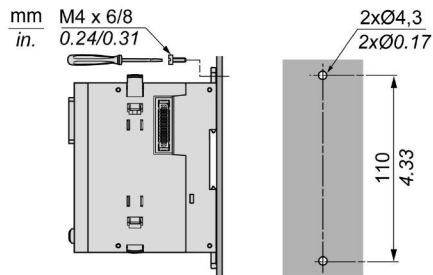
TMSES4



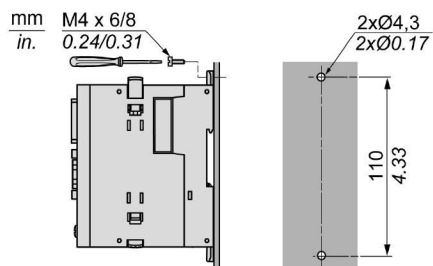
TMSCO1

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 | 35 |
| Grounding the System | 37 |

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.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 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 heavyduty 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 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 (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 point¹.
- Route communication 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 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 mm² (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

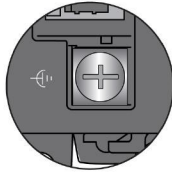
Connect the DIN rail to the functional ground (FE) of your installation.



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 | 0,5 |
| | | lb-in | 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).

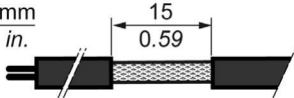
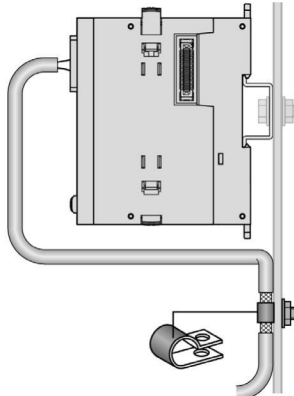
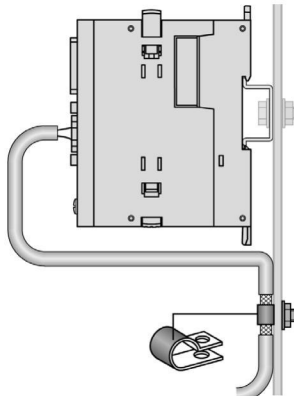
Failure to follow these instructions can result in death, serious injury, or equipment damage.

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.) |  <p>mm in.</p> <p>15 0.59</p> |
| 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>On a TMSES4:</p>  <p>On a TMSCO1:</p>  |

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

Part II

TMS Expansion Modules

What Is in This Part?

This part contains the following chapters:

| Chapter | Chapter Name | Page |
|---------|------------------------|------|
| 3 | TMSES4 Ethernet Module | 43 |
| 4 | TMSCO1 CANopen Module | 53 |

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 | 44 |
| TMSES4 Characteristics | 48 |
| TMSES4 Wiring Diagram | 50 |

TMSES4 Presentation

Overview

The TMSES4 Ethernet module provides an additional Ethernet interface to the controller. A maximum of three TMSES4 modules can be configured in the system.

The MAC address of the TMSES4 is unique for the three TMSES4, this MAC address is available on the label on the left side of the M262 Logic/Motion Controller.

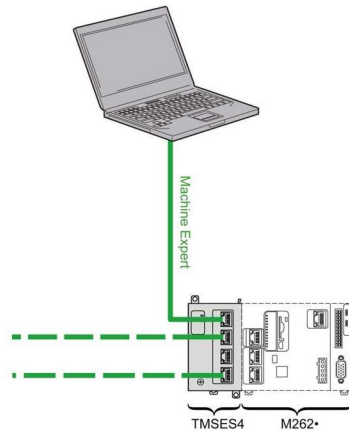
Main Characteristics

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:



NOTE: If you configure several TMSES4 modules, each module must be on a different subnetwork.

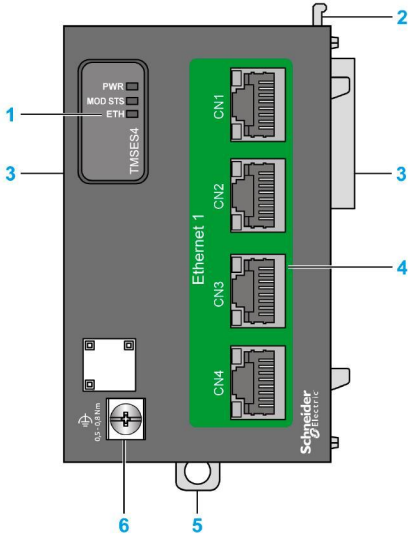
NOTE: TMSES4 modules must be on a different subnetwork than the controller Ethernet ports.

NOTE: Never connect two TMSES4 modules together if they are mounted on the same controller.

NOTE: Never connect a TMSES4 module to an Ethernet port on the controller on which it is mounted.

Elements

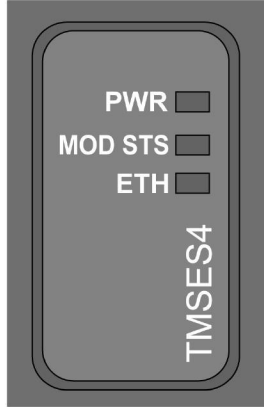
The following illustration shows the main elements of the TMSES4 module:



| 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) (see page 26) |
| 6 | Functional ground screw (see page 38) |

Module Status LED

The illustration shows the TMSES4 status LEDs:

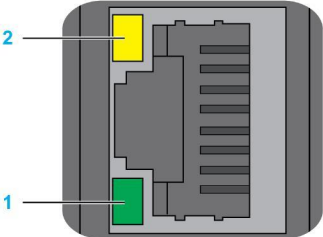


The table describes the TMSES4status LED:

| LED | Color | Status | Description |
|---------|----------|---------------------------------|--|
| PWR | Green | On | Power is applied. |
| | | Off | Power is removed. |
| MOD STS | Green | On | The module is running. |
| | | On | The module is not running. |
| | Flashing | A connection error is detected. | |
| ETH | Green | On | The module is running and one port is connected. |
| | | Flashing | If flashing: <ul style="list-style-type: none"> ● 3 times: no ports are connected. ● 4 times: IP address is duplicated. ● 5 times: IP address is awaiting. ● 6 times: default IP address is applied. |
| | 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 17*).

⚠ WARNING

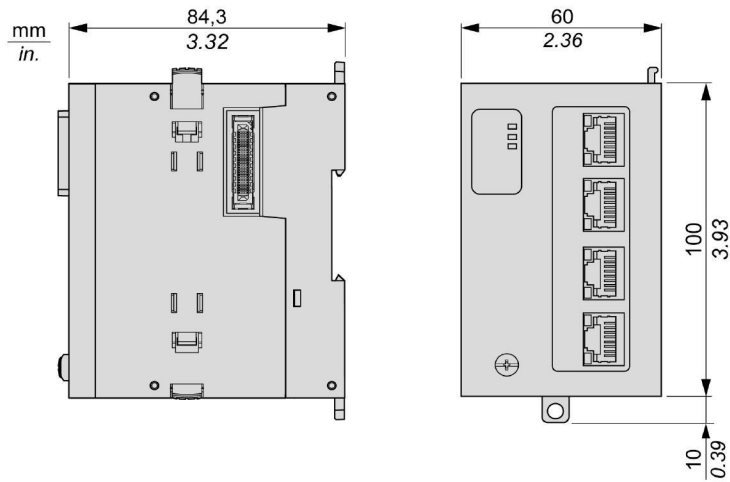
UNINTENDED EQUIPMENT OPERATION

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

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

Dimensions

The following diagrams show the dimensions of the 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 ⁽¹⁾ |
| 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. |
| (1) 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.) | |

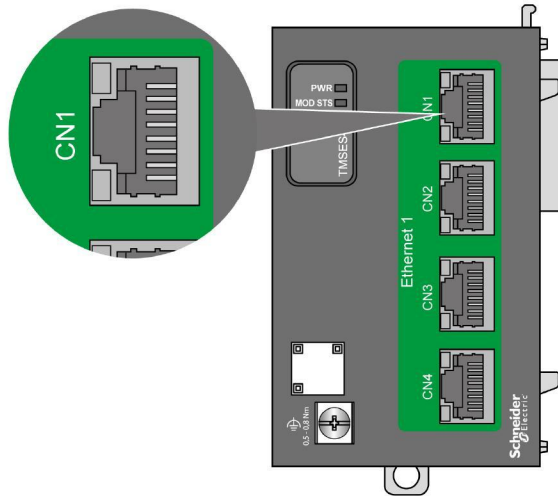
TMSES4 Wiring Diagram

Wiring Rules

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

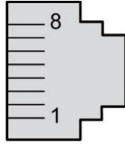
RJ45 Connector

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.

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 | 54 |
| TMSCO1 Characteristics | 57 |
| TMSCO1 Wiring Diagram | 59 |

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 at the last position on the TMS bus.

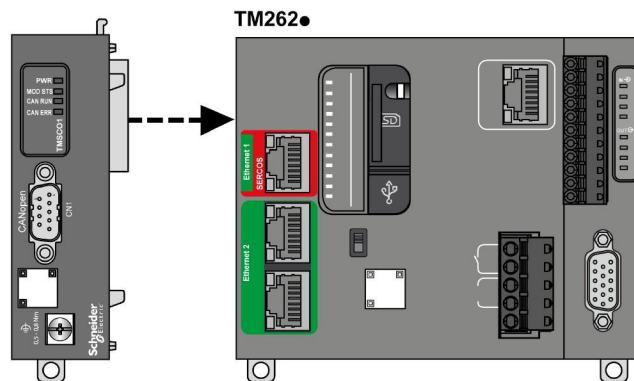
Main Characteristics

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 |

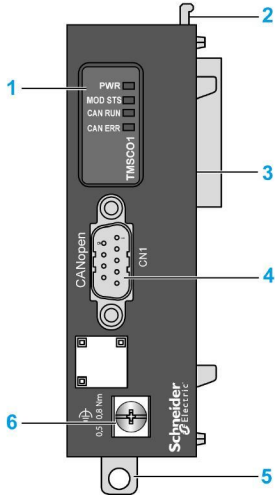
Connection

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



Description

The following illustration shows the elements of the TMSCO1 module:

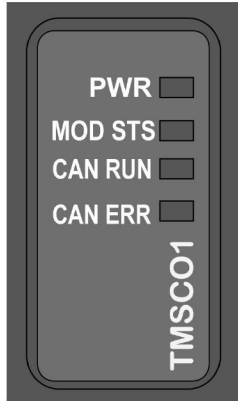


The table shows the elements of the TMSCO1 interface module:

| 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) <i>(see page 26)</i> |
| 6 | Functional ground screw <i>(see page 38)</i> |

Module Status LED

The following illustration shows the TMSCO1 interface module status LEDs:




The table describes the TMSCO1 status LEDs:

| LED | Color | Status | Description |
|---------|-------|----------------------|---|
| PWR | Green | On | Power is applied. |
| | | Off | Power is removed. |
| MOD STS | Green | On | The module is running. |
| | Red | On | The module is not running. |
| | | Flashing | A connection error is detected. |
| CAN RUN | 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. |
| CAN ERR | 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

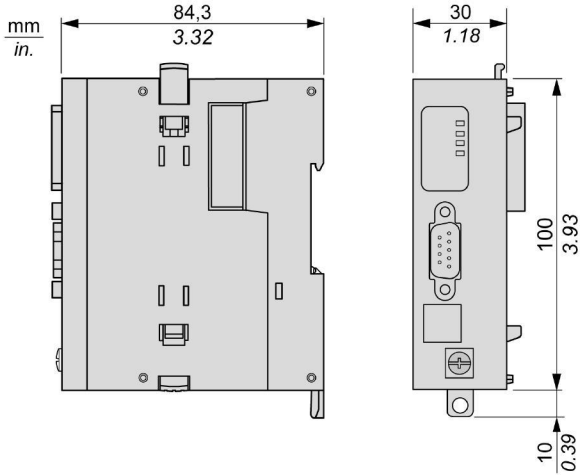
Introduction

These are the general characteristics of the TMSCO1 module.
 See also Environmental Characteristics (*see page 17*).

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

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:

| Characteristics | Value |
|---|---|
| Standards | CAN-CIA (ISO 11898-2:2002 Part 2) ⁽¹⁾ |
| 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. |
| (1) Part 1 and Part 2 of ISO 11898:20020 are equivalent to ISO 11898:1993. | |

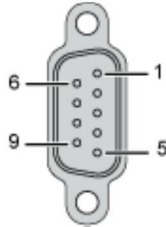
TMSCO1 Wiring Diagram

Wiring Rules

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

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.

Index



A

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