Modicon TM5

CANopen Interface
Hardware Guide

04/2012

Schneider Electric

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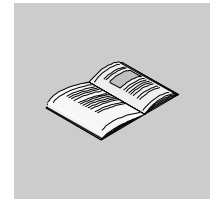
Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

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

Table of Contents

Safety Information

Important Information

NOTICE

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

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

PLEASE NOTE

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

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

About the Book
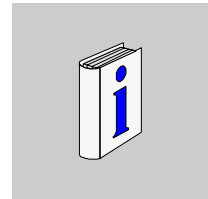
At a Glance

Document Scope

This manual describes the hardware implementation of the Modicon TM5 field bus interface. It provides parts descriptions, specifications, wiring diagrams, installation and setup for Modicon TM5 field bus interface.

Validity Note

This document has been updated with the release of the Performance Distributed I/O Configuration Software V1.0.

The technical characteristics of the device(s) described in this manual also appear online. To access this information online:

Step	Action
1	Go to the Schneider Electric home page *www.schneider-electric.com*.
2	In the **Search** box type the model number of a product or the name of a product range. ● Do not include blank spaces in the model number/product range. ● To get information on a grouping similar modules, use asterisks (*).
3	If you entered a model number, go to the **Product datasheets** search results and click on the model number that interests you. If you entered the name of a product range, go to the **Product Ranges** search results and click on the product range that interests you.
4	If more than one model number appears in the **Products** search results, click on the model number that interests you.

Step	Action
5	Depending on the size of your screen, you may need to scroll down to see the data sheet.
6	To save or print a data sheet as a .pdf file, click **Download *XXX* product datasheet**.

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

Related Documents

Title of Documentation	Reference Number
Modicon TM5 / TM7 CANopen Interface - Programming Guide	EIO0000000700 (Eng); EIO0000000701 (Fre); EIO0000000702 (Ger); EIO0000000703 (Spa); EIO0000000704 (Ita); EIO0000000705 (Chs)
Modicon TM5 Expansion Modules DTM Configuration - Programming Guide	EIO0000000679 (Eng); EIO0000000680 (Fre); EIO0000000681 (Ger); EIO0000000682 (Spa); EIO0000000683 (Ita); EIO0000000684 (Chs)
Modicon TM5 / TM7 Flexible System - System Planning and Installation Guide	EIO0000000426 (Eng); EIO0000000427 (Fre); EIO0000000428 (Ger); EIO0000000429 (Spa); EIO0000000430 (Ita); EIO0000000431 (Chs)
CANopen Hardware Setup Manual	35010857 (Eng); 35010859 (Fre); 35010858 (Ger); 35010860 (Spa); 35010861 (Ita); 33004206 (Chs)
TM5 CANopen Blocks Instruction Sheet	S1A3362300

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

Product Related Information

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

⚠ DANGER

EXPLOSIVE POTENTIAL

- 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.

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.

User Comments

We welcome your comments about this document. You can reach us by e-mail at techcomm@schneider-electric.com.

TM5 System General Rules for Implementing

1

What's in this Chapter?

This chapter contains the following topics:

Installation Requirements

Before Starting

Read and understand this chapter before beginning the installation of your TM5 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.

NOTICE
ELECTROSTATIC DISCHARGE
● Store all components in their protective packaging until immediately before assembly. ● Never touch exposed conductive parts such as contacts or terminals.
Failure to follow these instructions can result in equipment damage.

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

⚠ DANGER

EXPLOSIVE POTENTIAL

- 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.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Install and operate this equipment according to the environmental conditions described in the operating limits.

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

Installation Considerations

> ## ⚠ WARNING
>
> **UNINTENDED EQUIPMENT OPERATION**
>
> - Use appropriate safety interlocks where personnel and/or equipment hazards exist.
> - Install and operate this equipment in an enclosure appropriately rated for its intended environment.
> - Use the sensor and actuator power supplies only for supplying power to the sensors or actuators connected to the module.
> - Power line and output circuits must be wired and fused in compliance with local and national regulatory requirements for the rated current and voltage of the particular equipment.
> - Do not use this equipment in safety-critical machine functions.
> - Do not disassemble, repair, or modify this equipment.
> - Do not connect any wiring to reserved, unused connections, or to connections designated as Not Connected (N.C.).
>
> **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

NOTE: Schneider Electric recommends the use of UL-recognized and CSA approved JDYX2 or JDYX8 fuse types.

Wiring Rules and Recommendations

Introduction

There are several rules that must be followed when wiring the TM5 System.

Wiring Rules

> # ⚠ 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.**

The following rules must be applied when wiring the TM5 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 only.
- Use twisted-pair, shielded cables for analog, expert or fast I/O and TM5 bus signals.
- Use twisted-pair, shielded cables for encoder, networks and field bus (CAN, serial, Ethernet).

⚠ WARNING

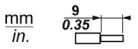**IMPROPER GROUNDING CAN CAUSE UNINTENDED EQUIPMENT OPERATION**

- Use cables with insulated shielded jackets for analog I/O, fast I/O and communication signals.
- Ground shielded cables for analog I/O, fast I/O and communication signals at a single point [1]
- Always comply with local wiring requirements regarding grounding of cable shields.

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

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

Refer to the section Grounding the TM5 System *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)* to ground the shielded cables.

The table below provides the wire sizes to use with the removable spring terminal blocks:

$\frac{mm}{in.}$ $\frac{9}{0.35}$				
mm²	0,08…2,5	0,25…2,5	0,25…1,5	2 x 0,25...2 x 0,75
AWG	28…14	24…14	24…16	2 x 24…2 x 18

⚠ DANGER

FIRE HAZARD

Use only the recommended wire sizes for I/O channels and power supplies.

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

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

⚠ DANGER

LOOSE WIRING CAUSES ELECTRIC SHOCK

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

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

Terminal Block

Plugging a terminal block into the incorrect electronic module can cause an electric shock or unintended operation of the application and/or damage the electronic module.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION OR ELECTRIC SHOCK

Be sure to connect the terminal blocks to their designated location.

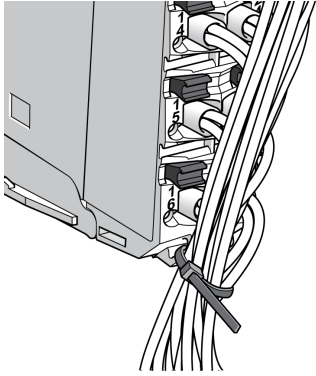**Failure to follow these instructions will result in death or serious injury.**
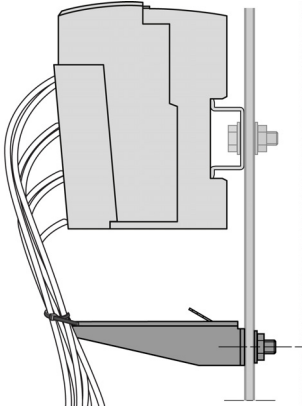
NOTE: To help prevent a terminal block from being inserted incorrectly, clearly and uniquely code and label each terminal block and electronic module according to the instructions in Coding the TM5 System *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*.

Stress Relief Using Cable Tie

There are two methods to reduce the stress on cables:
- The terminal blocks *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)* have slots to attach cable ties. A cable tie can be fed through this slot to secure cables and wires to reduce stress between them and the terminal block connections.
- After grounding the TM5 System via the TM2XMTGB grounding plate *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*, wires can be bundled and fixed to the grounding plate tabs using wire ties to reduce stress on the cables.

The table below provides the size of the cable tie and shows the two methods to reduce the stress on the cables:

Cable Tie Size	Terminal block	TM2XMTGB Grounding plate
Thickness	1.2 mm (0.05 in.) maximum	1.2 mm (0.05 in.)
Width	4 mm (0.16 in.) maximum	2.5...3 mm (0.1...0.12 in.)
Mounting figure		

Environmental Characteristics

Introduction

The following information describes the system-wide environmental requirements and characteristics for the TM5 System.

The general environmental characteristics are common to all components of the TM5 System.

Enclosure Requirements

TM5 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 the standard, or in environments that do not meet the specifications in this manual, your ability to meet electromagnetic compatibility requirements in the presence of conducted and/or radiated interference may be reduced.

All TM5 components meet European Community (CE) requirements for open equipment as defined by EN61131-2. You must install them in an enclosure designed for the specific environmental conditions and to minimize the possibility of unintended contact with hazardous voltages. Your enclosure should be constructed of metal to improve the electromagnetic immunity of your TM5 System. Your enclosure should have a keyed locking mechanism to minimize unauthorized access.

Environmental Characteristics

This equipment meets UL, CSA, GOST-R and c-Tick certifications and CE requirements as indicated in the table below. This equipment is intended for use in a Pollution Degree 2 industrial environment.

The table below provides the general environmental characteristics:

Characteristic	Specification	
Characteristic	**Specification**	
This product is compliant with Europe RoHS recommendations and China RoHS regulations.		
Standard	IEC61131-2 ed. 3 2007	
Agencies	UL 508 CSA 22.2 No. 142-M1987 CSA 22.2 No. 213-M1987	
Ambient operating temperature	Horizontal installation	-10...60 °C (14...140 °F)[1, 2]
	Vertical installation	-10...50 °C (14...122 °F)[2]
Storage temperature	-40...70 °C (-40...158 °F)	
Relative humidity	5...95% (non-condensing)	
Degree of pollution	IEC60664	2
Degree of protection	IEC61131-2	IP20
Corrosion immunity	No	
Operating altitude	0...2000 m (0...6.560 ft.)	
Storage altitude	0...3000 m (0...9.842 ft.)	
Vibration resistance	Mounted on a DIN rail	3.5 mm (0.138 in.) fixed amplitude from 5...8.4 Hz 9.8 m/s^2 (1 g_n) fixed acceleration from 8.4...150 Hz
Mechanical shock resistance	147 m/s^2 (15 g_n) for a duration of 11 ms	
Connection type	Removable spring terminal block	
Connector insertion/removal cycles	50	
Note: **1** Some devices have temperature operating restrictions that require de-rating between 55 °C and 60 °C (131 °F and 140 °F), and may be subject to other possible restrictions. See the specific characteristics for your electronic module. **2** For compliance to Class I, Div 2 environment ratings, do not operate this device in locations with ambient temperatures less than 0 °C (32° F).		

Electromagnetic Susceptibility

The table below provides the TM5 System electromagnetic susceptibility specifications:

Characteristic	Specification	Range
Electrostatic discharge	IEC/EN 61000-4-2	8 kV (air discharge) 4 kV (contact discharge)
Electromagnetic fields	IEC/EN 61000-4-3	10 V/m (80 MHz...2 GHz) 1 V/m (2...2.7 GHz)
Fast transients burst	IEC/EN 61000-4-4	Power lines: 2 kV I/O: 1 kV Shielded cable: 1 kV Repetition rate: 5 and 100 KHz
Surge immunity 24 Vdc circuit	IEC/EN 61000-4-5	1 kV in common mode 0.5 kV in differential mode
Surge immunity 230 Vac circuit		2 kV in common mode 1 kV in differential mode
Induced electromagnetic field	IEC/EN 61000-4-6	10 V_{eff} (0.15...80 MHz)
Conducted emission	EN 55011 (IEC/CISPR11)	150...500 kHz, quasi peak 79 dBµV
		500 kHz...30 MHz, quasi peak 73 dBµV
Radiated emission	EN 55011 (IEC/CISPR11)	30...230 MHz, 10 m @ 40 dBµV/m
		230 MHz...1 GHz, 10 m @ 47 dBµV/m

TM5 Field Bus Interface General Overview

2

What's in this Chapter?

This chapter contains the following topics:

General Description

Introduction

The TM5 field bus interface with built-in power distribution is the first element of the TM5 distributed I/O island *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*. When assembled together, the TM5 field bus interface is composed of four elements:

● Field bus Interface bus base
● Field bus interface module
● Interface Power Distribution Module (IPDM)
● Terminal block

The following figure shows a TM5 field bus interface when assembled:
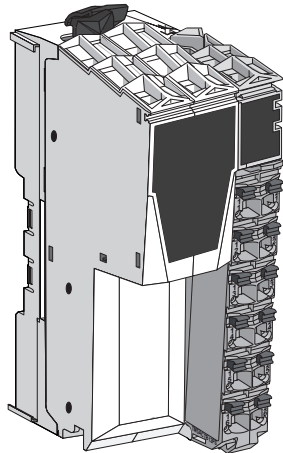
TM5 Field Bus Interface Features

The table below provides the bus base reference:

Reference	Description
TM5ACBN1 *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*	Bus base for field bus interface module and Interface Power Distribution Module (IPDM)

The table below provides the field bus interface module references:

Reference	Description
TM5NCO1 *(see page 31)*	CANopen interface module
TM5NS31	SERCOS III interface module

The table below provides the Interface Power Distribution Module (IPDM) reference:

Reference	Description
TM5SPS3 *(see page 45)*	Field bus interface 24 Vdc power supply

The table below provides the terminal block reference:

| Reference	Description
TM5ACTB12PS *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*	24 Vdc, 12-pin terminal block for PDM, IPDM and Receiver electronic module

Physical Description

Introduction

Each field bus interface consists of four elements. These elements are the:
- Field bus interface bus base
- Field bus interface module
- Interface Power Distribution Module (IPDM)
- Terminal block

Elements

The following figure shows the different parts that compose the TM5 field bus interface:
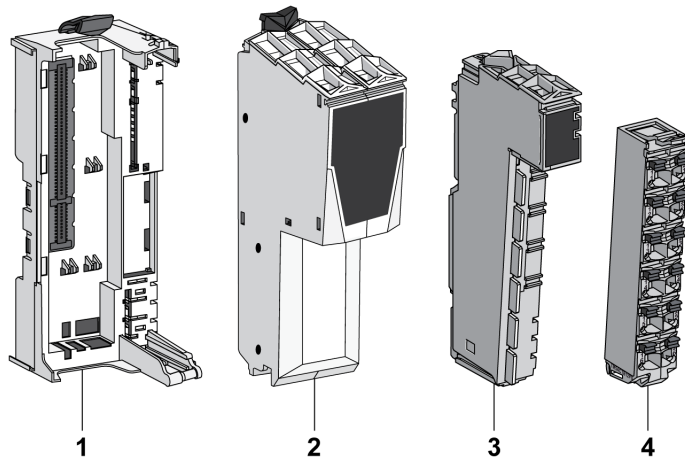
(1) Field bus interface bus base
(2) Field bus interface module
(3) Interface Power Distribution Module (IPDM)
(4) Terminal block

When assembled the four elements form an integral unit that resists vibration and electrostatic discharge.

NOTICE

ELECTROSTATIC DISCHARGE

- Never touch the pin connectors of the block.
- Always keep the cables or sealing plugs in place during normal operation.

Failure to follow these instructions can result in equipment damage.

Dimensions

The following figure shows the dimensions of the TM5 field bus interface:

$$\frac{mm}{in.}$$
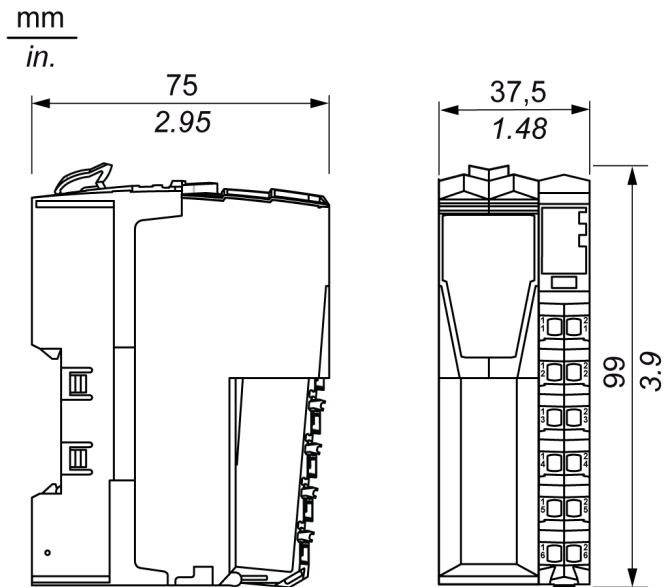
Accessories

Refer to the Installation of Accessories *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*.

Labeling

Refer to the Labeling the TM5 System *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*.

TM5 Field Bus Interface Installation

3

First Startup

Overview

This procedure helps you through the installation and startup of your TM5 field bus interface.

Startup Procedure

Step	Action	Comment
1	Unpack your field bus interface module and check the contents of the package.	Package content: ● Instruction Sheet ● field bus interface module
2	Unpack: ● The bus base of your field bus interface ● the Interface Power Distribution Module (IPDM) ● The terminal block	For more information, refer to the Physical Description *(see page 26)*.
3	Assemble all separate parts together.	For more information, refer to the Field Bus Interface Installation *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*.
4	Choose an appropriate cabinet and DIN rail and install your field bus interface on the DIN rail.	For more information, refer to the DIN Rail Installation and Enclosing the TM5 System *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*.
5	Install the expansion modules.	For more information, refer to the Slices Installation or Compact I/O Installation *(see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*.

Step	Action	Comment
6	Connect the communication field bus interface	For more information, refer to TM5NCO1 Wiring Diagram *(see page 42)*.
7	Connect your devices to the inputs and outputs.	For more information refer to TM5 Hardware Guides.
8	Connect the external 24 Vdc power source(s) to the Interface Power Distribution Module (IPDM) and any optional Power Distribution Modules (PDM).	For more information, refer to IPDM Wiring Diagram *(see page 50)*.
9	Verify all connections.	—

TM5 CANopen Interface Module

4

What's in this Chapter?

This chapter contains the following topics:

TM5NCO1 Presentation

Main Characteristics
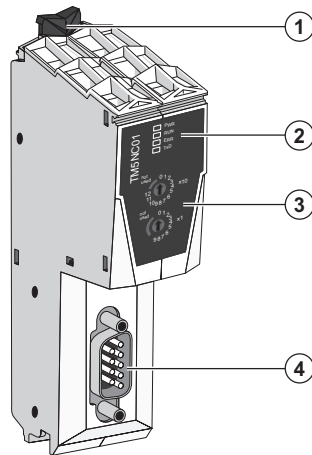
The table below describes the main characteristics of the TM5NCO1 CANopen interface module:

Main Characteristics	
Interface type	CANopen
Connector type	SUB-D 9, male

Presentation
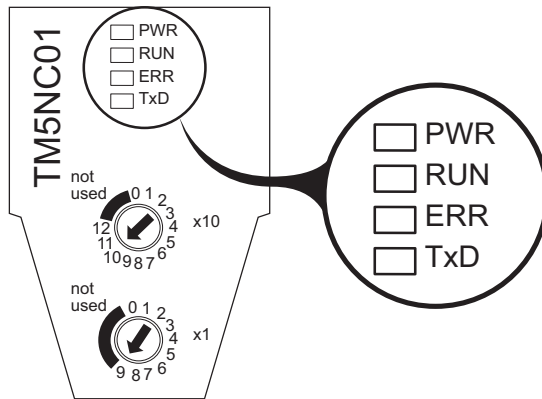
The figure below shows the TM5NCO1:

(1) Locking clip
(2) Status LEDs
(3) CANopen address and bit-rate setting rotary switches
(4) CANopen bus connector (SUB-D 9)

Status LEDs

The following figure shows the LEDs of the TM5NCO1 CANopen interface module:

The table below describes each LED available with the TM5NCO1 CANopen interface module:

LED	Description
PWR	Indicates the status of the distributed island: • power supply • detected internal errors
RUN	Dedicated to CANopen bus according to the CAN CiA standard and Schneider Electric implementation
ERR	
TxD	Indicates the communication on the TM5 Expansion bus

The table below describes the TM5NCO1 CANopen interface module status LEDs:

LED	Color	Status		Description
PWR	Green	On		Power supply connected, internal tests OK
	Red	On		Detected error on the TM5 bus
		Off		Power supply not connected
RUN (CAN_RUN)	Green	Flashing	On: 50 ms Off: 50 ms	Bit-rate detection in progress (alternatively flashing with the ERR LED)
		Flashing	On: 200 ms Off: 200 ms	Preoperational state
		1 x Flashing	On: 200 ms Off: 1 s	STOP state
		3 x Flashing	On: 200 ms Off: 1 s	Firmware update
		On		Operational state

LED	Color	Status		Description
ERR (CAN_ERR)	Red	Off		No detected error or operational state
		Flashing	On: 50 ms Off: 50 ms	Bit-rate detection in progress (alternatively flashing with the RUN LED)
		Flashing	On: 200 ms Off: 200 ms	Invalid configuration
		1 x Flashing	On: 200 ms Off: 1 s	At least one of the error counters of the CANopen interface module has reached the threshold "CANopen in Error Passive Mode".
		2 x Flashing	On: 200 ms Off: 1 s	Guard or heartbeat event occurred
		3 x Flashing	On: 200 ms Off: 1 s	The synchronisation message was not received in the configured time.
		4 x Flashing	On: 200 ms Off: 1 s	An expected PDO (Process Data Object) was not received before the event timer has expired.
		On		The CANopen interface module is in bus off state (no communication).
TxD	Yellow	Off		The TM5 CANopen interface module is not transmitting data via the TM5 expansion bus.
		On		The TM5 CANopen interface module is transmitting data via the TM5 expansion bus.

Setting the CANopen Bit-rate

Presentation

By default, the bit-rate is automatically detected by the CANopen interface module. However, you can force a bit-rate to be configured using the two rotary switches.
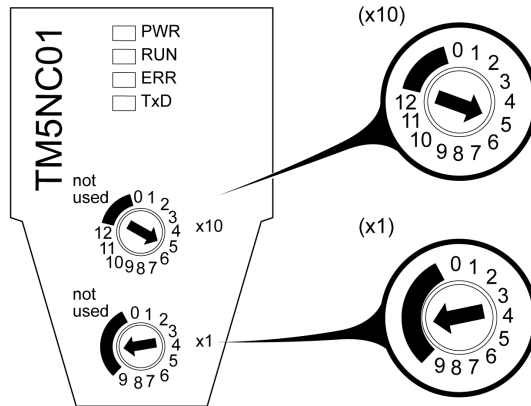
(x10) CANopen bit-rate setting
(x1) Authorize to set the CANopen bit-rate

The Bit-rate

The CANopen interface module detects a new bit-rate selection by the rotary switches only during power up. The bit-rate is written to non-volatile memory.

Set x1 rotary switch to any of the six unnumbered positions to set a particular bit-rate with the x10 rotary switch.

Setting the Bit-rate

Instructions for setting the bit-rate are in the table.

Step	Action	Comment
1	Remove power to the CANopen interface module.	The CANopen interface module detects the changes you are about to make only at the next power up cycle.
2	With a small screwdriver, set the x1 rotary switch to any position after 9.	Setting the rotary switch to any of these unnumbered positions prepares the CANopen interface module to accept a new bit-rate.

Step	Action	Comment
3	With a small screwdriver, set the x10 rotary switch to the position that corresponds to your selected bit-rate.	Use the rotary switch position you selected in the last step. Use the bit-rate selection table below to determine the position of the rotary switch.
4	Reapply power your CANopen interface module.	The CANopen interface module reads the rotary switch settings only during power up.
5	Wait until the RUN and ERR LEDs flash 3 times (ON: 50 ms / OFF: 50 ms).	The CANopen interface module has written the new bit-rate setting to memory.
6	Again, remove power to the CANopen interface module and proceed to the CANopen Address Settings Rotary Switches procedure *(see page 40)*.	The bit-rate has been established for the CANopen interface module.

Bit-rate Selection Table

The following table shows the rotary switch positions and the bit-rate:

Position x10 rotary switch	Bit-rate
0	10 kbits/s
1	20 kbits/s
2	50 kbits/s
3	125 kbits/s
4	250 kbits/s
5	500 kbits/s
6	800 kbits/s
7	1 Mbits/s
8	Automatic bit-rate detection
9	Automatic bit-rate detection (default value)
10...12	Not used

NOTE: Setting the x10 rotary switch between 10 and 12 and unnumbered part will generate an error detected at the next power on.

CANopen Bit-rate Setting Example

The following figure shows an example when the CANopen bit-rate is configured to 500 kbits/s:

(x10)

(x1)

(x10) Set the CANopen bit-rate
(x1) Authorize to set the CANopen bit-rate

Setting the CANopen Address

Presentation

The CANopen interface module address (from 1 to 126, decimal) is configured using the two CANopen address settings rotary switches. The factory setting of the rotary switches is 0.


⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION

Do not use an address outside of the specified range (from 1 to 126).

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

To reset the CANopen interface module, remove power and provide a correct address before reapplying power to the module.

The following figure shows the TM5NCO1 CANopen rotary switches:
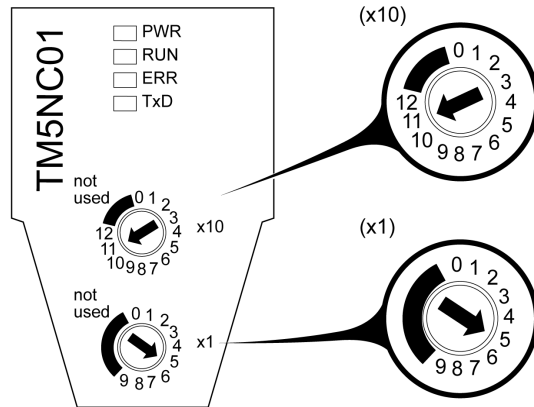
(x10) High order rotary switch: represents the 'tens' of the CANopen address
(x1) Low order rotary switch: represents the 'ones' of the CANopen address

CANopen Address Setting Example

The following figure shows an example when the CANopen address is configured to 115 (decimal):

(x10)

(x1)

(x10) High order rotary switch: the 'tens' of the CANopen address is set to 11
(x1) Low order rotary switch: the 'ones' of the CANopen address is set to 5

TM5NCO1 Characteristics

Capabilities

The protocol and function supported by the CAN port is CANopen. For more information, please refer to the CANOpen Hardware Setup Manual *(see page 8)*.

Characteristics

> ## ⚠ DANGER
>
> **FIRE HAZARD**
>
> Use only the recommended wire sizes for I/O channels and power supplies.
>
> **Failure to follow these instructions will result in death or serious injury.**

> ## ⚠ WARNING
>
> **UNINTENDED EQUIPMENT OPERATION**
>
> Do not exceed any of the rated values specified in the following tables.
>
> **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The table below provides the general characteristics of the TM5NCO1 field bus interface module:

General Characteristics	
TM5 power bus consumption	300 mA
Power dissipation	1.5 W
Weight	50 g (1.8 oz)

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

The table below describes the CAN characteristics of the TM5NCO1 field bus interface module:

| Characteristics	Description							
Standard	CAN-CIA (ISO 11898-2:2002 Part 2)[1]							
Connector type	Sub-D 9, male							
Protocol supported	CANopen							
CAN power distribution	No							
Maximal cable length	Refer to Transmission Speed and Cable Length chapter in the CANopen Hardware Setup Manual *(see page 8)*							
Isolation between CAN bus and ground	500 Vac RMS, 700 Vdc							
Line termination	Refer to Basic Topology chapter in the CANopen Hardware Setup Manual *(see page 8)*							
Bit-rate (Kbit/s)[2]	1000	800	500	250	125	50	20	10
ID code for firmware update	45164 dec							

[1] Part 1 and Part 2 of ISO 11898:2002 are equivalent to ISO 11898:1993.

[2] Auto bit-rate detection

TM5NCO1 Wiring Diagram

Wiring Diagram

The following figure shows the pins of the CANopen bus connector:
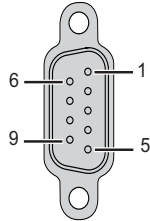
The table below describes the pins of the CANopen bus connector:

Pin	Designation	Description
1	–	Reserved (N.C.)
2	CAN_L	CAN_L bus Line (Low)
3	CAN_GND	CAN ground
4	–	Reserved (N.C.)
5	(CAN_SHLD)	Optional CAN shield
6	GND	Ground, connection to pin 3
7	CAN_H	CAN_H bus Line (High)
8	–	Reserved (N.C.)
9	(CAN_V+)	Reserved (N.C.)

Although the cable shield is connected to pin 6 (ground), it is still necessary to properly and externally ground the cable shield *(see page 43)* to your functional ground (FE).
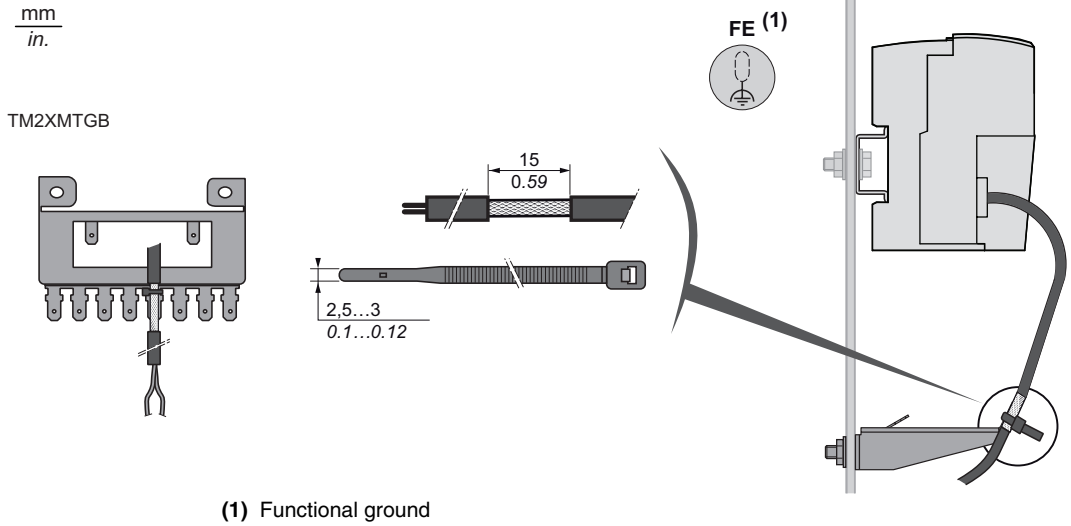

⚠ **WARNING**

UNINTENDED EQUIPMENT OPERATION

Do not connect wires to unused terminals or terminals marked "Not Connected (N.C.)".

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

Field Bus Cable Shielding

The following figure shows how to connect the field bus cable shielding:

(1) Functional ground

TM5 Interface Power Distribution Module (IPDM)

5

What's in this Chapter?

This chapter contains the following topics:

TM5SPS3 Presentation

Main Characteristics

The TM5SPS3 CANopen Interface Power Distribution Module (IPDM) consists of two dedicated electrical circuits:
- a 24 Vdc Main power that serves the electronics of the field bus Interface Module and generates independent power for the TM5 power bus that serves the expansion modules.
- a 24 Vdc I/O power segment that serves:
  - the expansion modules,
  - the sensors and actuators connected to the expansion modules,
  - the external devices connected to the Common Distribution Modules (CDM)

The table below provides the main characteristics of the TM5SPS3 interface power distribution module:

Main Characteristics	
Maximum current provided on 24 Vdc I/O power segment	6300 mA
TM5 power bus generated	750 mA

Ordering Information

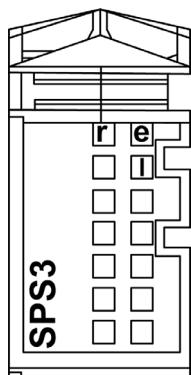The following figure and table provide the references to create a TM5 field bus interface with the TM5SPS3 IPDM:
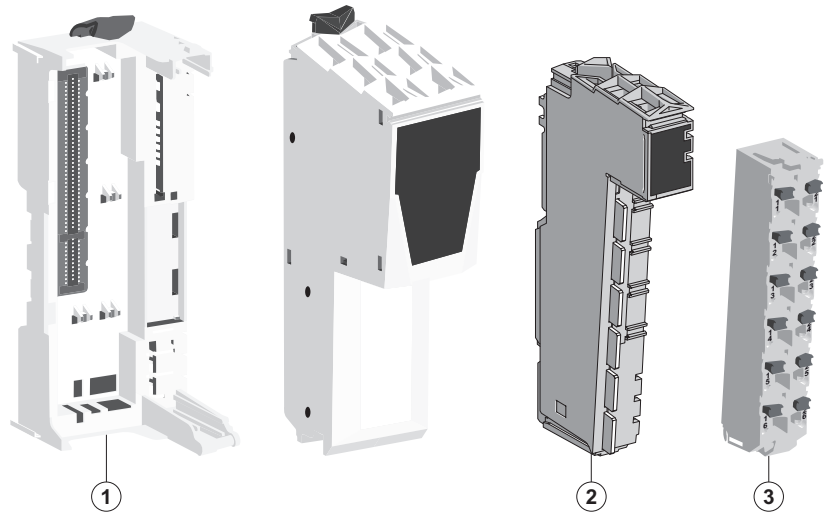
Number	Reference	Description	Color
1	TM5ACBN1	Bus base 24 Vdc I/O power segment left isolated	White
2	TM5SPS3	Field bus interface 24 Vdc power supply (Interface Power Distribution Module (IPDM))	Grey
3	TM5ACTB12PS	24 Vdc, 12-pin terminal block for PDM, IPDM and receiver electronic module	Grey

NOTE: For more information, refer to *TM5 Bus Bases and Terminal Blocks (see Modicon TM5 / TM7 Flexible System, System Planning and Installation Guide)*.

Status LEDs

The following figure and table provide the TM5SPS3 IPDM status LEDs:

LED	Color	Status	Description
r	Green	Off	Power supply not connected
		Single flash	Reset status
		Flashing	TM5 expansion bus in preoperational status
		On	RUN status
e	Red	Off	OK or module not connected
		Double flash	Indicates one of the following conditions: • 24 Vdc I/O power segment, via the external power supply or supplies, is too low. • TM5 power bus, via the external power supply or supplies, is too low.
e+r	Steady red/single green flash		Invalid firmware
l	Red	Off	The TM5 interface power distribution module supply is within the acceptable range
		On	The TM5 interface power distribution module supply is insufficient

TM5SPS3 Characteristics

General Characteristics

⚠ DANGER

FIRE HAZARD

Use only the recommended wire sizes for I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the following tables.

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

The table below provides the general characteristics of the TM5SPS3 interface power distribution module:

General Characteristics	
Rated power supply voltage	24 Vdc
24 Vdc I/O power segment current draw	25 mA
Power dissipation	1.82 W max.
Weight	30 g (1.1 oz)
ID code	8076 dec

See also Environmental Characteristics .

TM5 Power Bus Characteristics

The table below provides the TM5 power bus characteristics of the TM5SPS3 interface power distribution module:

TM5 Power Bus Characteristics	
Power supply range	20.4...28.8 Vdc
Rated input current	0.7 A at 24 Vdc
Reverse polarity protection	Yes
Fuse	Integrated, cannot be exchanged

TM5 Power Bus Characteristics	
Current generated	• On TM5 power bus: 750 mA • To supply the field bus interface module: 300 mA
Parallel operation	Yes [1]
Electrical isolation	See note [2]

[1] In parallel operation, only 75% of the rated power can be assumed. Please ensure that all parallel operating power supplies are switched on and off simultaneously.

[2] The two power circuits reference the same functional ground (FE) through specific components designed to reduce effects of electromagnetic interference. These components are rated at 30 or 60 V.

Temperature De-rating

The TM5SPS3 interface power distribution module is subject to temperature restrictions depending on the current consumption on the TM5 power bus:
• up to 500 mA: -10...60° C (14...140° F)
• over 500 mA: -10...55° C (14...131° F)

24 Vdc I/O Power Segment Characteristics

The table below provides the 24 Vdc I/O power segment characteristics of the TM5SPS3 interface power distribution module:

24 Vdc I/O Power Segment Characteristics	
Power supply range	20.4...28.8 Vdc
Rated power supply voltage	24 Vdc
Maximum current provided	10 A
Reverse polarity protection	No
Short circuit protection	External fuse type T slow-blow 10 A max. 250 V
Isolation between power segment and TM5 buses	See note [1]

[1] The isolation of the electronic module is 500 Vac RMS between the electronics power by the TM5 bus and those powered by 24 Vdc I/O power segment connected to the module. In practice, the TM5 electronic module is installed in the bus base, and there is a bridge between the TM5 power bus and the 24 Vdc I/O power segment. The two power circuits reference the same functional ground (FE) through specific components designed to reduce effects of electromagnetic interference. These components are rated at 30 Vdc or 60 Vdc. This effectively reduces isolation of the entire system from the 500 Vac RMS.

TM5SPS3 Wiring Diagram

Wiring Diagram

The following figure shows the wiring diagram for the TM5SPS3 interface power distribution module:
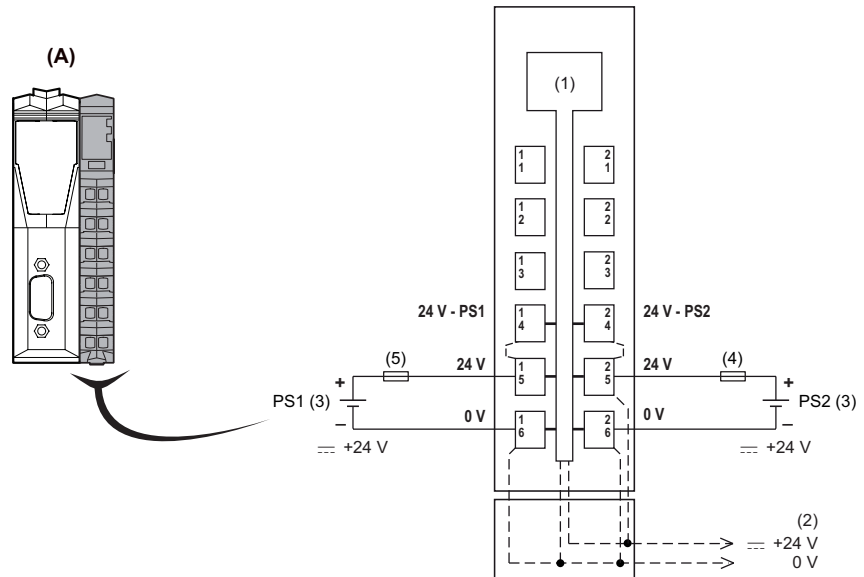
(A) Interface Power Distribution Module (IPDM)
(1) Internal electronics
(2) 24 Vdc I/O power segment integrated in the bus bases
(3) PS1/PS2: External isolated power supply 24 Vdc
(4) External fuse, Type T slow blow, 10 A max., 250 V
(5) External fuse, Type T slow blow, 1 A, 250 V

⚠ **WARNING**

POTENTIAL OF OVERHEATING AND FIRE

● Do not connect the modules directly to line voltage.
● Use only isolating PELV or SELV power supplies to supply power to the modules.

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

> ## ⚠ WARNING
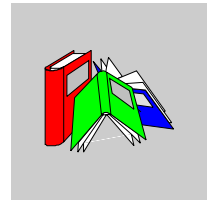>
> **UNINTENDED EQUIPMENT OPERATION**
>
> Do not connect wires to unused terminals or terminals marked "Not Connected (N.C.)".
>
> **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Glossary

A

analog input

An *analog input* module contains circuits that convert an analog DC input signal to a digital value that can be manipulated by the processor. By implication, the analog input is usually direct. That means a data table value directly reflects the analog signal value.

analog output

An *analog output* module contains circuits that transmit an analog DC signal proportional to a digital value input to the module from the processor. By implication, these analog outputs are usually direct. That means a data table value directly controls the analog signal value.

AWG

The *american wire gauge* standard specifies wire gauges in North America.

A coded

These connectors have one raised key on the male connector and one mating slot on the female connector. This is the standard coding used for sensors and distribution box applications:
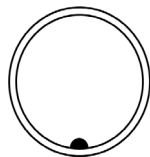
B

bus base

A *bus base* is a mounting device that is designed to seat an electronic module on a DIN rail and connect it to the TM5 bus for M258 and LMC058 controllers. Each base bus extends the TM5 data and to the power buses and the 24 Vdc I/O power segment. The electronic modules are added to the TM5 system through their insertion on the base bus. The base bus also supplies the articulation point for the terminal blocks.

B coded

These connectors have one raised key on the female connector and one mating slot on the male connector. These connectors (also called reverse keyed) are used for field bus applications:
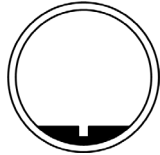
C

CAN

The *controller area network* protocol (ISO 11898) for serial bus networks is designed for the interconnection of smart devices (from multiple manufacturers) in smart systems for real-time industrial applications. CAN multimaster systems help ensure high data integrity through the implementation of broadcast messaging and advanced diagnostic mechanisms. Originally developed for use in automobiles, CAN is now used in a variety of industrial automation control environments.

CANopen

CANopen is an open industry-standard communication protocol and device profile specification.

compact I/O module

A *compact I/O module* is an indissociable group of five analog and/or digital I/O electronic modules in a single reference.

configuration

The *configuration* includes the arrangement and interconnection of hardware components within a system and the hardware and software selections that determine the operating characteristics of the system.

controller

A *controller* (or "programmable logic controller," or "programmable controller") is used to automate industrial processes.

CPDM

controller power distribution module

crosstalk

The crosstalk is an undesired signal caused by a capacitive, inductive or conductive coupling between two channels.

CSA

The *canadian standards association* defines and maintains standards for industrial electronic equipment in hazardous environments.

CTS

Clear to send is a data transmission signal and acknowledges the RDS signal from the transmitting station.

D

De-rating

De-rating describes a reduction in an operating specification. For devices in general it is usually a specified reduction in nominal power to facilitate operation at increased ambient conditions like higher temperatures or higher altitudes.

DHCP

The *dynamic host configuration protocol* is an advanced extension of BOOTP. DHCP is a more advanced, but both DHCP and BOOTP are common. (DHCP can handle BOOTP client requests.)

digital I/O

A *digital input* or *output* has an individual circuit connection at the electronic module that corresponds directly to a data table bit that holds the value of the signal at that I/O circuit. It gives the control logic digital access to I/O values.

DIN

Deutsches Institut für Normung is a German institution that sets engineering and dimensional standards.

E

electronic module

In a programmable controller system, most electronic modules directly interface to the sensors, actuators, and external devices of the machine/process. This electronic module is the component that mounts in a bus base and provides electrical connections between the controller and the field devices. Electronic modules are offered in a variety of signal levels and capacities. (Some electronic modules are not I/O interfaces, including power distribution modules and transmitter/receiver modules.)

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*).

encoder

An *encoder* is a device for length or angular measurement (linear or rotary encoders).

Ethernet

Ethernet is a physical and data link layer technology for LANs, also known as IEE 802.3.

expansion bus

The *expansion bus* is an electronic communication bus between expansion modules and a CPU.

expert I/O

*Expert I/O*s are dedicated modules or channels for advanced features. These features are generally embedded in the module in order to not use the resources of the PLC Controller and to allow a fast response time, depending of the feature. Regarding the function, it could be considered as a "stand alone" module, because the function is independent of the Controller processing cycle, it just exchanges some information with the Controller CPU.

F

FAST I/O

*FAST I/O*s are specific I/Os with some electrical features (response time, for example) but the treatment of these channels is done by the Controller CPU.

FE

Functional ground is the point of a system or device that must be grounded to help prevent equipment damage.

FG

frequency generator

firmware

The *firmware* represents the operating system on a controller.

H

hot swapping

Hot swapping is the replacement of a component with a like component while the system remains operational. The replacement component begins to function automatically after it is installed.

HSC

high-speed counter.

I

I/O

input/output

IEC

The *international electrotechnical commission* is a non-profit and non-governmental international standards organization that prepares and publishes international standards for all electrical, electronic, and related technologies.

input filter

An *input filter* is a special function that rejects input noises. It is useful for helping to minimize input noises and chatter in limit switches. All inputs provide a level of input filtering using the hardware. Additional filtering with software is also configurable through the programing or the configuration software.

IP 20

Ingress protection rating according to IEC 60529. IP20 modules are protected against ingress and contact of objects larger than 12.5 mm. The module is not protected against harmful ingress of water.

IP 67

Ingress protection rating according to IEC 60529. IP67 modules are completely protected against ingress of dust and contact. Ingress of water in harmful quantity is not possible when the enclosure is immersed in water up to 1 m (3.28 ft.).

L

LED

A *light emitting diode* is an indicator that lights up when electricity passes through it.

M

Modbus

The Modbus communication protocol allows communications between many devices connected to the same network.

N

NC

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

network

A network includes interconnected devices that share a common data path and protocol for communications.

P

PCI

A *peripheral component interconnect* is an industry-standard bus for attaching peripherals.

PDM

A *power distribution module* distributes either AC or DC field power to a cluster of I/O modules.

PE

Protective ground is a return line across the bus for fault currents generated at a sensor or actuator device in the control system.

Pt100/Pt1000

Platinum resistance thermometer are characterized by their nominal resistance R0 at a temperature of 0° C.
- Pt100 (R0 = 100 Ohm)
- Pt1000 (R0 = 1 kOhm)

PWM

Pulse width modulation is used for regulation processes (e.g. actuators for temperature control) where a pulse signal is modulated in its length. For these kind of signals, transistor outputs are used.

R

RS-232

RS-232 (also known as EIA RS-232C or V.24) is a standard type of serial communication bus, based on three wires.

RS-485

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

RTS

Request to send is a data transmission signal and will be acknowledged by the CTS signal from the destination node.

RxD

receiving data (data transmission signal)

S

SEL-V

A system that follows IEC 61140 guidelines for *safety extra low voltage* is protected in such a way that voltage between any 2 accessible parts (or between 1 accessible part and the PE terminal for Class 1 equipment) does not exceed a specified value under normal conditions or under single-fault conditions.

SERCOS

The *SErial Realtime COmmunications System* is a digital control bus that interconnects:
- motion controls,
- drives,
- I/Os,
- sensors and actuators, for numerically controlled machines and systems.

It is a standardized and open controller-to-intelligent digital device interface, designed for high-speed serial communication of standardized closed-loop real-time data.

SERCOS III

Industrial Ethernet based on the SERCOS implementation.

sink input

A *sink input* is a wiring arrangement in which the device provides current to the input electronic module. A sink input is referenced to 0 Vdc.

SL

serial line

source output

A *source output* is a wiring arrangement in which the output electronic module provides current to the device. A source output is referenced to +24 Vdc.

T

terminal block

The *terminal block* is the component that mounts in an electronic module and provides electrical connections between the controller and the field devices.

TxD

TxD represents a transmit signal.

U

UL

Underwriters laboratories, US organization for product testing and safety certification.

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